THE IMPACT OF CAPITAL INTENSIVE FARMING IN THAILAND:

A COMPUTABLE GENERAL EQUILIBRIUM APPROACH

A thesis
submitted in partial fulfilment
of the requirements for the Degree of
Doctor of Philosophy
in Agricultural Economics

at
Lincoln University
by
Anuwat Pue-On

Lincoln University
2010

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Although the structure of Thai economy has been transforming from an agricultural economy to an industrialized country (measured by the share of agriculture to GDP), in 2008 nearly 40 % of overall employment was still engaged in the agricultural sector. In addition, most of the poor (57%) were farm operators and farm workers. Since 1960, the outflow of workers from the agricultural sector to non-agricultural sectors has been increasing. A shortage of agricultural labour has resulted in increased use of farm machinery, a trend that seems to be continuing. Hence, Thai agriculture is expected to become more capital-intensive farming than labour-intensive farming.

The aim of this study is to explore whether efforts to encourage producers to use agricultural machinery and equipment will significantly improve agricultural productivity, income distribution amongst social groups and macroeconomic performance in Thailand. A 2000 Social Accounting Matrix (SAM) of Thailand was constructed as a data set, and then a 20 production-sector Computable General Equilibrium (CGE) model was developed for the Thai economy. The CGE model is employed to simulate the impact of capital-intensive farming on the Thai economy under two different forces: technological change and free trade. Four simulations were conducted. Simulation 1 increased the in share parameter capital in the agricultural sector by 5%. Simulation 2 is a 5% increase in agricultural capital stock. A removal in import tariffs for agricultural machinery sector forms the basis for Simulation 3. The last simulation (Simulation 4) is the combination of the above three simulations.

The results for each simulation are divided into five effects: input, output, price, income and macroeconomic effects. The results of the first two simulations were opposite in terms of the five effects. Simulation 2 accelerated the capital intensification of all agricultural sectors, whereas Simulation 1 led to more capital intensity in some agricultural sectors. The effects of the input reallocation had a simultaneous impact on output in every sector. Simulation 1 led to a fall of almost all outputs in the agricultural sector, whereas there was an increase in agricultural output in Simulation 2. Overall, almost all prices in Simulation 1 increased whereas Simulation 2 resulted in a decrease in agricultural prices but an increase in non-agricultural prices. In terms of domestic income effects, as a result of the decline of the average price of factors in Simulation 1, there was a decrease in factor incomes belonging to households and enterprises. Consequently, government revenue decreased by 0.7%. In contrast, Simulation 2 resulted in an increase in all incomes above. Finally, regarding macroeconomic variables, Simulation 1 had a negative impact on private consumption, government consumption, investment, exports and imports, resulting in Gross Domestic Product (GDP) decreasing by 0.8%. On the other hand, Simulation 2 had a positive impact on those same variables, affecting a 0.4% rise of GDP. The effects of Simulation 3 were very small in everything compared with the first two simulations. The effect of Simulation 4 was mostly dominated by Simulations 1 and 2; the negative results of Simulation 1 were compensated by the positive effects of Simulation 2.

Keywords: Capital intensive farming, CGE, general equilibrium, SAM, Thailand

Acknowledgements

My PhD. research would not have been possible to complete without the help and support of Mr. Bert Ward and Assoc. Prof. Christopher Gan, my main supervisor and associate supervisor, respectively. I owe my sincerest gratitude to both of them who have believed in, supported, advised, commented, and encouraged me with great patience whilst allowing me to work independently on my thesis.

I am deeply indebted to my source of funding, the Thai Agricultural Research Development Agency (Public Organization), for awarding me a full scholarship. Also, it is an honour for me to thank the New Zealand Agricultural and Resource Economics Society (NZARES) for the post-graduate award.

I am thankful to the Thai Office of Agricultural Economics (OAE), Ministry of Agriculture and Cooperatives, and the Office of the Civil Service Commission (OCSC) for permitting me to study overseas. Special thanks to Miss Veyha Mingwong (from OAE) who help managing funding, Ms. Thanida Techachokvivat (Minister Counsellor, Office of Educational Affairs, OCSC) on her help while I am living in New Zealand and Ms. Sivalee Tewsungwan (from Office of the National Economic and Social Development Board) in helping me on some data collection.

It is a pleasure to thank Ms. Annette Brixton, Ms. Carmen Campbell and Ms. Eileen Seymour who facilitated my studying by offering their assistance in various forms.

To all my friends both in Lincoln and in Thailand, thank you for your support and encouragement.

I am grateful to my parents and my brothers for praying to God wishing me success in my study.

Finally, I must thank my wife and my daughter for staying with me in New Zealand. Some difficult times whilst I was struggling to become proficient with the GAMS computer programming code, I forgot everything at home. I came back again on the other days with a *"pure heart and clear mind"* (Mr. Ward's phrase), having mastered this demanding task.

Anuwat Pue-On

Table of Contents

List of Tables

List of Figures

Chapter 1
Introduction

1.1 Introduction

Agriculture plays a significant role in economic growth and development, especially in the beginning stage of the transformation to an industrialized nation (Southworth & Johnston, 1967). In this regard, Johnston and Mellor (1961) state that, in developing countries, 40 – 60% of the national account is from agriculture and that employment in agricultural production is typically 60 – 80% of the labour force.

Thailand, an agricultural country, was expected to become a newly industrialized country (NIC) by the 1990s because of its positive economic growth rate since 1960. However, the 1997 Asian financial crisis delayed that transformation. Thailand's Gross Domestic Product (GDP) grew gradually from 133,336 million baht in 1951 to around 500,000 million baht in 1971 (see Table 1.1). It rose dramatically to 3,095,041 million baht the year before the 1997 Asian financial crisis. The export growth rate slumped to its lowest level since 1986, the financial sector (the stock market and some financial institutions) collapsed and, more importantly, the Thai baht depreciated (Pasuk & Baker, 1998). Because of the crisis, the GDP growth rate actually declined in 1997 for the first time (0.72%) and in 1998 (10.51%). However, the GDP increased from 1999 at 4.45% from 2,871,980 million baht to 3,851,295 million baht in 2005 (Table 1.1).

The total GDP in Thailand grew substantially, but from 1951 to 2005 the agricultural GDP rose slowly. Agriculture was nearly 40 % of GDP in 1951 but declined to 20 % in 1981, to 10% in 2001 and 8.9% by 2005. Meanwhile, the non-agricultural sector (Industry, Services and Manufacturing) increased significantly in GDP from 60% in 1951 to 80%, 90% and 91% in 1981, 2001 and 2005, respectively (see Figure 1.1). Hence, the structure of the Thai economy has transformed from an agriculture economy to an industrialized country.

Table 1.1: Value, share and growth rate of Thai GDP by agricultural and non-agricultural sector

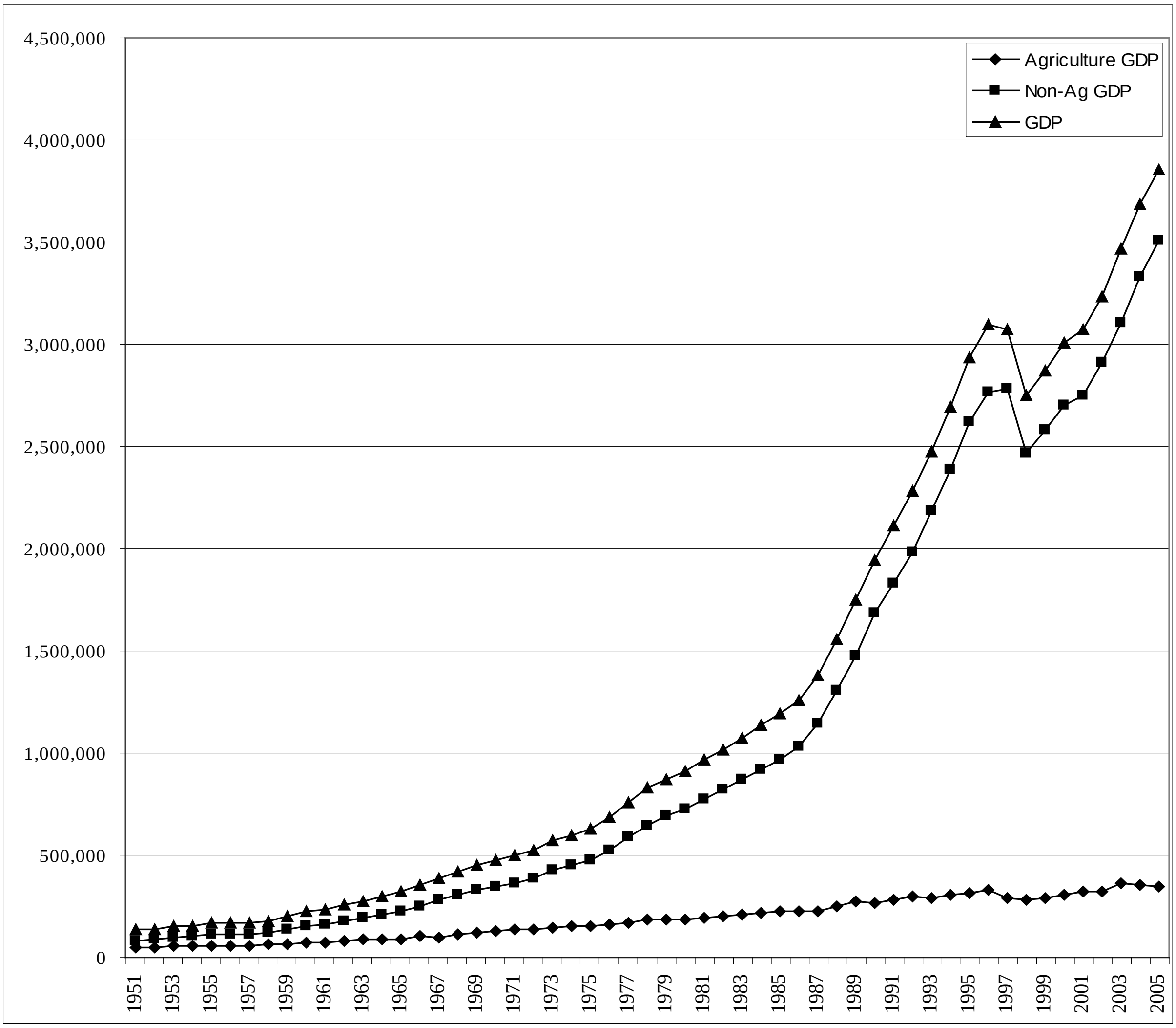
Year	GDP at 1988 price	% Share GDP		Growth Rate		
	(million baht)	Ag	Non-ag	GDP	Ag-GDP	Non-ag GDP
1951	133,366	37.88	62.12	Na	Na	Na
1960	225,667	31.53	68.47	12.13	13.01	11.73
1961	237,420	30.88	69.12	5.21	3.03	6.21
1962	255,875	30.77	69.23	7.77	7.40	7.94
1963	276,591	31.07	68.93	8.10	9.13	7.64
1964	295,466	29.56	70.44	6.82	1.65	9.16
1965	318,989	28.49	71.51	7.96	4.05	9.60
1966	354,897	28.90	71.10	11.26	12.85	10.62
1967	384,550	26.08	73.92	8.36	-2.21	12.65
1968	416,068	26.62	73.38	8.20	10.42	7.41
1969	448,666	26.50	73.50	7.83	7.35	8.01
1970	478,041	27.34	72.66	6.55	9.93	5.33
1971	501,203	27.17	72.83	4.85	4.18	5.09
1972	522,343	25.67	74.33	4.22	-1.52	6.36
1973	574,414	25.30	74.70	9.97	8.36	10.53
1974	600,154	24.98	75.02	4.48	3.15	4.93
1975	629,858	24.78	75.22	4.95	4.14	5.22
1976	687,607	23.98	76.02	9.17	5.63	10.33
1977	755,414	22.41	77.59	9.86	2.69	12.12
1978	830,025	22.57	77.43	9.88	10.65	9.65
1979	873,507	20.96	79.04	5.24	-2.27	7.43
1980	913,733	20.20	79.80	4.61	0.80	5.61
1981	967,706	20.05	79.95	5.91	5.12	6.11
1982	1,019,501	19.50	80.50	5.35	2.47	6.07
1983	1,076,432	19.35	80.65	5.58	4.77	5.78
1984	1,138,353	19.11	80.89	5.75	4.42	6.07
1985	1,191,255	19.08	80.92	4.65	4.51	4.68
1986	1,257,177	18.15	81.85	5.53	0.38	6.75
1987	1,376,847	16.58	83.42	9.52	0.07	11.61
1988	1,559,804	16.18	83.82	13.29	10.51	13.84
1989	1,749,952	15.80	84.20	12.19	9.60	12.69
1990	1,945,372	13.55	86.45	11.17	-4.69	14.14
1991	2,111,862	13.39	86.61	8.56	7.26	8.76
1992	2,282,572	12.98	87.02	8.08	4.79	8.59
1993	2,473,937	11.82	88.18	8.38	-1.34	9.83
1994	2,695,054	11.42	88.58	8.94	5.33	9.42
1995	2,933,168	10.76	89.24	8.84	2.50	9.65

Table 1.1: Value, share and growth rate of Thai GDP by agricultural and non-agricultural sector (cont.)

Year	GDP at 1988 price (million baht)	% Share GDP		Growth Rate		
		Ag	Non-ag	GDP	Ag-GDP	Non-ag GDP
1996	3,095,041	10.59	89.41	5.52	3.83	5.72
1997	3,072,615	9.34	90.66	-0.72	-12.46	0.66
1998	2,749,684	10.28	89.72	-10.51	-1.47	-11.44
1999	2,871,980	10.07	89.93	4.45	2.33	4.69
2000	3,008,401	10.30	89.70	4.75	7.18	4.48
2001	3,073,601	10.41	89.59	2.17	3.25	2.04
2002	3,237,042	9.95	90.05	5.32	0.68	5.86
2003	3,468,166	10.47	89.53	7.14	12.68	6.53
2004	3,685,944	9.61	90.39	6.28	-2.44	7.30
2005	3,851,295	8.90	91.10	4.49	-3.19	5.30

Source: National Economic and Social Development Board (NESDB.) (Various years)

Figure 1.1: The Thai GDP by agricultural and non-agricultural sector, at 1988 prices, 1951 – 2005 (million baht)



Source: National Economic and Social Development Board (NESDB.) (Various years)

Although the share of agriculture GDP has declined significantly, it is still a major source of employment. As shown in Table 1.2, 82.4% of the labour force was engaged in the agricultural sector in 1960, about 64% in 1990 and, in 2005, nearly 40% of all employment was still engaged in agricultural sector. Thus, it can be concluded that the agricultural sector in Thailand is still important in the economy if measured in terms of the labour force.

Table 1.2: Amount and share of employment by agricultural and non-agricultural sector in Thailand

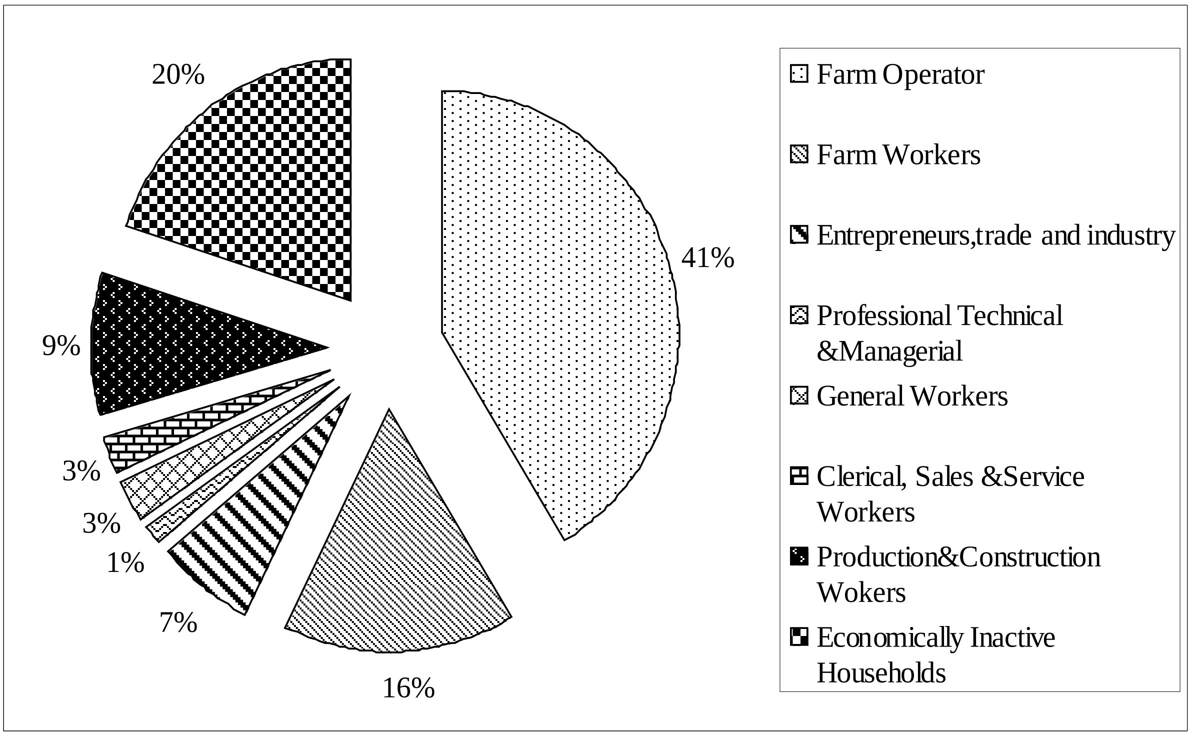
Year	Employment (1,000 Persons)		Employment (%)	
	Ag	Non-ag	Ag	Non-ag
1960	Na	Na	82.40	17.60
1970	Na	Na	79.30	21.70
1977	12,320	5,818	67.92	32.08
1978	13,247	5,969	68.94	31.06
1979	12,351	6,671	64.93	35.07
1980	15,943	6,581	70.78	29.22
1981	13,404	7,470	64.22	35.78
1982	16,985	7,847	68.40	31.60
1983	14,465	8,445	63.14	36.86
1984	15,764	8,395	65.25	34.75
1985	15,529	8,699	64.10	35.90
1986	15,681	9,405	62.51	37.49
1987	16,027	10,387	60.67	39.33
1988	17,379	10,347	62.68	37.32
1989	17,738	10,718	62.33	37.67
1990	19,726	11,118	63.95	36.05
1991	16,384	12,836	56.07	43.93
1992	17,305	13,489	56.20	43.80
1993	16,269	14,410	53.03	46.97
1994	15,180	14,984	50.33	49.67
1995	14,389	16,426	46.70	53.30
1996	14,137	17,029	45.36	54.64
1997	14,315	17,400	45.14	54.86
1998	13,407	16,698	44.53	55.47
1999	13,804	16,859	45.02	54.98
2000	13,830	17,462	44.20	55.80
2001	13,612	18,492	42.40	57.60
2002	14,042	19,019	42.47	57.53
2003	13,880	19,961	41.02	58.98
2004	13,634	21,095	39.26	60.74
2005	13,617	21,640	38.62	61.38

Source: Bank of Thailand (BOT) (Various years)
Note: Year 1960 and 1970 data from Medhi (1995)

1.2 Agricultural labour and capital in Thailand

Despite a relative decline, the agricultural sector in Thailand is still an important engine of economic growth and development. In addition, the majority of the poor (57%) are farm operators and farm workers (see Figure 1.2). The general physical constraints on agriculture are soil and climate, which affect agricultural productivity directly (O'Reilly & McDonald, 1983). However, one current problem of Thai agriculture is a shortage of labour (Poapongsakorn, Anuchitworawong, & Mathrsuraruk, 2006; Poapongsakorn, Ruhs, & Tangjitwisuth, 1998).

Figure 1.2: The proportion of poor in 2004 classified by occupation of household heads



Source: National Economic and Social Development Board (NESDB)(2005)

The share of labour in the agriculture sector has been decreasing since 1960 because of the outflow of workers to non-agricultural sectors (see Table 1.2). This downward trend of the labour market in the agriculture sector resulted in farming patterns dividing into two categories (Siamwalla, 1996). The first category is “casual farmers” who are old and conservative. A part of their income is remittances from their children who are working in the non-agricultural sector in urbanized areas. In contrast, farmers in the second category tend to be more progressive and adopt modern technology. Table 1.3 shows the number of farmers classified by age group. The percentage of new generation farmers (the first three age groups) was only 47.2% in 1992 and fell substantially to 40.6% in 2002. Conversely, the proportion of farmers aged over 45 years rose from 51.8% in 1992 to 59.4% in 2002.

On the other hand, the number of units of agricultural machinery, for example, tractors, water pumps and threshing machines, increased dramatically between 1980 and 2003. From Table 1.4, it can be seen that the number of 2-wheel tractors increased from 280,591 units to 5,109,060 units whereas the number of big tractors rose from 371,177 units to 821,014 units. Table 1.4 also shows that the number of water pumps and threshing equipment rose from 517,975 and 18,349 units in 1980 to 5,821,329 and 169,455 units in 2003 (see Table 1.4).

The increase in the number of farm machines is reflected by the growth in the value of agricultural machinery imports (see Table 1.5). Slightly less than 900 million baht worth of farm machinery was imported in 1998, but this had increased more than 10 times to around 6,900 million baht by 2007. The decline in agricultural labour and the increase in farm machinery showed that, in future, Thai agriculture will be more capital-intensive rather than labour-intensive (Poapongsakorn et al., 2006; Poapongsakorn et al., 1998; Siamwalla, 1996; Siamwalla, Patamasiriwat, & Setboonsarng, 1992).

Table 1.3: Number of holders by age group

Item	1992		1997		2002	
	Amount	%	Amount	%	Amount	%
Total number of holders (excluding corporation) by age group	5,644,339	100.00	5,576,439	100.00	5,808,112	100.00
Less than 25 years	99,756	1.8	46,867	0.8	51,293	0.9
25 – 34	961,786	17.0	733,248	13.2	749,561	12.9
35 – 44	1,603,257	28.4	1,498,758	26.9	1,553,793	26.8
45 – 54	1,364,877	24.2	1,567,061	28.1	1,628,867	28.0
55 – 64	1,047,098	18.5	1,137,406	20.4	1,064,851	18.3
65 and over	567,565	10.1	593,099	10.6	759,747	13.1

Source: National Statistical Office (2003)

Table 1.4: Number of agricultural machines in Thailand

Year	2-wheel tractors		Big tractors		Water pumps		Threshing equipment	
	Unit	Growth	Unit	Growth	Unit	Growth	Unit	Growth
1980	280,591	-	37,177	-	517,975	-	18,394	-
1981	284,351	1.34	50,044	34.61	603,548	16.52	20,601	12.00
1982	323,846	13.89	61,840	23.57	780,610	29.34	30,091	46.07
1983	364,948	12.69	68,024	10.00	858,671	10.00	33,100	10.00
1984	360,243	-1.29	28,340	-58.34	564,915	-34.21	28,243	-14.67
1985	402,082	11.61	31,415	10.85	614,791	8.83	30,762	8.92
1986	450,033	11.93	34,823	10.85	669,095	8.83	33,352	8.42
1987	515,075	14.45	40,450	16.16	768,328	14.83	34,884	4.59
1988	582,753	13.14	45,544	12.59	851,349	10.81	37,028	6.15
1989	660,685	13.37	51,279	12.59	943,387	10.81	39,352	6.28
1990	750,542	13.60	57,739	12.60	1,101,850	16.80	41,876	6.41
1991	854,279	13.82	65,101	12.75	1,220,726	10.79	44,626	6.57
1992	984,530	15.25	79,801	22.58	1,387,529	13.66	49,637	11.23
1993	1,135,742	15.36	98,096	22.93	1,577,220	13.67	55,240	11.29
1994	1,311,426	15.47	120,751	23.09	1,792,953	13.68	61,510	11.35
1995	1,515,693	15.58	148,841	23.26	2,038,314	13.68	68,527	11.41
1996	1,753,368	15.68	183,704	23.42	2,317,392	13.69	76,386	11.47
1997	2,022,467	15.35	218,237	18.80	2,624,304	13.24	83,575	9.41
1998	2,378,815	17.62	282,057	29.24	3,012,948	14.81	95,829	14.66
1999	2,786,704	17.15	351,171	24.50	3,448,297	14.45	107,645	12.33
2000	3,279,303	17.68	439,139	25.05	3,954,160	14.67	122,088	13.42
2001	3,851,541	17.45	553,623	26.07	4,532,258	14.62	138,387	13.35
2002	4,523,635	17.45	697,956	26.07	5,194,774	14.62	156,862	13.35
2003	5,109,060	12.94	821,014	17.63	5,821,329	12.06	169,455	80.3

Source: Poapongsakorn et al.(2006)

Table 1.5: Imports classified by economic classification (millions of baht)

Item	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Consumer Goods	145,670	157,487	205,721	236,726	247,858	264,732	301,298	337,205	370,559	382,250
Raw Materials and Intermediate Goods	870,591	932,619	1,183,103	1,199,311	1,236,277	1,380,170	1,690,732	1,985,564	2,003,234	2,090,053
Capital Goods	548,842	538,531	679,512	837,067	810,127	916,294	1,039,515	1,288,022	1,326,894	1,246,881
Electrical Machinery and Parts	172,222	141,038	187,776	240,616	246,537	250,345	286,652	361,903	352,252	440,133
Agricultural Machinery, Tools and Parts	896	1,367	1,769	1,861	2,905	3,475	3,627	3,938	4,069	6,874
Industrial Machinery, Tools and Parts	172,610	155,528	228,187	273,544	278,988	331,585	386,264	451,596	448,103	332,029
Computers and Accessories	11,613	13,912	24,892	46,139	78,052	72,989	60,131	74,628	73,107	59,907
Computer Parts	72,373	78,345	122,645	121,480	79,620	102,473	127,052	148,627	162,205	153,932
Tubes and Pipes	11,575	10,917	11,223	13,416	13,492	18,154	26,629	40,443	59,992	48,734
Glass and Other Mineral Products	1,765	1,805	2,207	2,706	2,750	3,076	3,834	3,340	3,408	1,451
Rubber Equipment	693	869	1,053	1,298	1,423	1,688	1,475	1,304	1,636	1,868
Metal Equipment	14,631	17,333	17,252	20,789	20,870	21,302	25,497	32,457	36,810	29,895
Scientific and Medical Equipment	28,437	29,377	37,325	39,276	40,636	53,218	63,118	84,559	86,658	88,372
Optical, Cinematographic, Photographic Equipment	5,678	5,529	8,615	8,557	7,171	7,737	9,082	8,584	9,366	26,080
Transportation Equipment	54,739	81,138	35,739	66,537	36,806	48,552	44,009	73,959	86,410	55,543
Other Capital Goods	1,603	1,367	823	844	868	1,693	2,148	2,679	2,872	2,057
Other Imports	208,962	278,752	425,802	479,240	480,576	577,578	769,520	1,143,232	1,242,235	1,152,810
Total Imports	1,774,066	1,907,390	2,494,141	2,752,346	2,774,840	3,138,776	3,801,066	4,754,024	4,942,922	4,871,995

Source: Bank of Thailand (BOT)(Various years)

1.3 Research objectives

In spite of the fact that the share of agriculture in the Thai GDP has been declining since 1951, it still plays an important role in the economy. Most of the poor are farmers who work in the agricultural sector. In additional, well over 60% of Thai farmers are ageing. Therefore, Thai agriculture, in future, is expected to face a shortage of labour and move to capital-intensive farming.

The aim of this study is to explore whether efforts to encourage producers to use agricultural machinery and equipment will significantly improve agricultural productivity and income distribution amongst sectors (agricultural and non-agricultural sector) and social groups (household, firms and government) in Thailand. For this purpose, different scenarios (in terms of percentage increase in agricultural input capital with the percentage decrease in agricultural labour) are developed in for this study.

The objectives of this research are:

1. To provide an overview of the status of, and relationships between, agricultural labour and capital in Thailand.
2. To develop a 2000 Social Accounting Matrix (SAM) and Computable General Equilibrium (CGE) model for Thailand that emphasises Thai agriculture.
3. To evaluate the effect on agricultural output, and the resulting distributional impacts, of the substitution of agricultural input capital for agricultural labour.

1.4 Data and methodology

The first research objective is answered by using standard measures of descriptive analysis. Information obtained from relevant literature and other documents relating to capital-intensive farming are synthesized. The findings are described in tables and graphs.

The second research objective is answered by constructing the 2000 SAM of Thailand by using the input-output table and national accounts for 2000. The input-output table is compiled every five years by The National Economic and Social Development Board (NESDB), Thailand.

By using the input-output table, national accounts, capital stock of Thailand and Socioeconomic Survey in the year 2000, the specific Social Accounting Matrix SAM for this research is constructed as a database for the Computable General Equilibrium (CGE) model, which is used to accomplish the second and third research objectives. In order to balance the 2000 SAM, calibrate the model and measure policy interventions using the CGE model, appropriate software, the General Algebraic Modelling System (GAMS), will be used to run the models.

GAMS is software that runs on Windows operating systems and was designed for general purposes rather than a single purpose with large, complex models. Therefore, it can solve not only general equilibrium problems but also other problems, such as linear programming problems (LP), mixed integer linear problems (MIP), stochastic linear problems and constrained nonlinear systems (CNS). Due to its complex applications, GAMS has been used in many areas including agricultural economics, energy economics, chemical engineering, econometrics, economic development, finance, forestry, management science, international trade, mathematics and statistics by over 10,000 users in 100 countries (Rosenthal, 2007).

This research constructs the data set called the Social Accounting Matrix (SAM) by using Thailand's newest input-output table. Therefore, GAMS can be used not only for balancing the SAM and calculating SAM multipliers but also for simulating the impacts of the substitution of capital for labour in the agricultural sector in the CGE model. Hence, GAMS is used as a tool for facilitating the policy simulations related to the second and third research objectives.

1.5 Significance of the study

The novel contribution of this study lies primarily in its combination and synthesis of a variety of economic planning tools (input-output table, SAM, CGE, econometrics), and their application to measuring and evaluating changes in capital/labour substitution ratios in the agricultural development process in the Thailand economy. Further, a related novelty of this research is incorporating the Jackson (1998) framework that deals with non-neutral technological change, especially substituting capital for labour. To date, Jackson's approach has not been integrated with SAM and CGE models developed for the agricultural sector of an economy. This is the first attempt at such integration.

1.6 Policy contributions of the study's results

This research develops the information needed to understand farm machinery industries and their interrelationships with both the agricultural sector and the non agricultural sector. The study provides a graphical picture of the agricultural sector, especially in farm machinery, for the design of appropriate public policies intended to enhance the efficient functioning of Thai farm machinery markets, leading to improvements in agricultural production processes, institutional income and macroeconomic performances.

In addition, since Thailand has been transforming from an agricultural country into a newly industrialized country, there has been an increased flow of migrant workers from the agricultural sector to industrial sectors. Therefore, capital inputs in agriculture have been playing an increasingly important role in maintaining/increasing production in that sector. However, to date, very little research has been conducted on the impact of capital-intensive farming in Thailand, especially using CGE models. Hence, the Thai government can determine the impact flowing from the stimulation of the increase in farm machinery on other sectors of the economy (Factors, Capital, Production, Export and Import markets) and can estimate effects on inputs, outputs, incomes, prices that will finally impact the macro economic variables when planning agricultural policies.

1.7 Outline of the research

Chapter 2 provides an overview of the history and nature of agricultural labour and capital in Thailand and its role in economic development. Chapter 3 reviews the relevant literature on the economics of SAM and CGE models that were constructed inside and outside Thailand. This chapter also discusses the concept of factor biases in the simulation design. Chapter 4 explains the methodology, model specification and estimation technique. The empirical results are presented in Chapter 5. Chapter 6 concludes the research findings and presents the important policy implications as well as the limitations of the research and areas for future study.

Chapter 2
Agricultural Labour and Capital in Thailand

The main focus of this chapter is the review of labour and capital and their roles in Thailand's economic development. The overview of agricultural labour in Thailand is given in section 2.1. Section 2.2 discusses the role and potential of capital input for agricultural economics in Thailand.

The principal resources to produce goods and services generally consist of four inputs: land, labour, capital and entrepreneurship (St John and Stewart, 1997; Callander, 1992; Marshall, 1959. In Thai agriculture in 1960 – 1980, land and labour used to be the major contributions to agricultural growth. However, after the closing of the land frontier since the mid-1980s, the contribution from capital has been more important. The study by Poapongsakorn et al. (2006) concluded that during 1981 – 2003, the majority of agricultural growth was from capital, which contributed around 60% of the growth in agricultural sector (see Table 2.1). It is predicted that there will be young professional farmers making more intensive use of land (Jitsanguan, 2001; Poapongsakorn et al., 2006). In addition, Coxhead and Plangpraphan (1998)'s study points out that, in the Thai agricultural sector, machinery is positively related with land demand but negatively with labour demand. They summarize that agricultural labour can be clearly substituted by agricultural machinery. As a result of this issue, Poapongsakorn et al. (2006) and Siamwalla (1996) forecast that Thai farmers will have a commercial attitude and use innovative production methods. Therefore, this section provides an overview of labour and capital in Thai agricultural sector.

Table 2.1: Growth accounting for agricultural GDP growth in Thailand

Period	Agricultural GDP Growth	Labour adjusted for quality and working hours	Land	Capital	Total Factor Productivity (TFP)
1981 – 1985	4.26	0.40	0.36	0.84	2.65
1985 – 1996	3.54	-0.43	0.12	2.62	1.24
1996 – 1998	0.57	-0.32	0.07	3.04	-2.22
1998 – 2003	3.43	-1.33	0.12	1.45	3.20
1981 – 2003	3.43	-0.28	0.16	2.06	1.50
	(100.00)	(-8.09)	(4.64)	(59.90)	(43.55)

Source: Poapongsakorn et al.(2006)
Note: Numbers in brackets are percentages of agricultural GDP growth.

2.1 Agricultural labour in Thailand

In general, there is an upward trend in total labour force in Thailand. It can be seen from the Table 2.2 that the total labour force has been increasing slowly since 2002. In 2006, slightly under 56% (or 36.43 million) of the total population (65.28 million) were able to work in the country. However, only around 55 % of total population (or 35.7 million) were employed (see Table 2.2).

On the other hand, there is a downward trend in the agricultural labour force. Table 2.3 shows the number employed by the agricultural and non-agricultural sectors in Thailand between 2002 and 2006. Among the employed in 2002, agriculture provided employment for 14 million (or 42.5%). This number steadily declined to 13 million (or 38.9%) in 2006. In contrast, during the same period, the proportion of non agricultural labour employed in the agricultural sector was 57.5% in 2002 and it increased to 61.1% in 2006 (see Table 2.3). This is not surprising since Siamwalla (1995) states that there has been an outflow of labour from the agricultural sector to the non-agricultural sector since the 1980s.

Table 2.2: Number and percentage of the population by labour force status in Thailand (thousands)

Labour Force Status	2002	2003	2004	2005	2006
Total Population	63,460.6 *(100.0)*	64,006.2 *(100.0)*	65,082.5 *(100.0)*	65,110.4 *(100.0)*	65,280.4 *(100.0)*
Total Labour Force	34,261.6 *(54.0)*	34,901.7 (54.5)	35,717.8 (54.9)	36,132.0 (55.5)	36,433.4 (55.8)
- Employed Labour Force	33,060.9 *(52.1)*	33,841.0 *(52.9)*	34,728.8 *(53.4)*	35,257.2 *(54.1)*	35,700.0 *(54.7)*
- Unemployed Labour Force	822.8 *(1.3)*	754.2 *(1.2)*	739.2 *(1.1)*	663.0 *(1.0)*	546.7 *(0.8)*
- Seasonally Inactive Labour Force	377.9 *(0.6)*	306.5 *(0.5)*	249.8 *(0.4)*	211.8 *(0.3)*	186.7 *(0.3)*
Persons not in Labour Force	29,198.9 (46.0)	29,104.5 (45.5)	29,364.7 (45.1)	28,978.4 (44.5)	28,846.9 (45.2)

Source: National Statistical Office (2001)
Note: Numbers in brackets are percentages of total population.

Table 2.3: Number and percentage of employed persons by agricultural and non-agricultural sectors in Thailand (thousands)

Sectors	2002	2003	2004	2005	2006
Employed Labour Force	33,060.9 *(100.0)*	33,841.0 *(100.0)*	34,728.8 *(100.0)*	35,257.2 *(100.0)*	35,700.0 *(100.0)*
Agriculture	14,041.8 *(42.5)*	13,880.1 *(41.0)*	13,633.9 *(39.3)*	13,617.0 *(38.6)*	13,876.6 *(38.9)*
Non-Agriculture	19,019.1 *(57.5)*	19,960.9 *(59.0)*	21,094.9 *(60.7)*	21,640.2 *(61.4)*	21,823.3 *(61.1)*

Source: National Statistical Office (2001)
Note: Numbers in brackets are percentages of the total population.

Regarding the unemployed labour force, although the numbers of unemployed decreased significantly from 0.82 million in 2002 to 0.54 million in 2006, the proportion of unemployed who have never worked increased gradually from 31.2 to 35.0% while the proportion of unemployed who used to work decreased slightly from 68.8 to 65.0% in this period. If we consider the unemployed labour force that used to work, it is clear that there was a decrease in the proportion of unemployed workers in agricultural sector whereas there was an increase in the proportion of unemployed workers outside the agricultural sector in this period (see Table 2.4).

Table 2.4: Number and percentage of unemployed persons in Thailand (thousands)

Industries	2002	2003	2004	2005	2006
Unemployed Labour Force	822.8 *(100.0)*	754.2 *(100.0)*	739.2 *(100.0)*	663.0 *(100.0)*	546.7 *(100.0)*
Never Worked	256.8 *(31.2)*	244.4 *(32.4)*	247.9 *(33.5)*	204.6 *(30.9)*	191.1 *(35.0)*
Ever Worked	566.0 *(68.8)*	509.8 *(67.6)*	491.3 *(66.5)*	458.4 *(69.1)*	355.6 *(65.0)*
-Agriculture Sector	219.3 *(26.7)*	168.8 *(22.4)*	164.0 *(22.3)*	121.3 *(18.3)*	93.7 *(17.1)*
-Non Agriculture Sector	346.7 *(42.1)*	340.9 *(45.2)*	326.9 *(44.2)*	337.1 *(50.8)*	262.0 *(47.9)*

Source: The Labour Force Survey, National Statistical Office (Various years)
Note: Numbers in brackets are percentage of total population

Similar to the decline in the number of agricultural labour units, the proportion of agricultural workforce under 40 years went down nearly 20% from 1985 to 2003. Conversely, the proportion of agricultural workforce aged over 60 was twice that of the base year. Furthermore, Bryant and Gray (2005) conclude that the median age of Thai agricultural workforce was higher than any other industry (see Table 2.5).

Table 2.5: Percent demographic structure of Thai agricultural workforce

Age-Structure	1985	1988	1991	1994	1997	2000	2003
Age 15 – 39	70.8	69.3	68.1	65.7	57.3	54.3	51.4
Age 40 – 59	24.7	25.9	26.7	28.5	35.1	37.9	39.4
Age 60+	4.5	4.8	5.2	5.8	7.7	7.8	9.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Median age (Years)	30.0	30.0	31.0	33.0	36.0	38.0	39.0

Source: Bryant and Gray (2005)

Ageing and education in the Thai agricultural sector are related to each other. Table 2.6 illustrates the proportion of the Thai agricultural workforce by level of educational attainment and age in 2003. In general, the young (aged 15 – 39) Thai males and females working in agriculture had higher education than older people; Table 2.6 shows that approximately 80% of the young had finished their education at an elementary school or higher. By comparison, over 90% of the agricultural workforce aged 40 – 59 and over 60 years old had completed less than the elementary level (see Table 2.6).

It seems that the new generation of the Thai agricultural workforce has a higher education level. Table 2.7 shows information about graduate students (vocational education, bachelor and higher than bachelor) who worked in the agricultural sector between 1996 and 2001. Generally, the number of graduate students rose somewhat during the 1996 – 2001 period. Although the proportion of graduate students with higher than a bachelor degree working in the agricultural sector fluctuated slightly over the period, the proportion of graduate students with bachelor or vocational education in the sector doubled over that period. The future of Thai agriculture depends on these “Professional Farmers” because they are learning and developing new skills and farm technology (Siamwalla, 1996).

Table 2.6: Percentage distribution of Thai agricultural workforce by level of educational attainment and age, 2003

Level of Educational Attainment	Age					
	Males			Females		
	15 – 39	40 – 59	60+	15 – 39	40 – 59	60+
No Education	2.4	4.2	10.7	3.8	8.7	17.8
Lower Than Elementary	15.3	84.1	84.8	21.6	87.2	81.2
Elementary	49.8	3.7	1.8	52.1	2.1	0.5
Secondary	30.2	7.1	2.2	21.1	1.8	0.5
Diploma or Equivalent	1.7	0.5	0.1	0.7	0.2	0.0
Bachelor or Higher	0.5	0.3	0.3	0.6	0.1	0.1
Other	0.1	0.1	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Bryant and Gray (2005)

Table 2.7: Number and percentage of graduates who work in agricultural and non-agricultural sectors in Thailand (thousands)

	1996	1997	1998	1999	2000	2001
Vocational Education	54,311	64,463	61,391	57,605	72,365	76,936
- Agriculture (%)	*0.8*	*0.6*	*0.5*	*1.7*	*1.6*	*1.6*
- Non Agriculture (%)	*99.2*	*99.4*	*99.5*	*98.3*	*99.4*	*99.6*
Bachelor	128,702	117,729	132,917	123,169	124,241	143,686
- Agriculture (%)	*0.7*	*0.8*	*0.4*	*0.9*	*1.1*	*1.5*
- Non Agriculture (%)	*99.3*	*99.2*	*99.6*	*99.1*	*98.9*	*98.5*
Higher than Bachelor	10,218	10,946	12,843	16,803	18,534	21,919
- Agriculture (%)	*0.1*	*0.2*	*0.1*	*0.2*	*0.3*	*0.1*
- Non Agriculture (%)	*99.9*	*99.8*	*99.9*	*99.8*	*99.7*	*99.9*

Source: National Statistical Office (2001)

2.2 Agricultural capital in Thailand

Rijk (1999) defines agricultural mechanization as the use of tools and machines for farm land development including land preparation, crop production, harvesting, storage and on-farming processing. He divides agricultural mechanization into three sources: manual power, animal utilization and powered machinery. However, the Agricultural and Rural Development Program,(1988) identifies mechanization in Thai agriculture into two forms: mechanization of irrigation and mechanization of ploughing.

In the 1950s, a large investment in irrigation systems in Thailand began. The output of this investment was large landmark irrigation systems. Siamwalla et al. (1992) report that, during 1956 – 1985, the area was around 18 million rais and it increased to 25 million rais by the end of 1988. As of 2006, there were up to 14,494 projects with the total capacity of 74,318 million cubic metres covering nearly 28 million rais or around 20% of arable land (139,800,119 rais) in Thailand (see Table 2.8).

Table 2.8: Summary irrigation statistics, 2006

Project Type	Number of Projects	Capacity (Million M^3)	Command Area (Rai)
Large Scale[1]	95	68,752.28	17,094,997
Medium Scale[2]	703	3,893.02	6,537,070
Small Scale[3]	11,567	1,672.86	568,518
Electric Water Pumping	2,129	-	3,787,777
Total	14,494	74,318.16	27,988,362

Source: Royal Irrigation Department (2006)
Note: 1 rai = 0.16 ha or 0.395 acre

[1] Large scale means the construction budget exceed 200 million baht.
[2] Medium scale means the construction budget 2 to 200 million baht.
[3] Small scale means the construction budget less than 2 million baht.

Although there was an increase in irrigated land, the current growth rate in agricultural capital was higher than that of irrigated land. Table 2.9 presents the output and input growth rate in the Thai agricultural sector between 1971 and 1995. During 1971 – 1981, the agricultural capital growth rate was only 1.00 compared with the growth rate of irrigated land and labour which were 3.82 and 3.75 respectively. The later period (1981 – 1995), both the output and input growth rate reduced a few percent except for agricultural capital. This is because of the rapid increase in the number of agricultural machines and equipment, for example, 2-wheel tractors, big tractors, water pumps and threshing equipment as discussed in section 1.2 (Table 1.4).

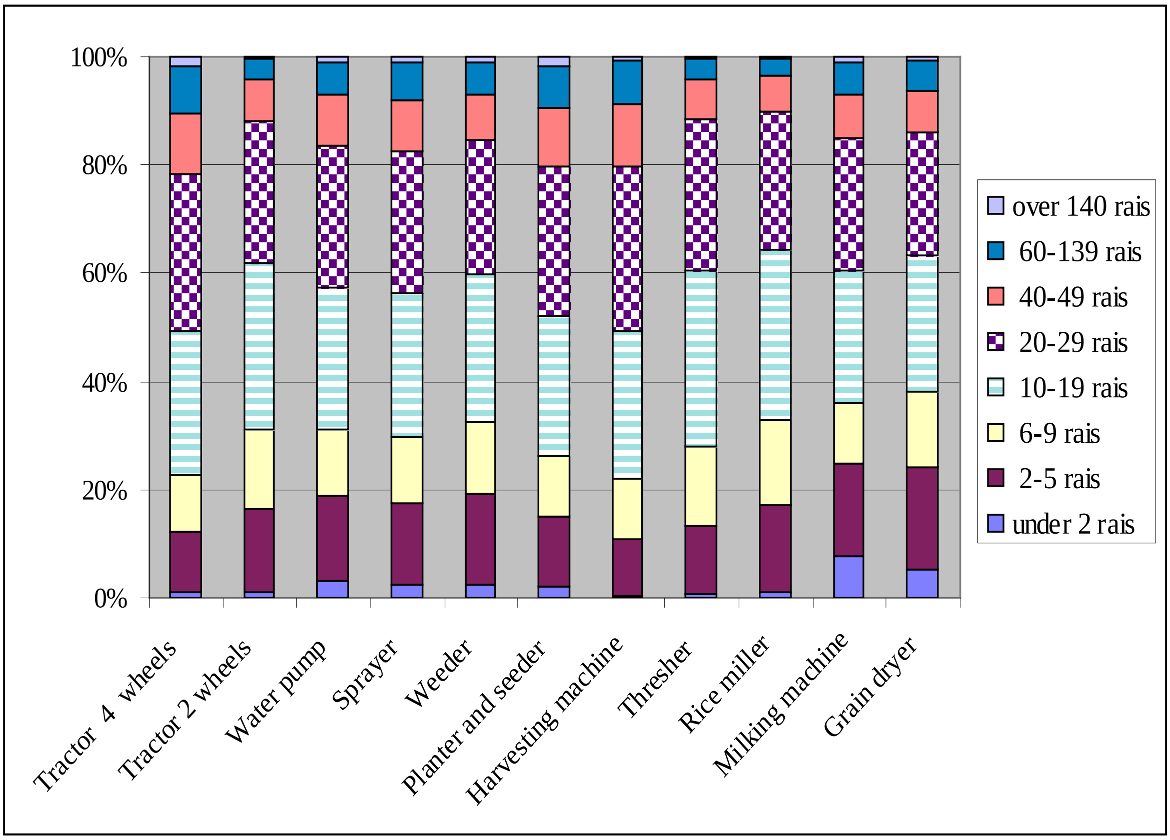
Table 2.9: Growth rate in agricultural outputs and inputs in Thailand, 1971 – 1995

Period	Output	Land		Labour	Capital
		Irrigated	Rain-fed		
1971-1981	3.78	3.82	1.36	3.75	1.00
1981-1995	3.22	2.61	0.09	0.42	3.15

Source: Mundlak, Larson and Butzer (2002)

The agricultural census conducted by National Statistical Office in 2003 indicates that agricultural machinery and equipment (Tractors, 2-wheel tractors, water pumps, sprayers, weeders, planters and seeders, harvesting machine, thresher, rice millers, milking machine and grain dryers) was mostly held by farmers who had farms ranging between 10 – 19 and 20 – 29 rais (Figure 2.1). These farmers are the core of agricultural land use in Thailand particularly for planting rice, field crops, permanent crops and para rubber. For example, the total area of holdings reporting land use was 112.68 million rais of which 58.91 million rais (or 52%) was under rice. Of these, the holdings that grow rice with an area between 10 – 19 and 20 – 29 rais were 13.33 and 20.95 million rais, respectively or 22.62 and 35.56% of the paddy fields in the whole kingdom (58.91 million rais) (Table 2.10).

Figure 2.1: Percent of holdings reporting the use of machinery and equipment by size of holding and types of machinery



Source: National Statistical Office (2003)

Even though, in the past, animal utilization was popularly used in farming especially in land preparation, from the 2003 agricultural census conducted by National Statistical Office, there were only 38,837 cattle and 130,827 buffaloes being used in Thailand. They are now rarely seen as a source of power in cultivation; they can be seen only in remote areas (Pray & Fuglie, 2001; Thepent, 2005). Table 2.11 shows the farming activities using machines and equipment in the production of rice, maize, sugarcane and soybean in Thailand estimated by Agricultural Engineering Division (AED), Department of Agriculture (Krishnasreni & Kiatwat, 1998, p. 68). It shows that the above four crops principally had mechanization of ploughing, planting, irrigating, weeding and threshing at high levels. However, the mechanization of harvesting needed more intensive control and sophisticated equipment than other operations. This problem is being solved by AED developing suitable harvesters for farmers.

Table 2.10: Number of holdings reporting land use and area of holding by size of total area of holding, 2003 (rais)

Size of total area of holding (rai)	Total area	Rice		Para Rubber		Permanent crop		Field crop		Vegetable crop, herb, flower and ornamental plant	
		Number	Area	Number	Area	Number	Area	Number	Area	Number	Area
Under 2	233,175	31,491	30,636	2,505	2,417	95,488	79,657	5,745	5,380	32,203	26,111
2 – 5	3,854,134	594,678	2,062,630	79,735	272,050	289,334	787,788	80,088	248,297	86,144	197,847
6 – 9	6,001,826	598,706	3,696,872	91,743	518,046	185,420	809,353	100,518	476,350	53,536	163,120
10 – 19	***21,777,027***	***1,225,517***	***13,326,554***	***194,655***	***1,989,322***	***335,092***	***2,307,793***	***299,996***	***2,504,649***	***92,039***	***354,220***
20 – 39	***35,561,167***	***1,039,321***	***20,949,203***	***158,370***	***2,990,198***	***284,664***	***3,195,674***	***348,839***	***5,553,992***	***72,509***	***350,262***
40 – 59	18,546,145	300,937	9,765,964	49,976	1,544,304	97,423	1,712,977	134,108	3,779,074	21,107	133,580
60 – 139	18,094,399	162,063	7,963,884	29,371	1,441,301	63,405	1,800,016	95,121	5,087,875	11,567	107,833
140 – 499	5,590,845	12,046	940,892	3,900	473,004	9,026	753,337	16,766	2,901,499	1,275	30,378
Over 500	3,026,756	402	178,801	535	413,786	1,061	746,706	1,429	992,297	128	15,379
Total	**112,685,474**	**3,965,161**	**58,915,436**	**610,790**	**9,644,428**	**1,360,913**	**12,193,301**	**1,082,610**	**21,549,413**	**370,508**	**1,378,730**

Table 2.10: Number of holdings reporting land use and area of holding by size of total area of holding, 2003 (rais) (cont.)

Size of total area of holding (rai)	Total area	Forest (planted)		Pasture		Pen		Fresh water culture		Others	
		Number	Area	Number	Area	Number	Area	Number	Area	Number	Area
Under 2	233,175	904	808	2,334	1,321	142,888	68,693	16,271	9,628	16,876	8,524
2 – 5	3,854,134	6,995	15,036	6,996	13,584	180,990	98,607	40,041	69,162	74,223	89,133
6 – 9	6,001,826	7,828	25,419	8,019	22,218	175,570	81,004	33,199	69,562	71,971	139,882
10 – 19	***21,777,027***	***17,716***	***92,917***	***27,701***	***130,001***	***390,688***	***215,223***	***83,614***	***233,724***	***175,984***	***622,614***
20 – 39	***35,561,167***	***21,108***	***168,571***	***40,459***	***342,415***	***350,559***	***289,588***	***93,163***	***364,486***	***197,340***	***1,356,778***
40 – 59	18,546,145	9,321	117,047	16,947	246,267	93,761	142,837	35,163	182,066	74,536	922,029
60 – 139	18,094,399	7,165	162,653	10,795	283,690	44,556	140,009	23,634	166,166	45,194	940,972
140 – 499	5,590,845	1,424	108,962	1,185	84,928	3,688	49,446	2,543	53,265	4,591	195,134
Over 500	3,026,756	316	322,888	112	74,992	283	41,442	185	77,536	451	162,929
Total	**112,685,474**	**72,777**	**1,014,301**	**114,548**	**1,199,416**	**1,382,983**	**1,126,859**	**327,813**	**1,225,595**	**661,166**	**4,437,995**

Source: National Statistical Office (2003)

Table 2.11: Mechanization level in the production of some major crops

Operation	Mechanization level by crop (% of cultivable area)			
	Rice	Maize	Sugarcane	Soybean
Ploughing	90	95	100	80
Planting	5	80	75	70
Irrigating	50	30	40	50
Weeding (spraying)	75	75	70	80
Harvesting	20	5	15	5
Threshing	90	90	-	90
Drying	10	20	-	5

Source: Krishnasreni and Kiatwat (1998)

Most agricultural machinery and equipment, for example, 2-wheel tractors, power tillers, disc ploughs, disk harrows, water pumps, sprayers, weeders, planters and seeders, harvesting machines, threshers, rice millers, milking machines and grain dryers are manufactured domestically. The only imported agricultural machines are some quality equipment and four-wheel tractors ((Krishnasreni & Kiatwat, 1998; Thepent, 2005).

There were around 170 manufacturers in Thailand supplying agricultural machines and equipment to farmers. The large and medium manufacturers are mostly located in the Central Plain but some set up branches, including small factories, in the other regions, especially in the major provinces. Table 2.12 reports the main agricultural machines produced by Thai manufacturers. This information was from the survey conducted by Agricultural Engineering Division, Department of Agriculture (Krishnasreni & Kiatwat, 1998, p. 71). Although these supplies of agricultural input fulfil the demand for them, some agricultural machinery and equipment still needs to be imported. This is because some small manufacturers produce low quality, inefficient products that are not standard and durable.

Table 2.12: Approximate annual agricultural input of products of local manufacturers in Thailand in 1994 and 1995

Item	Production (Units/Year)	Number of Firms
Small diesel engines	100,000	3
Single-axle 2-wheel tractors	70,000	30
Disc plough for power tillers	70,000	18
Disc plough for power tractors	7,000	15
Animal-drawn mouldboard plough	80,000	10
Frame for animal-drawn plough	8,000	10
Water pumps	75,000	20
Paddy threshers	1,800	3
Other crop threshers	400	8
Maize shellers	400	8
Peanut shellers	10	1
Seed drills	3,000	15
Knapsack sprayers	70,000	3
Sugarcane planters	300	5
Rice mills	3,500	50
Small rotary movers	10,000	10
Trailers	8,000	10
Farm trucks	2,500	30
Rice combine harvesters	400	8
Reapers	100	3
Dryers	50	5

Source: Krishnasreni and Kiatwat (1998)

As discussed in the section 1.2 (Table 1.5), there was a dramatic increase in the import value of agricultural machinery from 900 million baht in 1998 to around 6,900 million baht in 2007. Table 2.13 lists the main agricultural machines and equipment imported to Thailand in 2007. It is clearly seen that tractors were the most important imported machines in the Thai agricultural sector followed by machinery for poultry and bee-keeping, machinery used in the milling industry, harvesting and threshing machinery and water pumps. These agricultural machines and equipment were imported from many countries particularly from Asian and European countries, and the United States of America. For example, 70% of the import value of tractors was from Japan, 31 % of the import value of machinery for seed cleaning and grading was from the UK and around 53% of harvesting and threshing machines were from China. However, machinery for poultry-keeping was imported from Belgium, Germany, Spain, China, Malaysia and the United States, around 10% each.

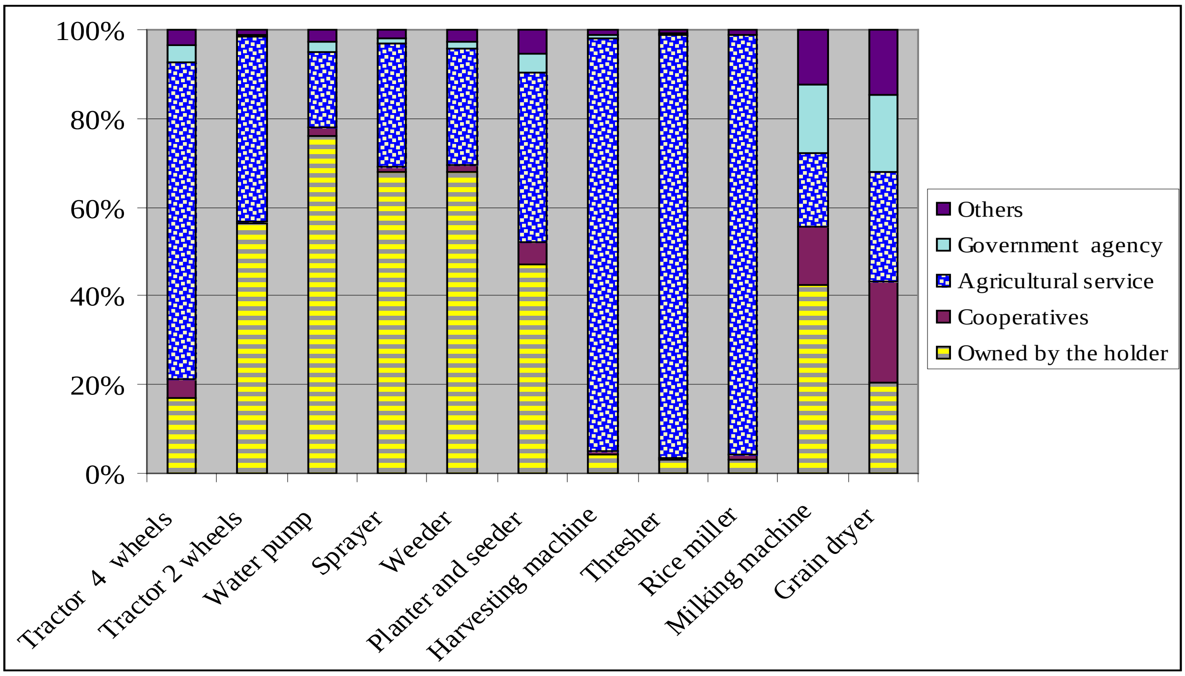
Table 2.13: Value of some important agricultural inputs imported to Thailand in 2007

Machinery and equipment	Value (1,000 baht)
Tractors (2-wheel and 4-wheel)[1/]	851,576
Machinery for poultry and bee keeping	830,874
Machinery for cleaning, sorting or grading seed and grain	804,538
Harvesting and threshing machinery	800,286
Water pump[1/]	413,049
Machinery for soil preparation	353,583
Sprayers	177,995
Agricultural hand tools	106,577
Milking and dairy machinery	20,627

Sources: Department of Custom (2007)
[1] Office of Agricultural Economics (2007)

Thepent (2005) reports that only two forms of agricultural machinery and equipment are used by farmers in Thailand, machine owner and machine hiring service. However, from 2003 the Agricultural Census, National Statistical Office divided the use of agricultural machinery and equipment into five sources: owned by holder, farmers' group (or cooperatives), agricultural service, government agency and others. The survey indicates that the low-cost items such as two-wheel tractors, water pumps, sprayers, weeders, planters and milking machines were mainly possessed by the holders. Conversely, the expensive machines, for instance, harvesting machines, threshers and rice millers were largely hired by farmers (Figure 2.2). Surprisingly, Thepent (2005) emphasizes that some small-scale farmers (small holding area), especially in remote areas, did not possess any machinery because of the small amount of production. Food and Fertilizer Technology Center (2005) or FFTC suggests that these small farmers need basic farm mechanization such as small-size tractors, mini-power tillers and small equipment in order to be successful farmers.

Figure 2.2: Percent of holdings reporting the use of machinery and equipment by sources and types of machinery



Source: National Statistical Office (2003)

Chapter 3
Literature Review

This chapter presents the background theory of Computable General Equilibrium (CGE) models, the related issue of "factor biases" in such models, and the Social Accounting Matrix (SAM) database. The chapter is structured as follows: Section 3.1 provides the basic theory of CGE model, including its application to a variety of economic issues. Section 3.2 discusses three classifications of factor biases: factor-saving (or using) biases, factor augmentation and other dimensions of bias pertaining to economic models, CGE models in particular. Finally, CGE models of Thailand including its database, SAM, are explored in Sections 3.3 and 3.4 respectively.

3.1 An overview of computable general equilibrium (CGE) models

Generally, a CGE model (alternatively Applied General Equilibrium or AGE model) is a set of simultaneous equations describing the flow of economic interactions among agents: producers, households, firms, government and the rest of the world (Hanson, Golan, Vogel, & Olmsted, 2002). The circular flow of income in a basic CGE model is shown in Figure 3.1, which can be explained as follows:

Producers purchase intermediate commodity goods and pay value-added to factor markets (rent for capital and wages for labour) that belong to households to produce commodity goods. On the other hand, producers receive payments from selling commodity goods to domestic markets, producing sales revenue. Robinson (2006) defines commodity markets as a department store that buys products from domestic producers and international markets (imports). Their receipts are from selling the products to other economic agents such as households, government and exports. Households' payments are consumption (buying commodities), direct taxes (paying to government) and household savings (investment in capital account). Government expenditure has a few outlay transactions: government consumption, saving and transfers to households and firms. The transactions in the capital account are investment and saving. The sources of funds for investment are from institution savings (households, firms and government savings) and the rest of the world (foreign savings). The outflow transaction from the local economy to the rest of the world is buying goods or services (imports). On the other hand, the rest of the world receipts payments from local commodities as exports.

The characteristics of CGE models are combinations of the behaviour of economic agents, equilibrium assumptions and a calculated database. The behaviour of economic agents usually meets optimizing assumptions. For example, households maximize their utility and firms tend to maximize their profits (or minimize their costs). CGE models employ equilibrium assumptions. That means demand and supply in commodity and factor markets are adjusted by prices determined by economic agents. Coefficients and parameters in the model equations are estimated by a numerical database such as input-output tables or SAM (Dixon & Parmenter, 1996).

A CGE model must satisfy three conditions: market clearance, zero profit and income balance. Market clearance means: "the firms' outputs are fully consumed by households, and that households' endowment of primary factors is in turn fully employed by firms" (Sue Wing, 2004, p. 6). Producers make zero profit, which means that the total revenue from selling products must be allocated to other agents (production activities, households and the government). Finally, income balance means the households' income (wages and rent) must be exhausted by commodity purchases and savings (Sue Wing, 2004).

As mentioned, a CGE model is a system of simultaneous equations describing the behaviour of agents in an economy. A full set of equations of a CGE model can be categorized into nine groups as shown in Table 3.1. Equations in the above nine groups are then put into the functioning of a CGE system as simultaneous equations illustrated in Figure 3.2 (Sadoulet & Janvry, 1995).

Figure 3.1: Structure of circular flows in the standard CGE model

Source: Modified from Thomas and Bautista (1999) and Ganuza, Morley, Pineiro, Robinson, and Vos (2005)

Table 3.1: Equations of a basic CGE model

Table 3.1: Equations of a CGE model (cont.)

Source: Modified from Sadoulet and Janvry (1995)

Note:

$\overline{K}_i$	Capital stock in sector *i*
F	Foreign capital flow
$p_i^{\$M}$, $p_i^{\$E}$	Foreign prices of imports and exports
t_k, t_i, t_h	Taxes on labour category *k*, non-labour income *i* and household *h*
t_{Ei}, t_{Mi}	Export taxes and import tariffs
a_{hk} , a_{hi}	Share of household *h* in wage income *k* and non-wage income *i*
$\overline{C}_G, c_{Gi}$	Total and shares in government consumption
s_h	Household savings rate
k_i , G_{ji}	Share of savings invested in sector *i* and capital composition in sector *i*
$A, (AQ)_i$	Matrix of input-output coefficients and intermediate demand for good *i*
b_i	Weights in aggregate price index
Q_i^s	Domestic production in sector *i*
L_{ki}, L_k^s, w_k	Demand in sector *i*, supply, and wage of labour of category *k*
F_k	After-tax wage income of skilled category *k*
V_i	After-tax none-wage income in sector *i*
Y_h, Y_G	Income of household *h* and government revenues
S_h, S_G	Saving of household *h* and government
I_i	Investment in sector *i*

C_{hi}, C_{Gi}, Z_i	Private and government consumption and demand for investment
D_i, Q_i^d	Domestic and total demand for domestic goods
M_i, E_i	Imports and exports
d_i	Ratio of domestic demand to imports
e	Exchange rate
p_i^d , p_i^q	Producer price of domestic and composite goods
p_i^c , p	Consumer price of composite goods in sector *i*
p_i^k	Price of capital goods in sector *i*
p_i^M , p_i^E	Import and export prices in domestic currency
CES	Constant elasticity of substitution function
CES^*	Derived demand relation from cost minimization in a CES
CES^{**}	Derived demand relation from profit maximization in a CES
CES^o	Derived aggregate price from a CES aggregation function
CET	Constant elasticity of transformation function
CET^*	Derived ratio of demand from profit maximization in a CET
CET^o	Derived aggregate price from a CET aggregation function

Figure 3.2: CGE flow chart

Source: Sadoulet and Janvry (1995)
Note:
The symbol ≠ *w* represents a market mechanism with equilibrium price *w* (wage).

The symbol ≠ *p* represents a market mechanism with equilibrium price *p*.

The symbol ≠ *e* represents a market mechanism with equilibrium price *e* (exchange rate).

σ_q are elasticities of substitution between factors of production.

σ_M are elasticities of substitution between imports and domestic goods.

σ_E are elasticities of transformation between exports and domestic goods.

η and *E* are income and price elasticities of household consumption.

If we consider Figures 3.1 and 3.2, it can be seen that they are very similar in terms of representing an economic system. The only difference is that Figure 3.1 shows the circular flow of income in a CGE model but Figure 3.2 transforms this flow of the economic interaction among agents into a simultaneous equation system.

To explain the working of CGE model in Figure 3.2, starting with a particular price: p_i^d (producer price), p_i^E (export price) and p_i^M (import price), the producer price is calculated by using the elasticity of transformation between exports and domestic sales (σ_E). Activities' demand for labour is determined by profit maximization behaviour at given prices and wages. The activities (or producers) use input factors, capital and labour, to produce goods. If we assume that there is a perfect labour market, there will be an adjustment of wages, labour supply and demand for the full employment. Meanwhile, factor incomes belong to the institutions: households, firms and government. There are also transfers among institutions, for example, households and firms pay taxes to government, firms distribute their profit to households and government transfers to firms and households.

The behaviour of households, firms and government in terms of saving and consumption is considered next. Households' demand is derived from utility maximization under their budget constraints. The proceeds of government consumption are from explicit policy. All residual income of firms is assumed to be saved. The consumer prices for these decisions are determined from domestic prices, import prices and elasticity of substitution between import and domestic goods (σ_M). Total investment is determined by total saving but investment demand by the commodity is derived from exogenous coefficients. The accumulation of household demand, government consumption and investment demand yield demand for commodities. This demand is distributed throughout imported and domestic goods by using the function of relative prices and the elasticities of substitution between imported and domestic goods (σ_M).

Returning to the activities (or producers), commodities from producers are allocated to domestic and export markets by the function of relative prices and the elasticities of transformation between exports and domestic goods (σ_E). Regarding the external market, imports and exports are from the total demand for foreign exchange and total supply respectively. The disequilibrium of supply and demand for commodities in the domestic market and foreign market are re-computed by the adjustment of the domestic prices and exchange rate mechanism. Finally, a new set of prices, p_i^d, p_i^E and p_i^M, are gained. A new policy simulation can now be added. That means there will be a new round as described above until the system reaches equilibrium of all markets with a new price set (Sadoulet & Janvry, 1995).

There are many recent CGE models for a variety of policy simulations. However, these CGE models can be classified into three different types (Thissen, 1998): 1. Multi-sector analysis and Macro CGE models, 2. Walrasian CGE models and 3. Parameter approach CGE models. According to Johansen (1974) (cited in Thissen, (1998)), the original Macro CGE model was the Johansen model. The model was gradually developed from input-output analysis. These models are further developed and well known such as the ORANI/MONASH model of Australia. Equations in these models are log differentials. The second CGE type, Walrasian CGE models, started from the theoretical framework of the two sector CGE model of tax incidence initiated by Harberger (1962). After that, the calculation of the equilibrium prices by the numerical approximation of the fixed point was done by Scarf (1984), which solved the theoretical Walrasian general equilibrium system. These kinds of models are prototypes of the multi-regional and multi-sector CGE model, which is called the Global Trade Analysis Project or GTAP. Finally, the parameter CGE model approach, which Thissen (1998) points out, is distinguished by two approaches to determining model parameters: calibration technique and econometric estimation. This kind of model is, for example, a SAM based CGE model that is widely used in static CGE models. Although it is possible to classify CGE models into the above three types, in practice, most CGE models are use the technique of calibration.

Since the original CGE model pioneer in 1960, it has been developed considerably as we can classify above. Each type also has many sub types depending on their closure rules and calibration technique. In recent years, hundreds of CGE models around the world have been applied to simulate the impact of a wide range of policy scenarios in many fields as summarised in Table 3.2:

Table 3.2: Summary of selected CGE models in various economic fields applied in a variety of policy scenarios

Sector	Economic subject	Model	Base year	Country	Main Policy interventions	Concluding remarks
1. Activity & Commodity	1.1 Macroeconomic	Storm (1994)	1985/86	India	1. Increase / decrease in public investment in irrigation intermediate and capital goods 2. Increase in rice and wheat 3. Input subsidy	Investment in irrigation is the most effective policy in achieving economic growth.
	1.2 Opportunity cost, structural change	Diao et al. (2002)	1975, 1990	South Korea	1. Agricultural trade protection was removed in 1975. 2. Agricultural trade protection was removed in 1990.	“The earlier the protections are removed, the better off Korea’s economy as a whole would be”.
	1.3 Poverty	Cororaton and Corong (2006)	1994	The Philippines	1. Actual tariff reduction in agricultural sector 2. Full tariff elimination in agricultural sector	The production costs of domestic products are cheaper. The number of the poor is reduced. However, the situation of the poorest of the poor gets worse.
	1.4 Industrial economics	Schumacher and Sands (2007)	1995	Germany	Charges on CO_2 emission at 10, 20, 30 and 50 € per ton of CO_2 in iron and steel productions in base on CES production function and technology approach.	Technology-based approach is vital for the economic measurement especially in input structure.

Table 3.2: Summary of selected CGE models in various economic fields applied in a variety of policy scenarios (cont.)

Sector	Economic subject	Model	Base year	Country	Main Policy interventions	Concluding remarks
2. Input factors	2.1 Factor Mobility	Kilkenny & Robinson (1990)	1986	The U.S.	1. Cropland can be adjusted, other inputs are fixed. 2. Labour assumed to be mobile. 3. Labour and capital assumed to mobile	Efficiency is gained when labour is mobile.
	2.2. Productivity	Yusuf (2000)	1990	The U.S.	The increase in productivity in the agricultural sector.	The productivity increase benefits to Washington households in short run. In the long run, on the other hand, there is a negative effect for rural households.
	2.3 Economic history	Harley (2002)	1841	Britain	The investigation of economic history by changing the primary input structure in agricultural sector of the model from a capitalist arrangement to a peasant arrangement.	There was a large transfer of income from capitalist and land owning classes to peasant agriculture. This resulted in a drop of non-agricultural labour and a rise in wages.
	2.4 Labour	Ping (2002)	1989	Scotland	Skill unbiased technical process with wage bargaining and with nominal wage rigidity.	Capital saving technical processes could reduce the disparity in the unemployment rate.

Table 3.2: Summary of selected CGE models in various economic fields applied in a variety of policy scenarios (cont.)

Sector	Economic subject	Model	Base year	Country	Main Policy interventions	Concluding remarks
3. Domestic Institutions	3.1 Microfinance institutions	Mahjabeen (2008)	1999/2000	Bangladesh	Comparison of the basic model (without the microfinance institutions: MFIs) and the extended model (with the MFIs).	Microfinance is an effective strategy to reduce the poverty gap and to narrow the income distribution.
	3.2 Industrial economics	Ghatak and Roberts (1997)	1990	Poland	An increase in the efficiency parameter in the production function of the key sector (fuel) and the non-key sector (fruit and vegetable products)	When the key sector was shocked, the macroeconomic key indicators were higher than when the non-key sector was promoted.
4. Government	4.1 Government expenditure	Jung and Thorbecke (2003)	1992,1995	Tanzania, Zambia	An increase in public expenditure	Economic growth and poverty alleviation are the contributions of public expenditure.
	4.2 Government transfer	Hanson (2002)	1996	The U.S.	1. Cutting of the food stamp programme ($US 5 billion) 2. Converting money from scenario 1 and Transfer $US 18.75 billion to low income households	Both simulations led to a drop in food production. Simulation 1 led to a decrease in wage rate for low income labour, whereas Simulation 2 resulted in a decrease in wage rate for middle and high income.

Table 3.2: Summary of selected CGE models in various economic fields applied in a variety of policy scenarios (cont.)

Sector	Economic subject	Model	Base year	Country	Main Policy interventions	Concluding remarks
	4.3 Taxes	Ye, Lee, and Chen (2006)	1999	Taiwan	An increase in cigarette tax	The results of cigarette tax increase: effects only minimal on the overall economic structure.
	4.4 Exchange rate	Cibils (2001)	1993	Argentina	Comparing the external financial shock under fixed and flexible exchange rates.	The flexible exchange rate model was more flexible than fixed exchange rate model regarding the adjustment to adverse external shocks.
5. International trade and investment	5.1 Trade liberalization	Zhang (2002)	1998	China	Reduction in import barriers following its entry into the World Trade Organization (WTO)	China would gain a little rise in GDP and employment but a dramatic increase in imports and exports.
	5.2 Foreign direct investment	Mérette, Papadaki, Hernandez and Human (2008)	2001 (GTAP 6)	Canada, The U.S.	The elimination of foreign direct investment barriers between Canada and the USA.	Canada's productive capacity would be accelerated and consumer welfare would be improved.

Table 3.2: Summary of selected CGE models in various economic fields applied in a variety of policy scenarios (cont.)

Sector	Economic subject	Model	Base year	Country	Main Policy interventions	Concluding remarks
6. Environment, Energy and Tourism	6.1 Climate change	Morris et al. (1999)	1994	Hungary	Environmental load fees are introduced on the emissions of sulphur dioxide and nitrogen oxide.	The overall level of air pollutants is sharply reduced.
	6.2 Natural hazard	Guha (2002)	1996	The U.S.	The outage of electricity and economic losses due to the impact of a hypothetical earthquake of 7.5 magnitude event on the Richter scale	The effects of economic losses were considerably greater than the effect of the outage of electricity.
	6.3 Energy economics	Galinis and Van Leeuwen (2000)	1994	Lithuania	The 1.7 and 14.2 % increase in the capacity of nuclear power.	The lower the capacity of nuclear power, the less economic development
	6.4 Tourism economics	Narayan (2004)	N/A	Fiji	The increase in tourism expenditure	The increase in tourism expenditure would result in an increase in GDP, real consumption and real national welfare by approximately 0.5%. It also improves the balance of payments.

3.2 Factor biases

According to Hall (1994), input biases in the economic approach to production can be classified into three groups: Factor-saving (or using) biases, Factor augmentation and Other dimensions of bias.

3.2.1 Factor-saving (or using) biases and the concept of neutral progress

The *bias of factor-saving (or using)* group has been applied in various studies in the economic literature. It commonly refers to the aspect of process innovation. This concept was first introduced by Hicks in the Theory of Wages in 1932. He defines labour-saving, neutral and capital saving as following (Hicks, 1963, pp. 121-122).

a. Labour-saving means "inventions increase the marginal product of capital more than they increase the marginal product of labour".
b. Capital saving means "inventions increase the marginal product of labour more than that of capital".
c. Neutral means "inventions increase both in the marginal product of labour and marginal product of capital in the same proportion".

If we consider only a concept of neutrality, Becker and Gundlach (2007) divide this concept into three different types considering the neoclassical production function $F[A(t)K, B(t)L]$, where *t* is an index of times, *A(t)* and *B(t)* are augmenting factors of capital and labour respectively. They conclude that if *A(t)* is constant and *B(t)* is increasing, it is called the *Harrod Neutrality*. If *A(t)* is increasing and *B(t)* is constant, it is called the *Solow Neutrality*. If *A(t)* and *B(t)* increase at the same rate, it is the neutral concept of *Hicks Neutrality* as mentioned above.

In terms of factor using (or saving biases), Salter (1966) gives the definition of "the labour or (capital) saving biases of technical advance which are measured by the relative change in capital per labour unit when relative factor prices are constant" (Salter, 1966, pp. 31-32). He also concludes that his concept of technical advance and Hicks's concept above were not much different in terms of labour-saving and capital-saving. He explains that the bias of technological advance (*D*) is measured by:

$$D = d\frac{(C/L)}{dt}.\frac{1}{(C/L)} \qquad 3.1$$

Where:

C Unit of capital;

L Unit of labour, and

t time.

Binswanger (1974) extends Hick's definition of factor biases mathematically. He says that the bias of factor saving (or using) is measured as follows:

$$B_i = \frac{d\alpha_i^*}{dt} \cdot \frac{1}{\alpha_i} \qquad 3.2$$

Where:

α_i is the share of factor i,

$d\alpha^*$ indicates that relative factor prices are held constant.

He concludes that there are three types of bias that are generally called *technical change*. He summarises technical change as *i-saving* if $B_i < 0$, *neutral* if $B_i = 0$, and *i-using* if $B_i > 0$. This concept was used to measure the bias of technical change in U.S. agriculture whether it was neutral or *i*-saving or *i*-using (where *i* in this study referred to land, labour, machinery and fertilizer). The results of his study show that the U.S. agricultural sector was fertilizer-using, machinery-using, labour-saving biased.

The term technical change *and* technological change have been used widely in economic literature. The meanings of those two terms are related depending on what are employed by authors in their research. For example, Binswanger and Ruttan (1978) define *technical change* as the change of production techniques which result from research and development and learning by doing at the firm level. Nevertheless, they use the term *technological change* to refer to new knowledge of scientific or engineering processes which result in production techniques "across a broad spectrum of economic activity" (Binswanger and Ruttan (1978, p. 19). Meanwhile, Jackson (1998, p. 14) defines *technical change* as "any change in knowledge about production; about methods of production; about products or about inputs to making products that results in both invention and innovations". On the other hand, he explains that *technological change* is the process of innovation that involves "a physical alteration (plant, equipment or intermediate products) as a central feature". Jackson classifies labour-saving (capital-using) and capital-saving (labour-using) as a type of non-neutral technological change that is a sub-type of technological change. Both technological change and technical change (change in technique) are involved in process of innovation as shown in

Figure 3.3 (Jackson, 1998, p. 15). The detail of Jackson's concept will be presented in Chapter 4.

Figure 3.3: The classification of process innovations

Source: Jackson (1998)

Binswanger and Ruttan (1978) follow Hick's definition in terms of technical change, which can be expressed as in equations 3.3 and 3.4 as follows:

$$B'_{ij} = \frac{\partial \left(K/L \right)}{\partial t} \cdot \frac{1}{K/L} \qquad 3.3$$

Where:

B_{ij}' is the bias of technical change;

K physical capital;

L labour and

t time.

$$B_{ij}' = \frac{\partial\left(f_K / f_L \right)}{\partial t} \cdot \frac{1}{f_K / f_L} \qquad 3.4$$

Where:

f_K marginal products of capital, and

f_L marginal products of labour.

They pointed out that if:

1. B_{ij}' > 0 that means it is labour-saving (or capital-using).

2. B_{ij}' = 0 that means it is input neutral.

3. B_{ij}' < 0 that means it is labour-saving (or capital-using).

Quizon and Binswanger (1983) applied the bias of technical change (B_{ij}') above in their partial equilibrium model by shocking technical change in the supply of the U.S. agricultural inputs. They introduce the rate of technical change as "a cost share-weighted sum of factoral rates of technical change" as follows:

$$T' = s_L A_L' + s_K A_K' + s_Z A_Z' \qquad 3.5$$

Where:

T' the total rates of technical change;

$A_i', (i = L, K, Z)$ is the factoral rate of technical change of factor L, K and Z respectively, and

s_L, s_K, s_Z are shares of factor L, K and Z respectively in the value of output or in total cost.

Therefore, the bias of technical change between two factors (*i* and *j*) or B_{ij}' is equal to $A_i' - A_j'$. They define that if:

1. $B_{ij}' = A_i' - A_j'$ > 0 that means it is *i*-saving.

2. $B_{ij}' = A_i' - A_j'$ = 0 that means it is *i*-neutral.

3. $B_{ij}' = A_i' - A_j'$ > 0 that means it is *i*-using.

They apply the above concept of technical change between two factors: labour-capital bias and labour-land bias, to measure the impact of labour-saving on income distribution in the agricultural sector. The results show that the labour-saving bias between labour and capital would decrease numéraire wages. However, when the labour-saving bias between labour and land was shocked, the effects are unclear.

The bias of factor applies not only to non-CGE models but also to CGE models. Unfortunately, only some studies in a few fields such as agriculture, trade and international trade include policy intervention in the bias of factors. Coxhead and Warr (1991) adopt the technical change concept from Quizon and Binswanger (1983) in their CGE models to investigate the effect of technical changes in the agricultural sector on the Philippines' economy. Coxhead and Warr (1991) use the profit functions derived from Quizon and Binswanger (1983). These profit functions were replaced in agricultural sector in their GCE model. Their CGE model comprises four sectors: irrigated agriculture, unirrigated agriculture, services and manufacturers with seven household categories. The equations in the model are written in percentage change of variables because they belong to the Johansen class of general equilibrium models. The results are that when capital is substituted for labour in sector 1 (irrigated agriculture), there is a 1.67% decrease in real wages. Consequently, household income of landless labourers, small farmers in irrigated areas and small farmers in unirrigated areas fell by 1.49, 0.02 and 0.13% respectively. Meanwhile, the substitution of labour for land brought the opposite effect to the first simulation above.

Another factor bias applying to a CGE model is in Salami, Alavalapati and Veeman (1998). This study is similar to that of Coxhead and Warr (1991) in that both models used the study of Binswanger (1974) in the CGE model. However, Salami et al. (1998) mixed the traditional multifactor productivity growth (MFPG) measurement from Morrison (1992) with the technical change concept of Binswanger (1974) in their CGE model. The MFPG measurement is formalized by using the elasticity of production function and cost function with respect to technology as follows (Morrison, 1992):

$$\frac{\partial \ln Y}{\partial t} \equiv \varepsilon_{Yt} \qquad 3.6$$

$$\frac{\partial \ln C}{\partial t} \equiv \varepsilon_{Ct} \qquad 3.7$$

Where:

$Y = Y(\upsilon, t)$ is a production function;

$C = (p, t, Y)$ is a cost function;

υ is a vector of J inputs with corresponding prices p: and
t represents technology (usually measured as a time counter).

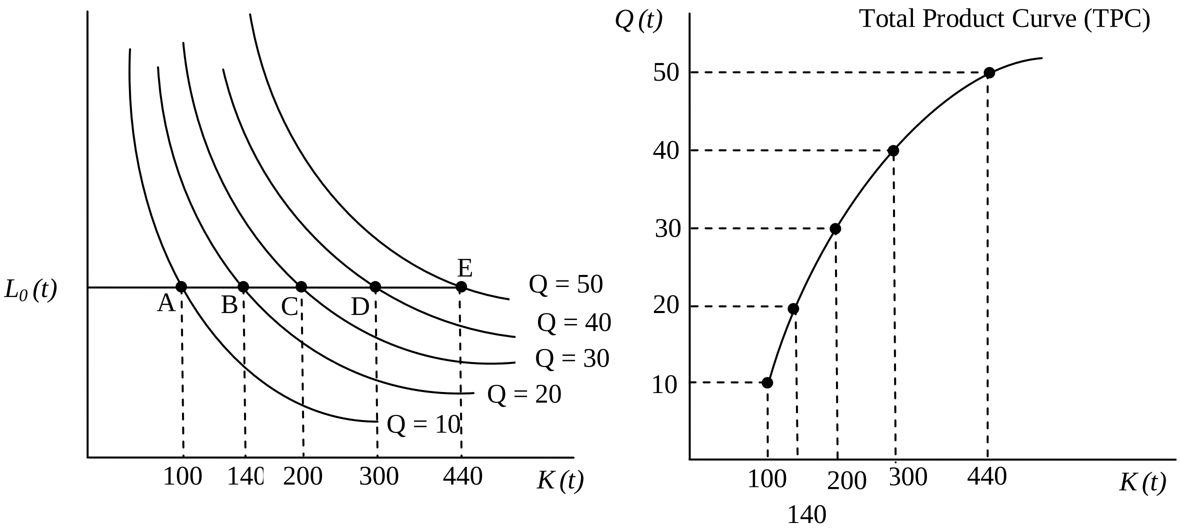
From equation 3.2, $B_i = \frac{d\alpha_i^*}{dt} \cdot \frac{1}{\alpha_i}$, Salami et al. (1998) followed the study by Kohli (1994) and replaced the right hand side of equation 3.2 with $\frac{\partial \ln Z_i}{\partial t} - \frac{\partial \ln C}{\partial t}$ (where Z_i is demand for the factor *i)*. Therefore, $B_i = \frac{\partial \ln Z_i}{\partial t} - \frac{\partial \ln C}{\partial t}$ is the rate of technical change. They conclude that technical change is *i-saving, i-neutral or i-using*, respectively, if $B_i < 0$, $B_i = 0$ or $B_i > 0$. They then apply this concept in their CGE model. The model consists of four sectors: agricultural, oil, manufacturing, and services with three inputs: labour, capital and land. The model belongs to the Johansen class (Coxhead and Warr, (1991). The bias of technical change is that a 10% increase in capital input is substituted for labour in the production function in the agricultural sector. Regarding capital-using and labour-saving technical change, the results show undesired effects such as a decline in the agricultural sector, a decrease in employment and a reduction in overall economic growth.

3.2.2 Factor augmentation

According to Hall (1994): "technological process could be represented by an upward shift in the Total Product Curve (TPC) or an inward shift in isoquants". The TPC can be derived from the isoquant map. As shown in Figure 3.4, it assumes that labour is constant. If capital is increased, for example, across the horizon line point ABCDE, it can be seen that the isoquant will shift to the right of the origin. This means that output is increasing from Q = 10, 20, 30, 40 and 50 in relation to capital levels (*K(t)*) linking with the fixed level of labour ($L_0(t)$). Total Product Curve then can be drawn from the pairs of value of capital levels and output. The TPC has a positive slope, which shows how much output increases if there is an increase in capital while labour is held constant. Hall (1994) summarises the characteristics of a production function in terms of return to scale as follows:

1. If output rises by more than the given multiple, there is an increasing return to scale.
2. If output rises by less than the given multiple, there is a decreasing return to scale.
3. If output rises by exactly the same multiple, there is a constant return to scale.

Figure 3.4: Deriving the total product curve from an isoquant map with fixed labour inputs ($l_0(t)$ and variable capital ($K_0(t)$)



Source: Modified from Hall (1994)

Hall (1994) states that technological process can be generated by an increase in factors of production. To capture this idea, he introduces multiplicative terms to input factors as written in equation 3.8.

$$Q(t) = F[A(t)K(t), B(t)L(t)] \qquad 3.8$$

Where:

$Q(t)$ output;

$K(t)$ capital input;

$L(t)$ labour input;

$A(t)$ the flow of effective capital; and

$B(t)$ the flow of effective labour.

He explains that there are three common types of technological process: pure capital augmenting, pure labour augmenting and equal capital and labour augmenting as shown in Table 3.3.

Table 3.3: Capital and labour augmentation coefficients from the production function and the classification of technological progress

Value of multipliers	Type of progress	Concept of neutrality[1/]
A(t) rising; *B(t)* = 1	Pure capital augmenting	*Solow Neutrality*
A(t) = 1; *B(t)* rising	Pure labour augmenting	*Harrod Neutrality*
A(t) and *B(t)* rising at the same proportionate rate per period	Equal capital and labour augmenting	*Hicks Neutrality*

Source: Hall (1994),

1/ Becker and Gundlach (2007)

The above factor augmentation concept of Hall (1994) and three types of neutral biases of Becker and Gundlach (2007) as discussed in section 3.2.1, seems to be the same concept. That means we can conclude that Hall's (1994) factor augmentation concept is the bias of technical change in the concept of neutrality (Table 3.3).

Becker and Gundlach (2007) apply the concept of Harrod Neutrality to neoclassical two-cone trade model. The model has three goods with two factors: capital and labour. The study tries to show how the bias of technical change affects the changes across the cones in terms of factor allocations and wages in general equilibrium. The result shows that the Harrod Neutral bias results in a decrease in the factor price diversity across cones.

An example of factor augmentation applying to the CGE model is the study of Hanson and Rose (1997). This study was extended from the US Department of Agriculture/Economic Research Service (USDA/ERS) computable general equilibrium model by Robinson, Kilkenny and Hanson (1990). Hanson and Rose's (1997) CGE model has 49 production sectors, two primary inputs (capital and labour) with two labour skill levels and 11 classes of household income. The model captures technological change biases by converting labour hour and capital stock into what they call "efficiency units" (μ_{if}).

The efficiency units were introduced into the CES production functions in their CGE model as shown in equation 3.9:

$$X_i = A_i \left[\sum_{f=1}^{2} \alpha_{if} \left(\mu_{if} FD_{if} \right)^{-\rho_i} \right]^{-1/\rho_i} \quad i = 1,...,49 \qquad 3.9$$

Where:

X_i output by sector;

A_i CES production function shift parameter;

f factor of production, f = labour (*l*), capital (*k*);

α_{if} CES production function shares;

μ_{if} factor augmentation parameter by sectors;

FD_{if} factor demand by and factor types;

ρ_i CES elasticity of substitution by sector; and

i production sectors, $i = 1,...,49$.

The factor augmentation parameters (μ_{if}) were assumed to be equal to one in the base year but in an augmenting experiment, they were increased by 1.6% from the base year. The results show that when labour-augmenting was simulated, it led to an increase in income inequality. Furthermore, the combination of labour-augmenting and capital-augmenting brought greater income inequality, but the effects were lower than the labour-augmenting.

Another simulation with the CGE model that included the above concept of *Hicks Neutrality* was the study of Arndt, Jensen, Robinson and Tarp (2000). This study examines the impact of a 30% increase of *Hicks Neutrality* in agricultural sectors in Mozambique. The model had 27 production sectors. Each sector employed three inputs: agricultural labour, non-agricultural labour and capital. Households are divided into two categories: rural and urban. The resulting simulation led to an improvement of 6.8% of real GDP because there was an increase in household consumption of 24.3%. The simulation also results in a rise of factor prices: agricultural wage, non-agricultural wage and rent.

3.2.3 Other dimensions of bias

According to Hall (1994), the last form of bias is dealing with scale or substitutability or scope. Regarding scale, he points out that "one highly visible technological trajectory was the exploitation of scale economies across many types of production". He concludes that technological processes would benefit only the production function with high-output isoquants. In terms of substitutability, he states that technological change may be influenced by only a section of any specific isoquant, for example, a single capital-labour ratio. That means the isoquant in this case is L shaped and it results in an elasticity of substitution of zero. Finally, with scope, he states that technological change involves in multi-output production, i.e., a firm produces more than one product. He summarises that "technological change might favour increased jointness in production function and if so could be viewed as scope-enhancing" (Hall, 1994, p. 54).

A good mixed concept of the dimension of bias in terms of scale and CGE model is in the study by Gooroochurn and Blake (2005). They investigate the effect of a tourism boom on the small open economy of the Republic of Mauritius where tourism plays an important role in the export sector. They construct a single country CGE model using the Social Accounting Matrix (SAM) for 1997. The model has 17 production sectors and eight household groups. In the model, tourism is treated as additional group of final demand. The results show that the welfare effects of the tourism boom with increasing returns to scale in export-oriented sectors was lower than for constant returns to scale. In contrast, the welfare effect following the tourism boom with increasing returns to scale in the tourism-related sectors and non-tradable sectors was higher than for constant returns to scale.

Nevertheless, some studies apply in context of Total Factor Productivity (TFP) into CGE models as a simulation form that could not be grouped into the above three classifications of biases. TFP was first measured by Solow (1957). However, to define TFP in the easiest way, Lipsey and Carlaw (2004) explain TFP by using the Cobb-Douglas function as shown in equation 3.10:

$$Y = AL^{\alpha}K^{\beta}, \quad \alpha + \beta = 1, \text{ and } (\alpha, \beta) \in (0,1) \qquad 3.10$$

Where:

Y output,

K physical capital,

L labour and

A shift in the relation between measured aggregate inputs and outputs.

If we divide equation 3.10 by $L^{\alpha}K^{\beta}$, we obtain the index of TFP as follows:

$$TFP = \frac{Y}{L^{\alpha}K^{\beta}} = A \qquad 3.11$$

Janvry and Sadoulet (2002) use TFP as a proxy for technological change to investigate its bias on poverty in the agricultural sector in the African, Asian and Latin American archetype. They employed the TFP (a_i) in the production functions in their CGE model as follows:

$$X_i^s = a_i CES\left(\overline{K}_i, CD\left(L_{li}^d\right)\right), \qquad i, j \in NAg \qquad 3.12$$

$$X_i^s = a_i GLT\left({PX_j}/{PX_i}\right), \left({w_l}/{PX_i}, \overline{K}_A\right), \qquad i, j \in Ag \qquad 3.13$$

$$a_i = a_{io} I_g^{\varepsilon g_i} I_i^{\varepsilon p_i} \qquad 3.14$$

Where:

X_i^s Domestic production;

a_i Total factor productivity (TFP);

CES Constant elasticity of substitution function

CD Cobb-Douglas function

GLT Generalized Leontief function;

PX_i Average producer price of sector *i*;

PX_j Average producer price of sector *j*;

w_l Wage of labour of category *l*;

$\overline{K}_A$ Fixed factor in agricultural sectors;

$\overline{K}_i$ Capital stock in sector *i*;

L_{li}^{d} Demand of labour of category *l* in sector *i*;

NAg Set of non-agricultural activities;

i, j Index of activities/commodities;

Ag Set of agricultural activities;

I_g Public investment; and

I_i Investment in sector *i*.

Janvry and Sadoulet (2002) construct three different CGE models by archetype. The model has seven sectors in the African and Asian archetype but eight sectors in Latin American archetype. Households are divided into two types: urban and rural. The model differs from a standard CGE model in terms of production specification. They use a joint production function for agricultural sectors (agricultural export, cereals and other agriculture) as normally used in multi-market models. The nature of multi-market models is that it gives information about the characteristic of the agricultural production system in profit function forms. The profit function forms are derived product supply functions and factor demand functions (Janvry & Sadoulet, 2002). They measure the direct and indirect effects of technological change by simulating the 10% increase in Total Factor Productivity (a_i) in production functions in their CGE model. The results of the simulations show that technological change in Africa results in a direct increase in especially poor rural household income. The non-agricultural sector and GDP rose slightly as a consequence of a rise in household income. Technological change also benefits indirect agricultural employment effects in Asia. In Latin America, technological change affects agricultural growth, which simultaneously affects the rest of the economy more strongly than in Asia.

Similarly, Dorosh, El-Saidand Lofgren (2002) examine the impact of the increase in TFP in agricultural sector on rural income in Uganda. This model contains 25 production sectors. There are nine factors of production (capital, two types of labour and six types of land). Households are divided into nine categories. The database for this model was the Social Accounting Matrix (SAM) 1999 that was constructed especially for this analysis. The result show that a 5% increase in TFP of all agricultural crops results in an increase in major endogenous variables such as production commodities, return to capital input and household consumption and income.

Other studies combining CGE models and a measurement of the technology effect, for example, Wu, Alavalapati, Carter, Wear and Das (2002) and Yusuf (2000), use the sense of productivity, which is a measure of output from production processes per unit of input. They just assume that there is an increase in productivity in the agricultural sector such as an increase in output caused by genetic improvements. Therefore, their hypotheses assume what effect would occur if there was, say, a 10% productivity increase in agricultural sector compared with the base year. The difference between these two studies is that Yusuf's (2000) model is a single country CGE model whereas Wu et al.'s (2002) model belongs to the Global Trade Analysis Project model or GTAP.

In conclusion, all types of factor bias: factor using, factor augmentation and other dimensions of biases, have been applied to CGE models except the concept of factor using by Salter (1966), which is extended by Jackson (1998). Therefore, this study applies this concept in policy simulations in a CGE model, which will be discussed in Chapter 4.

3.3 CGE Models of Thailand

Various Thai CGE models have been constructed since 1981. These Thai CGE models can be grouped into three categories by time of construction: 1980s, 1990s and 2000s.

3.3.1 The 1980s models

The starting point of the Thai CGE model in the 1980s probably was the Siam 1 model constructed by Grais (1981). This study uses the base year SAM 1975 to simulate the effect of the oil price increase during the 1970s. A year later, Drud, Grais and Vujovic (1982) modified Grais's (1981) model analyse the effect of structural change in terms of the change in fiscal policy, exchange rate and productivity improvement. Drud et al.'s (1982) model is quite similar to Grais (1981). The main difference is that the Drud et al. (1982) model used the SAM base data of 1980 whereas Grais (1981) was based on SAM for 1975. In 1987, a CGE model with real and financial sector linkages was constructed by Vongpradhip (1987). The Vongpradhip (1987) model was designed especially for a policy simulation in terms of the effect of credit allocation. Therefore, this model has six institution groups and 12 categories of financial assets and liabilities (Table 3.4).

Table 3.4: Summary of the main features of CGE models of Thailand in the 1980s

Model	Base year	Single/ Multi region	Static/ Dynamic	Demand side		Supply side		Policy interventions incorporated
				Demand functions	Disaggregation	Function for production structure	Number of industrial commodities	
1. Grais (1981)	SAM 1975	Single country	Static	CES	1 household	CES	4 sectors	1. Increasing energy prices 2. Decreasing agricultural growth 3. Increasing government revenue and saving 4. Discouraging energy import and consumption
2. Drud, Grais and Vujovic (1982)	SAM 1980	Single country	Static	CES	1 household	CES	4 sectors	1. Fiscal policy (i.e. increasing taxes and tariffs) 2. Changing Exchange rate 3. Productivity improvement
3. Vongpradhip (1987)	SAM 1984	Single country	Static	CES	1 household	CES	2 sectors, 12 categories of financial assets and liabilities, 6 groups of institutions	Decreasing foreign interest rate

3.3.2 The 1990s models

In the early of 1990s, Rosensweig and Taylor (1990) claimed that their work was an initial model that included financial markets. However, if we compare the model structure of Rosensweig and Taylor (1990) with Vongpradhip (1987), it can be seen that both models consider the disaggregation of financial assets and liabilities, thus we can see the level of assets, liabilities and institutions in both models (Table 3.5).

The Thailand Development Research Institute or TDRI produced a few papers in the 1990s using the CGE model, for example, Devarajan, Jitsuchon, and Sussangkarn (1991) and Sussangkarn (1996). Those models are quite different from each other in terms of the base year data, demand function, the number of household disaggregations and the number of production sectors. This is because each model has different policy interventions (Table 3.5).

As mentioned in section 3.1, the first of three types of CGE models are the Multi-sector analysis and Macro CGE models originated by Johansen (1974). The CGE model has been developed continuously. It is now known as the ORANI (static model) and MONASH (dynamic model) models of Australia. The ORANI model has also been developed for other countries, which is called ORANA-G. A single country Thai CGE model based on this ORANI-G model is called Chulalongkorn and Monash University General Equilibrium Model or CAMGEM (Centre of Policy Studies and Impact Project, 2009). A multi-regional CGE model developed from ORANI is called General Equilibrium Model and Regional or GEMREG. This kind of multi-regional CGE model of Thailand is found in Siksamat (1998). According to Siksamat's (1998) study, the model contains a national part and seven regional parts. One of the seven regional parts is Bangkok-and-vicinity. This part is disaggregated in order to simulate the effect of the increase in government demand to infrastructure on Bangkok industry. The idea of the Siksamat (1998) model is that, first, the policy interventions were imposed on the national CGE model. Then the outcomes from the national CGE were shocked again using the system of regional equations (Table 3.5, Model 5).

Another CGE model in the Johansen class constructed for Thailand is the PARA model. The PARA model is a joint project between the Office of Agricultural Economics (Thailand) and the Australian National University (Australia). The project was supported by Australian Centre for International Agricultural Research (ACIAR). The PARA model was probably the largest model of Thailand at that time because it contained 60 sectors (in national model) and 120 sectors (in the regional model) in the supply side. In the demand side, households were disaggregated into five categories by their income levels (Warr, Khatikarn and Pant, 1994).

The model used the base year of 1985 as the latest data available at the time (Pant, Jieamanugulgit, & Warr, 1994) (Table 3.5, Model 3).

3.3.3 The 2000s models

In the current decade, 2000s, there is an explosion of Thai CGE models. Many GCE models were constructed by various institutions and independent researchers such as the Thailand Development Research Institute (TDRI), universities, and research institutes around the world. The Thai CGE models of the 2000s can be divided into two main kinds by their policy simulation types: tax and tariff (Table 3.6) and non-tax and tariff policies (Table 3.7).

Before going into the two categories, there is another model called a multipurpose model. This model can be adapted for different policy simulations or specific issues. Therefore, multipurpose models generally contain many commodities with many household disaggregation levels (Mansur & Whalley, 1984). Sussangkarn (2005) explains that the CGE model for Thailand, constructed by TDRI, called the TDRI-CGE model contains 79 commodity sectors, 10 households (by income), six types of government investment and six categories of taxes. The model also separately identifies agricultural sectors from non-agricultural sectors. This model was used and modified for specific policy issues constructed by other TDRI's modellers. For example, Sussangkarn (1996) aggregates the above model's 79 sectors into only four sectors, three labour skill groups and only two household types in an attempt to measure the impact of foreign migrant workers. Devarajan et al.'s (1991) model is another aggregate model in the class of multipurpose models. They grouped the 79 commodities into only 27 commodities but the number of household types was expanded to 19 in order to examine the impact of VAT on the Thai economy, which we have already discussed.

Among other policy simulations, taxes and tariffs were the most popular policy issues in Thai CGE modelling in the 2000s, for example, Mallikamas (2002), Economic Research and Training Center (2004), Rochananonda (2004), Li (2005), Pungchareon (2005), Poapongsakorn, Suzuki, Tantivasadakarn, Punyasavatsut and Tulyawasinphong (2005), Diao, Rattso and Stokke (2005), Akapaiboon (2007), Field and Wongwatanasin (2007), Kitwiwattanachai, Nelson and Reed (2007) and Iemthanon (2007) (Table 3.6).

Table 3.5: Summary of the main features of CGE models of Thailand in the 1990s

Model	Base year	Single/ Multi region	Static/ Dynamic	Demand side		Supply side		Policy interventions incorporated
				Demand functions	Number of household disaggregation	Function for production structure	Number of industrial commodities	
1. Rosensweig and Taylor (1990)	SAM 1980	Single country	Static	CES	1 household group	CES	3 sectors, 13 categories of financial assets and liabilities, 4 groups of institutions	1.Increasing government consumption, minimum reserve ratio and government loan ratio 2. Reduce rediscount 3. Devaluation of baht
2. Devarajan et al.(1991)	SAM 1987	Single country	Static	LES	5 household groups	CES	27 sectors, 19 households	Introducing VAT on each output
3. (Warr et al., 1994)	SAM 1985	Single country / multi regions	Static	Leontief aggregation function	5 household groups	Leontief aggregation function	60 sectors (in national model), 120 sectors in regional mode l)	A 25% decrease in the rate of protection in each commodity
4. Sussangkarn (1996)	SAM 1995	Single country	Static	CES	2 household groups	CES	4 sectors, 3 labour skill groups	Removing all foreign labour, tax on foreign labour
5. Siksamat (1998)	I-O 1990	Single country / multi regions	Static	CES using a Stone-Geary aggregation function	1 household group, 7 regions	CES using a Leontief aggregation function	27 sectors,	1. Decreasing required rate of return to capital 2. Increase in government demand to infrastructure in Bangkok industry

The Economic Research and Training Center (2004) model, the second large CGE model in Thailand after TDRI-CGE model, and the Li (2005) model, the third large CGE model in Thailand, measure the effect of tax policies using the same database (SAM 1998). However, Li (2005) modifies the SAM 1998 from TDRI whereas Economic Research and Training Center (2004) constructs its own SAM. The models use slightly different types of functional forms (Table 3.6, Models 2 and 4).

The Mallikamas (2002), Pungchareon (2005), Poapongsakorn et al. (2005) and the Kitwiwattanachai et al. (2007) models use the multi-regional CGE model (GTAP model). The latest GTAP version (as at September 2009) is GTAP version 7, which covers 113 regions. Each region has 57 commodity sectors. The base year data of GTAP 7 is 2004 (Narayanan, 2008). In general, all four models attempt to evaluate, among other things, the possible impacts of free trade between Thailand and other countries (USA, EU, Australia, Indonesia, Malaysia, the Philippines, Singapore, Vietnam, China, Japan, New Zealand, Korea and India). The Mallikamas (2002) model studies the impact of bilateral free trade between Thailand and other 15 countries and it uses GTAP version 4. Pungchareon (2005) uses GTAP version 5 to examine the effect of import tariff elimination between Thailand and China. Kitwiwattanachai et al. (2007) analyse the effect of a free trade area between a group of countries, the Association of Southeast Asian Nations or ASEAN, and China, Japan and Korea using GTAP version 5. Unlike the previous three GTAP models, the Poapongsakorn et al. (2005) model studies the impact of free trade under the WTO Doha Round of Trade Negotiations using GTAP version 6. The results from GTAP were used in the TDRI-CGE model (Sussangkarn, 2005) in order to examine further the impacts within Thailand (Table 3.6, Models 1, 5, 6 and 10).

The remaining CGE models dealing with tariff simulations are Rochananonda (2004), Diao et al. (2005), Akapaiboon (2007), Field and Wongwatanasin (2007) and Iemthanon (2007). All models use SAM as a database except the Iemthanon (2007) model, which uses an input-output table (compiled by National Economics and Social Development Board of Thailand every five years). That means the Iemthanon (2007) model is in the Johansen class of general equilibrium models (Table 3.6, Models 3, 7 – 9 and 11).

Table 3.6: Summary of the main features CGE models of Thailand in the 2000s with tax and tariff simulations

Model	Base year	Single/ Multi regions	Static/ Dynamic	Demand side		Supply side		Policy interventions incorporated
				Demand functions	Disaggregation	Function for production structure	Number of industrial commodities	
1. Mallikamas (2002)	1995	Multi regions	Static	CES functions	13 countries	CES functions using Leontief aggregation function	50 sectors in each country (GTAP version 4)	Elimination of tariffs between Thailand and ASEAN countries, China, Australia, New Zealand, India, Japan, Korea and the USA
2. Economic Research and Training Center (2004)	SAM 1998	Single country	Static	CES using LES aggregation function	5 household groups	CES functions	60 sectors, 5 labour skill groups, 5 capital	Tax reduction in the industrial sector
3.Rochananonda (2004)	SAM 1998	Single country	Static	CES functions	3 household groups	CES functions	8 sectors	Removing import tariffs
4. Li (2005)	SAM 1998	Single country	Static	LES function	3 household groups	CES functions	61 sectors	1. Introducing carbon tax 2. Income tax and tariff reduction
5. Pungchareon (2005)	1997	Multi regions	Static	CES functions	6 countries	CES functions	11 key sectors (GTAP version 5)	Elimination of tariffs between Thailand and China

Table 3.6: Summary of the main features of Thai CGE models in the 2000s with tax and tariff simulation (cont.)

Model	Base year	Single/ Multi regions	Static/ Dynamic	Demand side		Supply side		Policy interventions incorporated
				Demand functions	Disaggregation	Function for production structure	Number of industrial commodities	
6.Poapongsakorn et al. (2005)	SAM 2001	Single country	Static	CES using a Stone-Geary aggregation function	10 household groups	CES functions	79 sectors, 6 groups of government investment, 6 categories of taxes, separate agricultural sector from non-agricultural sector	Doha round tariff changes; gradual tariff and100% tariff reduction in GTAP 6, then the results were put in the TDRI-CGE model
7. Diao et al. (2005)	SAM 1995	Single country	Static	Cobb Douglas functions	1 household group	Cobb Douglas functions	2 sectors	A gradual reduction of tariffs compared with immediate tariff reduction
8. (Akapaiboon, 2007)	SAM 1998	Single country	Static	LES function	3 households, 2 enterprises	CES functions	15 sectors	Decreasing tariffs by 50% and 100%
9. Field and Wongwatanasin (2007)	SAM 1980, 1985	Single country	Static	N/A	10 household groups	CES functions	20 sectors, 4 types of input	1. Changing ad valorem tariff, export and investment subsidy rates, 2. Replacement of government tax

Table 3.6: Summary of the main features of Thai CGE models in the 2000s with tax and tariff simulation (cont.)

Model	Base year	Single/ Multi regions	Static/ Dynamic	Demand side		Supply side		Policy interventions incorporated
				Demand functions	Disaggregation	Function for production structure	Number of industrial commodities	
10.Kitwiwattanachai et al. (2007)	SAM 2001	Multi regions	Static	LES aggregation function	14 regions	CES functions	11 key sectors (GTAP version 5)	Elimination of import tariffs among countries
11. Iemthanon (2007)	I-O 2000	Single country	Static	Cobb Douglas functions	1 household group	CES using LES aggregation function	50 sectors	Reducing import tariffs under WTO's new round negotiation

In terms of CGE models with non-tax and tariff intervention, there is a variety of policy simulations applied to the Thai GCE in 2000s, e.g., structural change, government expenditure, subsidy, exchange rate, prices, input allocations and tourism (Table 3.7).

Starting with the investigation of structural changes in Thailand, Siksamat (2002) uses a Johansen class CGE model to measure the structural change of Thai economy during 1990 – 1995. The policy interventions incorporate structural changes in terms of technology and taste changes and the pattern of changes in trade, investment and some macro factors. The model measures technology changes by introducing shift variables into the production functions. This idea is also used in other interventions in the model (Table 3.7, model 1). Another investigation of Thai structural changes is Thaiprasert (2006). This study focuses especially on the transformation of an agricultural economy to an industrial country. Unlike Siksamat’s (2002) study, a statistical approach, related historic economic data and the information of input-output table of Thailand (various years) were utilised in Thaiprasert (2006) to explore the structural changes. However, a CGE model with only six production sectors (primary agricultural, agro-industry, other industries, utility and construction, trade and transport and services) was used to simulate the effect of input allocations in the economy (Table 3.7, Model 4).

One more perspective of Thai CGE models in the 2000s is related to government expenditure (Chainakul, 2002) and oil price change policy simulations (Mahathanaseth, 2004) (Table 3.7, Models 2 and 3). Both models contain a few sectors in supply side and only one household group on the demand side. Although both models use the base year of 1998, the Chainakul (2002) model is calibrated from 1998 SAM whereas the Mahathanaseth (2004) one, a Johansen class CGE model, used the input-output table of 1998.

The CGE models have been applied to environment, energy and tourism economics not only in other countries as already discussed in section 3.1 but also for Thailand as shown in Table 3.7, models 5 – 8. Phuwanich and Tokrisna (2007) modify the 1998 SAM (constructed by Li (2001)) into a 23 sector SAM. Three sectors: irrigation, transmission water system and pipe water supply, were introduced into the modified SAM. Two policy scenarios were conducted: first a 30% increase in the shift parameter in the CES production function of the transmission water system. Secondly, a 5% increase in the price of pipe water supply. The first simulation led to an increase in GDP but the second simulation could reduce scarcity of water (Table 3.7, Model 5).

The next model, Watcharejyothin and Ram (2007), is the only dynamic CGE model of Thailand in the 2000s. The model analyses the impact of increases in power import. The model has 26 production sectors. Of these 26 sectors, 24 incorporate industry. The database of the Watcharejyothin and Ram (2007) model, SAM 2000, was constructed for the year 2000. The dataset of dynamic parameters were prepared from various data sources. The main policy scenario of this study is to examine the impact of the increase in imported power (Table 3.7, Model 6).

The second last non-tax and tariff CGE model in Thailand, the study of Govinda and Ram (2008), uses the SAM 1990. Even though the model was based on the old SAM, it was the first attempt to apply demand-side management (DSM) under a clean development mechanism into a CGE model. Similar to the other CGE models that focus on the industrial sector, it had only one agricultural sector in the model. In order to examine the impact of household consumption of electricity, a variable called rate of replacement, is created by using the ratio of old electrical appliances and the efficient counterparts in a household. This variable is equal to one in the base year but is assumed to increase to 1.25 in the policy simulation. That means households are buying efficient appliances 25% more than in the base year (Table 3.7, Model 7).

The last Thai CGE model without tax and tariff simulation focuses on tourism. Thanks to the prototype of the standard CGE model in GAMS (Lofgren, Harris, & Robinson, 2002), many modellers have modified this prototype, including the study of Wattanakuljarus and Coxhead (2008) (Table 3.7, Model 8). Wattanakuljarus and Coxhead (2008) introduce their interest, tourism demand, into the CGE model. The database for the model, SAM, is modified from the main SAM builder in Thailand: TDRI. The policy simulation is a 10% increase in tourism in Thailand.

Table 3.7: Summary of the main features of Thai CGE models in the 2000s without tax and tariff simulation

Model	Base year	Single/ Multi regions	Static/ Dynamic	Demand side		Supply side		Policy interventions incorporated
				Demand functions	Disaggregation	Function for production structure	Number of industrial commodities	
1. Siksamat (2002)	I-O 1990, 1995	Single country	Static	CES using a Stone-Geary aggregation function	1 household group	CES functions using Leontief aggregation function	53 sectors, 2 labour skill groups	Structural change in terms of technology, taste, trade, investment and some macro factors
2. Chainakul (2002)	SAM 1998	Single country	Static	N/A	1 household group	CES functions	3 sectors	1. An increase in government expenditure 2. An increase in loans to the industrial sector
3. Mahathanaseth (2004)	I-O 1998	Single country	Static	Stone-Geary function	1 household group	Leontief aggregation function	7 sectors	An increase in oil price

Table 3.7: Summary of the main features of Thai CGE models in the 2000s without tax and tariff simulation (cont.)

Model	Base year	Single/ Multi regions	Static/ Dynamic	Demand side		Supply side		Policy interventions incorporated
				Demand functions	Disaggregation	Function for production structure	Number of industrial commodities	
4. Thaiprasert (2006)	SAM 1998	Single country	Static	Cobb Douglas functions	1 household group	Cobb Douglas functions	6 sectors	1. Input allocations and the exemption of sales tax 2. An increase in export subsidy, government expenditure and import tariffs 3. The exchange rate was depreciated 4. The changes in import and export prices
5. Phuwanich and Tokrisna (2007)	SAM 1998	Single country	Static	LES functions	1 household group	CES functions using Leontief aggregation function	23 sectors	1. Increase in shift parameter by 30% 2. Introducing the fee for irrigation users
6.Watcharejyothin and Ram (2007)	SAM 2000	Single country	Dynamic	N/A	N/A	CES functions	26 sectors	Increase in the power imports
7. Govinda & Ram (2008)	SAM 1990	Single country	Static	Nested CES functions	1 household group	Nested CES functions	21 sectors	Old electrical appliances are replaced by the efficient counterparts in a household
8. Wattanakuljarus and Coxhead (2008)	N/A	Single country	Static	LES functions	4 household group	CES functions	6 sectors	A 10% increase in tourism

In summary, almost all CGE models in Thailand use constant elasticity of substitution (CES) functions both in demand and production functions, which is a more general functional form. However, Cobb-Douglas (C-D), linear expenditure system (LES) and constant ratios of elasticity of substitution (homothetic) (CRESH) were also used in CGE studies in Thailand. As factor biases were reviewed in Section 3.2, we found that all kinds of biases were applied not only into non-CGE models but also to CGE models. Only two different concepts, the non-neutral technological change by Jackson (1998) and the factor intensity concepts by Chung (1994), have not been applied into any study. More importantly, both concepts use the same function which is Cobb-Douglas function form. To fill this gap, therefore, the Cobb-Douglas function is used in this study. Detail of simulation design is discussed in Section 4.3.Therefore, this study uses Cobb-Douglas functions in both the demand and supply sides.

Although CGE models, both in Thailand and other countries, have been constructed to measure the impact of a variety of economic issues, for example macroeconomic, structural change, poverty, finance, environment, energy and tourism, taxes and tariff were the most popular policy simulations in CGE modelling. It seems that there is no CGE model that focuses especially on inputs using in the agricultural sector in Thailand. Only a few simulation parts of Siksamat (2002) and Thaiprasert (2006) measure structural changes in their CGE models. Unfortunately, these two models did not rely on any economic theory in terms of input bias. Therefore, this study will fill the gap by applying the original factors using the concept of Salter (1966) modified by Jackson (1998) in a CGE model that will be present in the next chapter.

3.4 Social accounting matrix (SAM)

3.4.1 The overview of SAM

Robinson (2003, p. 2) points out that “the SAM is a square matrix, where entries represent payments from column accounts to row accounts, and the corresponding row and column sums must balance since they represent the double-entry, receipt-expenditure accounts of the various economic actors”. The objectives of SAM are twofold: to provide information on the economic and social structure of a nation in a specific year, and to be used as a statistical basis by a country for policy simulation by a reasonable model (King, 1985).

SAM basically consists of six accounts: Activities, Commodities, Factors, Institutions, Capital, and the World. Table 3.8 shows the general structure of a macro SAM. The column entries represent payments from own account to other accounts whereas the row entries represent receipts from other accounts. All payments and receipts must be equal, which means that the SAM can represent the flow of resources among agents in an economy (Provide Project, 2003). If we consider Table 3.8, Figures 3.1 and 3.2 it can be seen that they explain the same thing but different situations. Figure 3.1 explains the circular flow of economic transactions in a chart. Figure 3.2 describes them in simultaneous equations used in a CGE model. Finally, Table 3.8 presents the same thing in a square matrix that can be explained as follows:

The Activity account (production account) purchases intermediate commodities and pays value-added to factors (rent for capital and wages for labour) to produce commodities. This account also pays indirect taxes to government (column 1). On the other hand, the Activity account receives payments from selling commodities to the domestic market and from exporting to the world market (row 1). The Commodity account acts as a department store that buys products from domestic and international markets (imports). It also pays indirect taxes to government (column 2). Its receipts are from selling the products to other economic agents (row 2).

The Factor account comprises labour and capital accounts. In the Factor account (column 3), the outflows are payments to households as labour income and distributed profits. Labour pays taxes on social security and capital pays taxes on their profits to government. In contrast, the factor account receives income from product activities as wages and rent. Another source of factor income is from abroad (row 3).

Households, firms and government are included in the Institutions account. In the column for institutions (column 4), households' payments are household consumption, intra-household transfers, transferring to firms, direct taxes and household savings (investment in capital account). Similarly, firms distribute their incomes by transferring to households and abroad, paying taxes to government and savings in the form of the Capital account. In terms of government expenditure, there are five outlay transactions: export subsidies (to produce activities) government consumption (in the Commodity account) and transfers (to households, firms and capital account). On the other hand, in the receipts of the Institutions account (row 4), for example, households' incomes are from labour income, distributed profit from capital and transfers from firms, government and abroad.

The transactions in the Capital account relate to savings and investment. In column 5, there is a demand for investment in commodities. The sources of funds for investment (row 5) are from institution savings (households, firms and government savings) and from the rest of the world.

Table 3.8: The basic structure of a SAM

Source: Sadoulet and Janvry (1995)

The last account is the Rest of the World account. The transactions in this account are between the local economy and the rest of the world. The payments by the rest of the world to the local economy are buying goods or services (exports), transferring to Institutions and Capital account (column 6). On the other hand, the rest of the world receives payments from commodities, factors and institutions (row 6).

CGE models use SAM as a database to explain the circular flow of products (goods and services) in an economy. Both SAM and CGE models are based on equilibrium in an economy. A CGE model is constructed from accounts in the SAM: Activities, Commodities, Institutions, Capital and the Rest of the World (Lofgren et al., 2002).

To explain how a SAM is used to construct a CGE model in an algebraic framework, we employ three assumptions: (The material in this section draws heavily from the discussion in Sue Wing, (2004).

1. There are no taxes or subsidies in the economy.
2. There are only households, which act as a representative of institutions. Household incomes are from selling labour for wages and renting out the factor for rent. On the other hand, household expenditure buys commodities to fulfil consumer demands.
3. Each activity acts as a firm in the economy. The activity sector buys inputs from commodities (as intermediate goods) and hires inputs from primary factors to produce its outputs.

From the concept of the circular flow of SAM and the first condition of general equilibrium (market clearance), the value of gross output of activity ($\bar{y}_i$ (must be equal to the summation the j^{th} commodity ($\bar{x}_{ij}$) and final demand ($\bar{g}_{id}$) (row *i* of Figure 3.5):

$$\bar{y}_i = \sum_{j=1}^{N} \bar{x}_{ij} + \sum_{d=1}^{D} \bar{g}_{id} \qquad 3.15$$

Likewise, the factor inputs are fully employed by activity production:

$$\bar{V}_f = \sum_{f=1}^{F} \bar{v}_{fj} \qquad 3.16$$

In the column of sector j activity, the zero profit implies that total output of the j^{th} activity ($\bar{y}_j$) is equal to the sum of value of intermediate goods ($\bar{x}_{ij}$) and primary factors ($\bar{v}_{fj}$):

$$\bar{y}_j = \sum_{i=1}^{N} \bar{x}_{ij} + \sum_{f=1}^{F} \bar{v}_{fj} \qquad 3.17$$

If m is the agent's income, the income is rent (or wages), which is the sum of $\overline{V}_f$. However, the agent's income and expenditure must balance, so the sum of $\overline{V}_f$ is also equal the sum of $\overline{g}_{id}$:

$$\overline{m} = \sum_{f=1}^{F} \overline{V}_f = \sum_{i=1}^{N} \sum_{d=1}^{D} \overline{g}_{id} \tag{3.18}$$

Where:

i = 1,…,N	set of commodities;
j = 1,…,N	set of industry sectors (of production activities);
f = 1,…,F	set of primary factors;
d = 1,…,D	set of final demands;
$\overline{x}_{ij}$	N x N input-output matrix of activities;
$\overline{v}_{fj}$	F x N matrix of factor inputs and
$\overline{g}_{id}$	the N x D matrix of final demand activities.

Figure 3.5: A Stylized Social Accounting Matrix (SAM)

Source: Sue Wing (2004)

In a Cobb-Douglas Economy, the relationship between a SAM and a CGE model is that "CGE models' algebraic framework results from the imposition of axioms of producer and consumer maximization on the accounting frame work of the SAM" (Sue Wing, 2004, pp. 11-14).

Households maximize their utility (Cobb-Douglas preferences) subject to a budget constraint:

$$\max_{c_i} U = A_c c_1^{\alpha_1} c_2^{\alpha_2} \ldots c_N^{\alpha_N} = A_c \prod_{i=1}^{N} c_i^{\alpha_i}) \qquad 3.19$$

subject to $m = \sum_{i=1}^{N} p_i (c_i + s_i)$

Where:

c_i levels of consumption of i^{th} commodity;

N commodities;

m income;

p_i commodity prices and

s saving, which is assumed to be exogenous and constant.

$\alpha_1 + \alpha_2 + \ldots + \alpha_N = 1$

The agent's demand functions for i^{th} commodities are obtained by solving the household's optimization problem to yield:

$$c_i = \alpha_i \frac{\left(m - \sum_{i=1}^{N} p_i s_i\right)}{p_i} \Rightarrow \alpha_i = \frac{c_i p_i}{\left(m - \sum_{i=1}^{N} p_i s_i\right)} \qquad 3.20$$

Sue Wing (2004, p. 12) indicates that the α_i parameters are "the exponents of the utility function which may be interpreted as the shares of each commodity in the total value of consumption".

Regarding the supply side, producers maximize profit subject to existing production technology, thus:

$$\max_{x_{ij}, v_{fj}} \pi_j = p_j y_j - \sum_{i=1}^{N} p_i x_{ij} - \sum_{f=1}^{F} w_f v_{fj} \qquad 3.21$$

subject to $y_i = A_j (x_1^{\beta_1} x_2^{\beta_2} \ldots x_n^{\beta_n})(v_1^{\gamma_1} v_2^{\gamma_2} \ldots v_F^{\gamma_N}) = A_j \prod_{i=1}^{N} x_{ij}^{\beta_{ij}} \prod_{f=1}^{F} v_{fj}^{\gamma_{fj}}$

Where:

p_j price of sector *j* outputs;

p_i price of sector *i* inputs;

w_f price of primary factor;

x_{ij} intermediate inputs and

v_{ij} primary factors.

$$\beta_{1j} + \beta_{2j} + ... + \beta_{Nj} + ... + \gamma_{Nj} = 1$$

Producers' demand functions for intermediate inputs and its demand for primary factors are found by solving the above optimization problem to yield:

$$x_{ij} = \beta_{ij} \frac{p_j y_j}{p_i} \Rightarrow \beta_{ij} = \frac{p_i x_{ij}}{p_j y_j} \qquad 3.22$$

$$v_{fj} = \gamma_{fj} \frac{p_j y_j}{w_f} \Rightarrow \gamma_{fj} = \frac{w_f v_{fj}}{p_j y_j} \qquad 3.23$$

To summarize, we see that β_{ij} and γ_{fj} represent the shares of inputs to the production in the value of the output.

At equilibrium, the first three conditions in a Cobb-Douglas economy for general equilibrium refer to market clearance. For the first general equilibrium condition, equation 3.15 can be rewritten as equation 3.24 when the agent's final demand is replaced by input consumption and saving activities. Therefore, equation 3.24 is given as follows:

$$y_i = \sum_{j=1}^{N} x_{ij} + c_i + s_i \qquad 3.24$$

Equation 3.16 can be rewritten as equation 3.25:

$$V_f = \sum_{f=1}^{F} v_{fj} \qquad 3.25$$

If x_{ij} and c_i in equation 3.24 are substituted by equations 3.22 and 3.20, respectively, it yields the divergence between supply and demand in the commodity market (Δ_i^C) as follows:

$$\Delta_i^C = \sum_{j=1}^{N} \beta_{ij} p_j y_j + \alpha_i \left(\sum_{f=1}^{F} w_f V_f - \sum_{j=1}^{N} p_j s_j \right) + p_i s_i - p_i y_i \qquad 3.26$$

Similarly, if v_{fj} in equation 3.25 is substituted by equation 3.23, it yields the divergence between supply and demand in the factor market (Δ_f^F) as follows:

$$\Delta_f^F = \sum_{j=1}^{N} \gamma_{fj} \frac{p_j y_j}{w_f} - V_f \tag{3.27}$$

The second condition in general equilibrium, zero profit, means the value of outputs must equal the value of inputs, which can be written as an equation as follows 3.28.

$$p_j y_j = \sum_{i=1}^{N} p_i x_{ij} - \sum_{f=1}^{F} w_f v_{fj} \tag{3.28}$$

If x_{ij} and v_{fj} from equations 3.22 and 3.23 are substituted into the production function ($y_i = A_j \prod_{i=1}^{N} x_{ij}^{\beta_{ij}} \prod_{f=1}^{F} v_{fj}^{\gamma_{fj}}$), we have the excess profit per unit (Δ_j^π) in each sector:

$$\Delta_j^\pi = p_j - A_j \prod_{i=1}^{N} \left(\frac{p_i}{\beta_{ij}} \right)^{\beta_{ij}} \prod_{f=1}^{F} \left(\frac{w_f}{\gamma_{fj}} \right)^{\gamma_{fj}} \tag{3.29}$$

The last general equilibrium condition, the income balance, means producers' income must equal expenditure for the use of primary factors:

$$m = \sum_{f=1}^{F} w_f V_f \tag{3.30}$$

Equation 3.30 can be rewritten as "the excess of income over returns to the agent's endowment of primary factors" (Δ^m) as follows:

$$\Delta^m = \sum_{f=1}^{F} w_f V_f - m \tag{3.31}$$

Sue Wing (2004) concludes that the joint minimization of the above divergences ($\Delta^C, \Delta^F, \Delta^\pi, \Delta^m$) is the status of general equilibrium.

To compute the general equilibrium with real data, a CGE model is calibrated using the SAM. Therefore, if we compare equations 3.15 – 3.18 with equations 3.24, 3.25, 3.28 and 3.30 (Table 3.9) "a fundamental equivalence may be drawn between the equations in a CGE model and the benchmark flows of value in a SAM by assuming that in the benchmark year all prices are equal to unity" (Sue Wing, 2004, p. 18).

Table 3.9: Equation comparison between a SAM and a CGE model

Source: Sue Wing (2004)

According to Table 3.9, if $\pi_j = 0$ (the second condition in equilibrium), then, $p_i x_{ij} = \bar{x}_{ij}$ and $w_f v_{fj} = \bar{v}_{fj}$ under the assumption that all prices equal unity. Finally, the technical coefficients and elasticity parameters of the utility and production functions can be directly solved as shown below (Mansur and Whalley, 1983 cited in Sue Wing, 2004):

$$\alpha_i = \frac{\bar{g}_{iC}}{\bar{G}_C} \qquad 3.32$$

$$A_C = \frac{\bar{G}_C}{\prod_{i=1}^{N} \bar{g}_{iC}^{\alpha_i}} \qquad 3.33$$

$$\beta_{ij} = \frac{\bar{x}_{ij}}{\bar{y}_{ij}} \qquad 3.34$$

$$\gamma_{fj} = \frac{\bar{v}_{fj}}{\bar{y}_j} \qquad 3.35$$

$$A_j = \frac{\bar{y}_j}{\left(\prod_{i=1}^{N} \bar{x}_{ij}^{\beta_{ij}} \prod_{f=1}^{F} \bar{v}_{fj}^{\gamma_{fj}}\right)} \qquad 3.36$$

$$s_i = \bar{g}_{iS} \qquad 3.37$$

$$V_f = \bar{V}_f \qquad 3.38$$

and $m = \sum_{f=1}^{F} \bar{V}_f$ 3.39

By setting the quantities of the variables in the Cobb-Douglas economy equal to the values of the corresponding cells in the SAM (i.e., $x_{ij} = \overline{x}_{ij}$, $v_{fj} = \overline{v}_{fj}$ and $c_i = \overline{g}_{iC}$), the numerical problem in the general equilibrium can be solved (Sue Wing, 2004).

3.4.2 SAM of Thailand

The oldest SAM for Thailand is Siam 2, which was constructed by National Economics and Social Development Board of Thailand (NESDB) in the co-operation with the World Bank in 1982. This SAM is based on the year 1975 and consists of 20 commodities. The objectives of Siam 2 are to analyse structural changes in the production sector and to measure the resulting impacts of relevant policies on the industrial sector in Thailand (World Bank, 1982).

Although NESDB was the first organization to construct a SAM for Thailand, TDRI, a private non-profit foundation established in 1984, is the main organization that has published SAMs for Thailand. Because constructing a SAM is a difficult and tedious exercise, most Thai CGE model (discussed in section 3.5) used databases from TDRI. The latest SAM for Thailand, published by TDRI, is the SAM for 1998. This SAM is widely used and was modified as a database for the Thai CGE models in the 2000s as previously discussed.

A SAM can provide not only a picture of an economy or a database for a CGE model but can also be applied as a tool to examine the economic effect of growth across sectors by using SAM multiplier analysis (Round, 2003). In Thailand, many SAM multiplier models can be found, for example, SaeBae (2001) and Jianpakdeesombat (2001). TDRI is the main SAM provider in Thailand, thus the above SAM-based models just modified and aggregated sectors in TDRI's SAM into their SAM. TDRI, itself, constructed the SAM for 1995 and uses it as a base year to investigate the effect of Thai government budgets using SAM multipliers (Sussangkarn & Tinakorn, 1999). Though not many studies construct their own SAM because of time constraints, perseverance and ingenuity, Thanopajai (2004) constructed three production sector SAMs that include a particularly interested sector (environmental investment).

A SAM-based model is very simple because it does not include supply constraints and price adjustments (Robinson & Lofgren, 2005). In addition, Mansur and Whalley (1984) point out that this is the major difference between CGE and conventional analyses: input-output or SAM-based model. This is because CGE models "incorporate extensive substitutability on both the demand and production function sides of the model". This is the weakness of a SAM multiplier analysis. To fill these gaps, therefore, a CGE model is an ideal picture of an economy and policy simulations in the real world (Robinson & Lofgren, 2005).

Different issues and policy simulations among CGE models lead to different disaggregation of accounts in a SAM. Disaggregation of the demand and production sides in the models operates differently depending on their objectives. The Coxhead and Warr (1991) model, the Yusuf (2000) model and the Hanson and Rose (1997) model emphasise household income distribution. Consequently, the authors disaggregated households in the SAM into many groups whereas other models had only a few groups of households. Similarly, the disaggregation of the demand side and the disaggregation of the production side also depend on the modellers' objectives. The Hanson and Rose (1997) model has 49 sectors in industrial commodities. Therefore, this model could measure the impact of technical change in a specific sector (such as rice) rather than a general sector (such as agriculture).

To conclude, SAM multipliers can be used for policy analyses with some limitations. For a specific purpose, a SAM may be constructed. The greater the disaggregation of sectors, factors and agents, the more difficult is the mission of reconciliation and SAM balance. The objectives in SAM disaggregation will reflect the intended policy simulations of the authors. For that reason, this study will construct a 20 production sector SAM with eight agricultural sectors because we are interested in capital intensive farming. The SAM will be based on the latest available input-output table, year 2000, which will be described in Chapter 4.

Chapter 4
Research Methodology

This chapter describes the methodology used in this study. The real sector CGE model specification of Thailand is presented in section 4.1. The construction of the 2000 micro SAM as the database for the CGE model, including software, is provided in section 4.2. The last section in this chapter, simulation design, is discussed in section 4.3.

4.1 Model specification

This static Thai CGE model has been developed and modified from the standard CGE model of Lofgren, Harris and Robinson (2002) and Lofgren (2003). The model is a small open economy. It is calibrated using data from the 2000 micro Social Accounting Matrix (SAM) constructed by the author. The 2000 micro SAM of Thailand comprises 20 production sectors (see Appendices A and L). Each sector has two inputs: capital and labour. There are three types of institutions (households, enterprises and government) and three groups of taxes: income tax, indirect tax and tariffs (see section 4.2). The equations in the model can be divided into four blocks: price block, production and commodity block, institution block and system constraint block. Each block contains equations relating to their function. The equations in each block shown in this section are based on, and extend, those given in Lofgren et al. (2002) and Lofgren (2003). In the discussion below, endogenous variables are in upper case Latin letters, whereas exogenous variables and parameters are in lower case Latin or Greek letters. The definitions of all indices, endogenous and exogenous variables and the parameters in the model are given in the Appendix B.

4.1.1 Price block

The price system of the model is defined in the price block, which consists of equations 4.1 to 4.6. Each price links to other prices and other model variables. As we assumed that Thailand is small relative to the world market, the import and export commodity price equations can be written as equations 4.1 and 4.2.

$$PM_c = (1 + tm_c) \cdot EXR \cdot pwm_c, \qquad c \in CM \qquad 4.1$$

$$PE_c = (1 + te_c) \cdot EXR \cdot pwe_c, \qquad c \in CE \qquad 4.2$$

The absorption for each commodity is the total domestic spending on the commodity at domestic prices ($PQ_c \cdot QQ_c$). It can be expressed as the spending of domestic outputs ($PD_c \cdot QD_c$) plus imports ($PM_c \cdot QM_c$) including an upward adjustment for sales tax as shown in equation 4.3. Therefore, the composite price (PQ_c) can be derived by dividing equation 4.3 by the composite supply (QQ_c) (see discussion of QQ_c on equation 4.11).

$$PQ_c \cdot QQ_c = \left[PD_c \cdot QD_c + \left(PM_c \cdot QM_c\right)_{|c \in CM}\right] \cdot \left(1 + tq_c\right) , \qquad c \in C \tag{4.3}$$

Domestic output value at the producer price ($PX_c \cdot QX_c$) is the value of domestic sales ($PD_c \cdot QD_c$) plus the export value ($PE_c \cdot QE_c$). This can be expressed as equation 4.4. The producer price (PX_c) can be derived when dividing equation 4.4 by the domestic output (QX_c).

$$PX_c \cdot QX_c = \left[PD_c \cdot QD_c + \left(PE_c \cdot QE_c\right)_{|c \in CE}\right] , \qquad c \in C \tag{4.4}$$

The last two price equations are activity price (PA_a) and value-added price (PVA_a). Equation 4.5 describes activity price, which is the sum of producer price times the yields of commodities whereas equation 4.6, the value-added price, is the activity price minus the value added tax and input cost per activity unit.

$$PA_a = \sum_{c \in C} PX_c \theta_{ac} , \qquad a \in A \tag{4.5}$$

$$PVA_a = PA_a \cdot \left(1 - tia_a\right) - \sum_{c \in C} PQ_c \cdot ica_{ca} , \qquad a \in A \tag{4.6}$$

4.1.2 Production and commodity block

In this block, it is assumed that each producer maximizes profits subject to its production function, which uses the Cobb-Douglas production technology. There are two inputs: capital and labour. Therefore, the activity production function can be expressed as equation 4.7.

$$QA_a = ad_a \prod_{f \in F} QF_{fa}^{\alpha_{fa}} , \qquad a \in A \tag{4.7}$$

With perfect competition and profit maximization, the demand for factor inputs is derived as equation 4.8. The left-hand side of equation 4.8 is the marginal cost of factor f in activity a, which equals the marginal revenue product of factor f in activity a (right- hand side of equation 4.8). The factor markets are clear when the model solves for average factor prices (WF_f). The parameters ($WFDIST_{fa}$) are equal to one when there are no distortions in the factor markets.

$$WF_f \cdot WFDIST_{fa} = \frac{\alpha_{fa} \cdot PVA_a \cdot QA_a}{QF_{fa}} \quad , \qquad f \in F \text{ and } a \in A \qquad 4.8$$

Equation 4.9 is the demand for intermediate inputs, which is fixed. It is the function of activity level. Equation 4.10, another kind of function of activity level, is the output function.

$$QINT_{ca} = ica_{ca} \cdot QA_a \qquad 4.9$$

$$QX_c = \sum_{a \in A} \theta_{ac} QA_a - ag_a \quad , \qquad c \in C \qquad 4.10$$

According to imperfect substitutability between imports (QM_c) and domestic output sold domestically (QD_c), the Armington function is used. The composite commodities (QQ_c) are produced by using domestic commodities (QD_c) from domestic markets and from imported markets (QM_c). As the original idea of the Armington assumption was based on the Constant Elasticity of Substitution function (CES), the composite supply (Armington) function can be written as equation 4.11.

$$QQ_c = aq_c \left[\delta_c^q \cdot QM_c^{-\rho_c^q} + (1 - \delta_c^q) \cdot QD_c^{-\rho_c^q} \right]^{-1/\rho_c^q} , \qquad c \in CM \qquad 4.11$$

The optimal mixture between imports and domestic output in equation 4.11 is described in Equation 4.12. It is the import-domestic demand ratio for commodity *c*. Together, equations 4.3, 4.11 and 4.12 constitute the first-order condition for cost minimization given the two prices (PM_c and PD_c) subject to equation 4.11 and the fixed quantity of composite commodity: QQ_c (dividing equation 4.3 with PQ_c).

$$\frac{QM_c}{QD_c} = \left[\left(\frac{PD_c}{PM_c} \right) \cdot \frac{\delta_c^q}{1 - \delta_c^q} \right]^{\frac{1}{1+\rho_c^q}} , \qquad c \in CM \qquad 4.12$$

Similarly, domestic output has the choice between selling its commodity on the domestic market or on foreign markets as exports (QE_c), which is captured by equation 4.13. The Constant Elasticity of Transformation function, CET, is applied because its property is the same as CES function except for the elasticity. Therefore, the domestic output (QX_c) is written as the output transformation (CET) function, which is shown as equation 4.13.

$$QX_c = at_c \cdot \left[\delta_c^t \cdot QE_c^{\rho_c^t} + \left(1 - \delta_c^t\right) \cdot QD_c^{\rho_c^t} \right]^{\frac{1}{\rho_c^t}} , \qquad c \in CE \qquad 4.13$$

In the same way as described for equation 4.12, the optimal mixture between exports and domestic sales in equation 4.13 is described in Equation 4.14, which is the export-domestic demand ratio for commodity c. Again, equations 4.4, 4.13 and 4.14 constitute the first-order condition for producer profit maximization given the two prices (PE_c and PD_c), subject to equations 4.13 and 4.10 (a fixed quantity of domestic output).

$$\frac{QE_c}{QD_c} = \left[\left(\frac{PE_c}{PD_c} \right) \cdot \frac{1-\delta_c^t}{\delta_c^t} \right]^{\frac{1}{\rho_c^t - 1}}, \qquad c \in CE \qquad 4.14$$

4.1.3 Institution block

In the institution block, there are nine equation types: factor income, institution factor incomes, household income, household consumption demand, enterprise income, enterprise expenditure, investment demand, government revenue and government expenditure.

Equation 4.15 defines the income of factor f (YF_f), capital and labour, as equal to the sum of the average factor prices (WF_f) multiplied by the quantity demand of factor f (QF_{fa}) with distortion wage ($WFDIST_{fa}$). The factor income in equation 4.15 then is split into household and enterprise in fixed shares ($shryid_{id,f}$) as shown in equation 4.16. Labour income belongs to household whereas capital income must be subtracted from the payment of tax on capital before flowing to household and enterprise.

$$YF_f = \sum_{a \in A} WF_f \cdot WFDIST_{fa} \cdot QF_{fa}, \qquad f \in F \qquad 4.15$$

$$YFID_{id,f} = shryid_{id,f} \cdot \left[\left(1 - tcap_f\right) \cdot YF_f \right], \qquad id \in ID, f \in F \qquad 4.16$$

Household income (YH_h) is from three sources: factors (capital and labour), transfer from government and remittances from aboard as described in equation 4.17. In contrast, household expenditure is direct income taxes (paid to government) and direct payments to enterprise as interest or insurance. Income after expenditure is household savings, which are used to calculate household savings rate or Marginal Propensity to Save (MPS) for the household. The rest of households' payments are consumption (buying commodities). It is assumed that a household maximises the Cobb-Douglas utility function subject to budget constraints. The result of the first-order conditions is then derived for household consumption demand (QH_{ch}) as shown in equation 4.18.

$$YH_h = \sum_{f \in F} YFID_{hf} + tr_{h,gov} + EXR \cdot tr_{h,row}, \qquad h \in H \qquad 4.17$$

$$QH_{ch} = \frac{\beta_{ch} \cdot \left(1 - mps_h\right) \cdot \left(1 - ty_h\right) \cdot \left(1 - \mathrm{int}_{ent,h}\right) \cdot YH_h}{PQ_c}, \quad c \in C, h \in H \qquad 4.18$$

Equation 4.19 and 4.20 define enterprise income and expenditure respectively. The sources of its income ($YENT_{ent}$) are rent, interest payments from households, transfers from government and transfers from the rest of the world (equation 4.19), whereas, a firm distributes its income by paying taxes to government and transferring to abroad. Income after expenditure of the firm is enterprise savings (equation 4.20).

$$YENT_{ent} = \sum_{f \in F} YFID_{ent,f} + \left(\sum_{h \in H} \text{int}_{ent,h} \cdot YH_h \right) + tr_{ent,gov} + EXR \cdot tr_{ent,row} \;,\; ent \in ENT \qquad 4.19$$

$$YENT_{ent} - \left(tent_{ent} \cdot YENT_{ent} \right) - EXR \cdot tr_{row,ent} = ENTSAV_{ent} \;, \quad ent \in ENT \qquad 4.20$$

Equation 4.21 defines quantity demand for investment for each commodity. It multiplies base-year investment demand ($qinvbar_c$) by investment adjustment factor ($IADJ$).

$$QINV_c = qinvbar_c \cdot IADJ \qquad 4.21$$

In terms of the government sector, its income and expenditure are shown in equations 4.22 and 4.23 respectively. Government revenue is direct income tax from domestic institutions (households and enterprises), direct taxes from factors, value added tax, import tariffs, export taxes, sales tax and transfers from the rest of the world (equation 4.22). On the other hand, government expenditure is from government consumption of commodity goods, transfers to households, firms and the rest of the world (equation 4.23). Government income after expenditure is government savings.

$$\begin{aligned} YG = & \left(\sum_{f \in F} tcap \cdot YF_f \right) + \left(\sum_{h \in H} ty_h \cdot YH_h \right) + \left(\sum_{ent \in ENT} tent_{ent} \cdot YENT_{ent} \right) \\ & + \sum_{c \in C} tic_c \cdot \left(PD_c \cdot QD_c + \left(PM_c \cdot QM_c \right)_{|c \in CE} \right) \\ & + \left[\sum_{a \in A} tia_a \cdot \left(PA_a \cdot QA_a \right) \right] + \left(\sum_{c \in CM} tm_c \cdot EXR \cdot pwm_c \cdot QM_c \right) \\ & + \left(\sum_{c \in CE} te_c \cdot EXR \cdot pwe_c \cdot QE_c \right) + EXR \cdot tr_{gov,row} \end{aligned} \qquad 4.22$$

$$EG = \left(\sum_{c \in C} PQ_c \cdot qg_c \right) + \sum tr_{h,gov} + \sum tr_{rnt,gov} + \sum EXR \cdot tr_{row,gov} \qquad 4.23$$

4.1.4 System constraint block

Equations in this block define the system constraints that must be satisfied by the model. Commodity and factor markets are cleared by the flexible prices while current account balance is cleared by foreign exchange rate. The model satisfies Walras' law. Therefore, the macro constraint satisfies the identity in equation 4.27, which means savings equal investment.

The equilibrium in the factor market is defined in equation 4.24, which is the equality in total quantity demanded and supplied of the two factors capital and labour. In the model, it is assumed that supplies of the factors capital and labour are exogenous and given as parameters. The factor market is cleared by the average factor prices (WF_f) and wage distortion factor for factor *f* in activity *a* ($WFDIST_{fa}$).

$$\sum_{a \in A} QF_{fa} = QFS_f, \qquad f \in F \tag{4.24}$$

The condition in equation 4.25 is the equality in composite commodity supply and demand. The composite commodity supply (QQ_c) is from the Armington function as described in equation 4.11 whereas the composite commodity demand (the right hand side of equation 4.25) is the sum of domestic demand for commodity by activity, household, government and investment demand. This composite commodity market is cleared by the composite commodity price (PQ_c).

$$QQ_c = \sum_{a \in A} QINT_{ca} + \sum_{h \in H} QH_{ch} + qg_c + QINV_c, \qquad c \in C \tag{4.25}$$

Besides the composite commodity, this model includes quantity variables, namely, import quantity (QM_c), export quantity (QE_c), domestic output quantity (QX_c), quantity of domestic output sold domestically (QD_c) and activity level (QA_a) with their associated prices such as import price (PM_c), export price (PE_c), producer price (PX_c), domestic output price (PD_c) and activity price (PA_a) respectively. These quantity variables represent both roles: quantities supplied and demanded. That means "the equilibrium quantity has been substituted for the quantity supplied and demanded thorough out the model" (Lofgren, 2003, p. 31). The QX_c, QD_c and QA_a are cleared by the PX_c, PD_c and PA_a. However, for imports and exports, the markets are cleared by the quantities demanded and supplied ("infinitely elastic world market demands and supplies at fixed foreign-currency prices") (Lofgren, 2003, p. 31).

Regarding the current account balance (expressed in foreign currency), the country's earnings equal its spending of foreign exchange, which is represented by equation 4.26. The earnings side is from export revenue, transfers from aboard and foreign savings. The spending side comes from import spending, transfers to the rest of the world and foreign investment. In this model, it is assumed that foreign savings are fixed and the current account balance is cleared by the foreign exchange rate.

$$\sum_{c \in CE} pwe_c \cdot QE_c + \sum_{i \in I} tr_{i,row} + FSAV = \sum_{c \in CM} pwm_c \cdot QM_c + \sum_{i \in I} tr_{row,i} + finv \tag{4.26}$$

Another macro constraint is the saving-investment balance as shown in equation 4.27. Total savings are the sum of savings from households, enterprises, government and the rest of the world. In contrast, total investment is the sum of the value of domestic investment and foreign investment. The $WALRAS$ variable is introduced in this equation in order to check whether the saving-investment balance holds. If the model works, the value of $WALRAS$ will be zero.

$$\begin{aligned} &\sum_{h \in H} mps_h \cdot (1 - ty_h) \cdot (1 - \mathrm{int}_{\mathrm{int},h}) \cdot YH_h + (YG - EG) \\ &+ \left[\sum_{ent \in ENT} YENT_{ent} - (tent_{ent} \cdot YENT_{ent}) - EXR \cdot tr_{row,ent} \right] + EXR \cdot FSAV \\ &= \sum_{c \in C} PQ_c \cdot QINV_c + EXR \cdot finv + WALRAS \end{aligned} \tag{4.27}$$

The last equation in the system constraint block is price normalization (equation 4.28). The consumer price index is defined as a weighted sum of the composite commodity price. The weights, commodities weight in consumer price index, are the ratios of demand for each commodity to total demand. The consumer price index (cpi) in equation 4.28 is fixed. Hence, in a simulation, when a simulated price changes, it can be directly given a value vis-à-vis the cpi.

$$\sum_{c \in C} PQ_c \cdot cwts_c = cpi \tag{4.28}$$

4.1.5 Equilibrium condition and macro closure

There are three main equilibrium conditions: the market equilibrium (equation 4.25), current account balance (equation 4.26) and saving-investment balance (equation 4.27). Since the model has chosen the neoclassical closure, which is based on Walrasian models, it is assumed that, at equilibrium, there is full employment in the economy.

There are three macro closures: savings-investment closure, factor market closure and foreign market closure. First, all investment is determined by savings or, in other words, it is a saving driven model (Thissen, 1998). Due to the simulation of the increase in input capital in agricultural sector, the second macro closure, input capital, is fully utilized and activity-specific and labour is mobile and fully employed. The capital market is cleared by the rent distortion factor ($WFDIST_{cap,a}$). The change in each sector's rent is recorded as change in the rent distortion factor. In addition, the labour market is cleared by the average wage ($WF_{lab,a}$). The last closure, foreign savings, is fixed. Therefore, a flexible exchange rate clears the current account.

The model must satisfy Walras' law, therefore a slack variable ($WALRAS$) is introduced in equation 4.27. The number of endogenous variables equals the number of equations. The $WALRAS$ variable should return a zero value at equilibrium when the model is fully closed and all markets are cleared.

4.2 Data, software and model calibration

4.2.1 Data and software

Since the 1998 SAM of Thailand was constructed by TDRI to examine the impact of the financial economic crisis in Thailand in 1997, many recent CGE modellers have modified this SAM as a database for their models. This is because constructing a SAM is somewhat time-consuming. In a SAM construction, the main data source is the national income plus supplementary data, the input-output table, which is required to disaggregate the activity and commodity accounts (Sadoulet & Janvry, 1995).

In Thailand, the national income information is produced every year whereas the input-output table is usually compiled every five years by NESDB. The most recent input-output table for Thailand is for 2000. Therefore, this study constructs the database for the CGE model, 2000 SAM, using data from the input-output table and the national income of Thailand for 2000. There are three steps in the 2000 SAM construction. First, a macro 2000 SAM of Thailand was constructed to use as control numbers for the second step. Secondly, the activities and commodities in the 2000 macro SAM were disaggregated into the 2000 micro SAM with 20 sectors with eight agricultural sectors to serve for policy simulations in the CGE model. The disaggregated SAM was called the 2000 micro SAM of Thailand. Lastly, the Cross Entropy technique was used to balance the 2000 micro SAM. The balanced 2000 micro SAM was then used as benchmark data for the model.

4.2.1.1 A 2000 macro SAM for Thailand

To construct the 2000 macro SAM for Thailand in practice, it is necessary to fill the cells of the basic SAM structure, as shown in Table 3.8 in section 3.4.1, from various sources (Cororaton, 2003). Each cell in the macro SAM refers to its ‘row’ and ‘column’ placement. For instance, intermediate demand is in the ‘commodities’ and ‘activities’ cells. All cells are in millions of baht. There are only a few cells left because of unavailable data and for the pertinent account balance purposes. All entries are from the national income of Thailand year 2000 except intermediate demand, value added and domestic sales, which are from the 2000 input-output table of Thailand (see Appendix C for detail of all data entries).

Table 4.1 shows the unbalanced 2000 macro SAM of Thailand. As the data of the macro SAM are from different sources, it is not surprising that a few sums of accounts (the sum of commodities, household, firm and the rest of the world) are not balanced. If we make the Table 4.1 balance, it can be used as an overview of the economic and social structure of Thailand for 2000. However, the main objective of this study focuses on the impact of capital intensive farming. Therefore the production sides, activities, commodities and their related accounts, are disaggregated. The detail of disaggregation is provided in the next section.

Table 4.1: 2000 macro SAM for Thailand (millions of baht)

	Activities (1)	Commodities (2)	Labour (3)	Capital (4)	Households (5)	Firms (6)	Government (7)	S-I (8)	ROW (9)	Total (10)
Activities (1)		11,017,207								**11,017,207**
Commodities (2)	6,471,709				2,762,925		581,273	1,124,164	3,263,818	**14,203,899**
Labour (3)	1,609,453									**1,609,453**
Capital (4)	2,493,198									**2,493,198**
Households (5)			1,609,453	1,662,712			36,715		34,721	**3,343,601**
Firms (6)				782,364	34,596		16,299		169,929	**1,103,188**
Government (7)	442,847	62,931		48,122	112,109	105,985			3,668	**775,662**
S-I (8)					367,833	311,602	140,300		304,428	**1,124,164**
ROW (9)		2,862,305				246,803	1,075			**3,110,183**
Total (10)	**11,017,207**	**13,942,443**	**1,609,453**	**2,493,198**	**3,277,463**	**664,390**	**775,662**	**1,124,164**	**3,776,564**	

Source: Appendix C

4.2.1.2 A 2000 micro SAM for Thailand

Generally, a macro SAM can describe an overall circular flow of an economic system as discussed in section 3.4. However, this study specifically focuses on Thailand's agriculture. Therefore, several cells in the macro 2000 SAM for Thailand (Table 4.1) involved in the agricultural sector are disaggregated. The level of disaggregation in this study depends on two things. First, the availability of elasticity (CES and CET) in the disaggregated sectors and, secondly, the policy simulation design in simulation 3 (see section 4.3). Therefore, the agricultural machinery sector (sector 16) is disaggregated especially for this simulation. For these reasons, the production side was disaggregated into 20 sectors with eight agricultural sectors and 12 non-agricultural sectors. One of the 12 non-agricultural sectors related to the agricultural sector, agricultural machinery sector, is also disaggregated and there are three types of taxes and tariffs.

In the 2000 micro SAM for Thailand, activities and commodities are aggregated from the 2000 input-output table. The 180 x 180 matrix 2000 input-output table (Appendices D and E) is aggregated into a 20 x 20 sector matrix as displayed in Appendix F. The three categories of taxes and tariffs are disaggregated because one of the simulations removes tariffs on the Agricultural Machinery sector.

To disaggregate the macro SAM into micro SAM of Thailand for 2000, the information of 2000 input-output table is needed. The non-zero cells in the macro SAM (see Table 4.1) are preserved as a control total for the disaggregation into the micro SAM. Therefore, there are 11 cells in the macro SAM that need to be split as shown in Table 4.2. These 11 control cells are disaggregated by using coefficients calculated from the 20 x 20 sector matrix, which was aggregated from the 180 x 180 sector matrix of the Thailand 2000 input-output table. Appendix G shows the coefficients for disaggregating the control cells numbered 2 – 4 and 6 – 11. The coefficients for disaggregating the intermediate input and domestic sales (control cells number 1 and 5) are shown in Appendices H and I, respectively. Other cells in the macro SAM that are not disaggregated remain as entered in the 2000 macro SAM. Finally, the outcome of disaggregation is the 2000 micro SAM for Thailand with a 50 x 50 matrix. The 50 x 50 matrix has 20 activities, ACT01 – ACT20; 20 commodities, COM01 – COM20; two factors, labour (LAB) and capital (CAP); three institutions, household (HHD), firm (ENT) and government (GOV); three taxes, income tax (YTAX), indirect tax (ITAX) and tariffs (TAR); saving-investment (S-I) and the rest of the world (ROW) are as shown in Appendix J.

Table 4.2: The control cells for disaggregation of the macro SAM into the micro SAM (millions of baht)

No.	Name	Cells in 2000 Macro SAM for Thailand (row, column)
1.	Intermediate Input	6,471,709 (2,1)
2.	Value added (wages)	1,609,453 (3,1)
3.	Value added (rent)	2,493,198 (4,1)
4.	Indirect taxes	442,847 (7,1)
5.	Domestic sales	11,017,207 (1,2)
6.	Tariffs	62,931 (7,2)
7.	Imports	2,862,305 (9,2)
8.	Household consumption	2,762,925 (2,5)
9.	Government consumption	581,273 (2,7)
10.	Investment	1,124,164 (2,8)
11.	Exports	3,263,818 (2,9)

Source: Table 4.1

There is no surprise that the micro SAM, as shown in Appendix J, is not balanced. This is because of the procedure of the SAM construction, different data sources and disaggregation. There are techniques to balance the SAM or other matrices, for example, RAS and the cross-entropy (CE) method.

RAS, the classic SAM balancing method, is widely used when we have new information about the row and column sum. In this technique, we update the existing SAM with the old matrix including the new row and column sum. However, this method would not work when there is a zero in the row and column (Robinson, Cattaneo, & El-Said, 2000). Moreover, Nielsen (2002) states that in the RAS technique's assumption, there is no measurement error in the row and column sum and RAS uses only information in the row and column sums for balancing.

The cross entropy econometric approach, on the other hand, "uses all available information, including prior parameters estimates, and supports estimation even in a data sparse environment" (Robilliard & Robinson, 2003, p. 397). For these reasons, this study uses the cross-entropy approach to balance the 2000 micro SAM for Thailand. The cross entropy method was first introduced by Shannon in 1948 in A Mathematical Theory of Communication (Shannon, 2001). The following two cross-entropy methods are drawn heavily from Robinson et al. (2000) and Robinson and El-Said (2000):

4.2.1.2.1 Deterministic approach: information theory

Let $t_{i,j}$ be the payment from column account j to row account i of the T matrix. As mentioned, in a SAM, each row sum (y_i) has to equal the corresponding column sum (y_j).

A SAM coefficient matrix, A, is calculated by dividing each cell in the column by the column sum (equation 4.29).

$$A_{i,j} = \frac{t_{i,j}}{y_j} \qquad 4.29$$

The starting point of the cross entropy method is the prior coefficient matrix ($\bar{A}$) of the unbalanced SAM. The cross entropy estimation problem is to find a new set of the coefficient matrix (A). To solve this problem, the Lagrangian is set by minimizing the entropy distance between the prior coefficient matrix ($\bar{A}$) and the new coefficient matrix (A) as shown in equations 4.30, 4.31 and 4.32.

$$\min_{\{A\}} I = \left[\sum_i \sum_j A_{i,j} \ln \frac{A_{i,j}}{\bar{A}_{i,j}} \right] \qquad 4.30$$

Subject to:

$$\sum_j A_{i,j} y_j^* = y_i^* \qquad 4.31$$

$$\sum_j A_{i,j} = 1 \text{ and } 0 \leq A_{j,i} \leq 1 \qquad 4.32$$

4.2.1.2.2 Stochastic approach: measurement error

Robinson et al. (2000) suggest that the cross entropy stochastic approach is useful in real world economic data when the row and column sums of the SAM involve measurement errors and the prior coefficient matrix ($\bar{A}$) is not based on a balanced SAM. The concept of the stochastic approach starts from the general regression model:

$$y = x\hat{a} + e \qquad 4.33$$

Where:

y is the vector of dependent variables;

$\hat{a}$ is the coefficient vector to be estimated;

x is the vector of independent variables; and

e is the error term.

Robinson et al. (2000) extend the basic regression model for cross entropy by introducing an error term (e) in the independent variable vector (equation 4.34). That means these independent variables are measured with noise. The equation 4.34 is then rewritten as a SAM equation as shown in equation 4.35, which reflects the concept of a SAM that the row sums are equal to the corresponding column sums.

$$y = A[\bar{x} + e] = A\bar{x} + Ae \qquad 4.34$$

$$y = \bar{x} + e \tag{4.35}$$

Where:

y is the vector of row sums and

$\bar{x}$, the vector of column sums, is measured with error (e).

The error term (e) can be written as weighted average of known constant as shown in equation 4.36:

$$e_i = \sum_w w_{i,w} \bar{v}_{i,w} \tag{4.36}$$

Where:

$\bar{v}_{i,w}$ is the support set for the error (constant term);

subject to:

$$\sum_w w_{i,w} = 1 \text{ and } 0 \leq \sum_w w_{i,w} \leq 1 \tag{4.37}$$

Where $w_{i,w}$ is the error weights estimated in the cross entropy procedure.

Robinson et al. (2000) conclude that the error weights ($w_{i,w}$) are treated as probabilities to be estimated. The support set for the error term or $\bar{v}_{i,w}$ in equation 4.36 is chosen to be a symmetric error distribution around zero. There are two types of weight error distribution: three weight error distribution and five weight error distribution. In terms of three weight error distribution, there are three the support sets for the error term ($\bar{v}_{i,w}$) which is symmetric around zero as shown in equation 4.38. In this case, there are three weights ($\bar{w}$) to be estimated. Therefore, we have:

$$\bar{v}_{i,1} = -3\sigma$$

$$\bar{v}_{i,2} = 0$$

$$\bar{v}_{i,3} = +3\sigma \tag{4.38}$$

Where σ is the standard error.

Similarly, in the case of the five weight error distribution there are five weights to be estimated. In this case, we have:

$$\bar{v}_{i,1} = -3\sigma$$

$$\bar{v}_{i,2} = -\sigma$$

$$\bar{v}_{i,3} = 0$$

$$\bar{v}_{i,4} = +3\sigma$$

$$\bar{v}_{i,5} = +3\sigma \qquad 4.39$$

Robinson and El-Said (2000) conclude that in the cross entropy estimation, it specifies the error on column sums ($w1's$), the error on macro aggregates ($w2's$) and the extent of cross entropy in equation 4.30 as follows:

$$\min_{\{A,w1,w2\}} I = \left[\sum_i \sum_j A_{i,j} \ln A_{i,j} - \sum_i \sum_j A_{i,j} \ln \bar{A}\right]$$

$$+\left[\sum_i \sum_w w1_{i,w} \ln w1_{i,w} - \sum_i \sum_w w1_{i,w} \ln \overline{w}1_{i,w}\right]$$

$$+\left[\sum_i \sum_w w2_{i,w} \ln w2_{i,w} - \sum_i \sum_w w2_{i,w} \ln \overline{w}2_{i,w}\right] \qquad 4.40$$

The cross entropy estimation is to minimize equation 4.40 and to find a set of $A's$ $w1's$ and $w2's$ subject to the following constraints (Robinson & El-Said, 2000):

$$T_{i,j} = A_{i,j} \cdot \left(\bar{X}_i + e1_i\right) \qquad 4.41$$

$$Y_i = \bar{X}_i + e1_i \qquad 4.42$$

$$e1_i = \sum_{jwt} w1_{i,jwt} \cdot \bar{v}1_{i,jwt} \qquad 4.43$$

$$\sum_{jwt} w1_{i,jwt} = 1 \qquad 4.44$$

$$\sum_j T_{i,j} = Y_i \qquad 4.45$$

$$\sum_i T_{i,j} = \bar{X}_i + e1_i \qquad 4.46$$

$$\sum_i \sum_j G_{i,j}^{(k)} T_{i,j} = \gamma^{(k)} + e2_k \qquad 4.47$$

$$e2_k = \sum_{jwt} w2_{k,jwt} \cdot \bar{v}2_{k,jwt} \qquad 4.48$$

$$\sum_{jwt} w2_{k,jwt} = 1 \qquad 4.49$$

Where:

i, j are the row i and column j entries;

k is the set of constraints;

w is the set of weights;

$T_{i,j}$ is the SAM in values;

$\bar{A}_{i,j}$ is the prior SAM in column coefficients;

$A_{i,j}$ is the new SAM in column coefficients;

$\overline{X}_i$ is the prior value for the SAM column sums;

$e1_i$ is the error term associated with column sum;

Y_i is the value for the SAM row sums;

$w1_{i,jwt}$ is the error weights;

$\overline{v}1_{i,jwt}$ is the error support values;

$G_{i,j}^{(k)}$ is an n x n aggregator matrix for each constraint k;

$\gamma^{(k)}$ is the aggregator value of constraint k;

$e2_k$ is the error term associated with macro aggregates;

$w2_{k,jwt}$ is the error weights for macro totals and

$\overline{v}2_{k,jwt}$ represents the error support values for macro totals.

The above cross entropy estimation technique is implemented with the 2000 micro SAM for Thailand (see Appendix K) using the software called General Algebraic Modelling System or GAMS.

The GAMS is designed for high-level algebraic modelling systems for large scale and complex optimization models. GAMS can formulate many different types of models such as, Mixed Integer Linear/Quadratic Programs (MIP/MIQCP), Mixed Integer Nonlinear Programs (MINLP), Mixed Complementarity Problems (MCP), Mathematical Programs with Equilibrium Constraints (MPEC) and Constrained Nonlinear Systems (CNS). The form of GAMS language is easy to understand by people who commonly have programming language experience. Almost all platforms, for example, Windows, Linux, Mac OS X, and AIX, are fully portable by GAMS (GAMS Development Corporation, 2009a).

Although there are many model types that GAMS can formulate as identified above, the Constrained Nonlinear Systems (CNS) was selected because it is defined as a square system of equations. This means the CNS not only solves a CGE model, but also checks the model whether the number of variables is equal to the number of constraints on CGE modelling.

Many solvers are capable on the above model types in GAMS for instance, CONOPT 3, MILES, MINOS, MPSGE, MSNLP, NLPEC, OQNLP, PATH, SBB and SNOPT (GAMS Development Corporation, 2009b). However, as the CNS model was selected to run the CGE model, only two solver choices for SAM estimation, CONOPT 3 and PATH, are available as they are the only ones capable for the CNS. In this study, CONOPT 3 is the better selection as recommended by Robinson and El-Said (2000, p. 9).

The GAMS code for estimating this 2000 micro SAM was developed from Robinson and El-Said (2000). There are two macroeconomic control aggregates: GDP at factor cost and GDP at market prices. There are five weights error distributions that can incorporate more information regarding the error distribution. Following the cross entropy method and the above modified GAMS code, a balanced 2000 micro SAM for Thailand (see Appendix L) was developed and used as the database for the CGE model in this study. The core GAMS code for SAM estimation in this study is presented in Appendix K.

4.2.2 Model calibration, Walras' law and the base run

4.2.2.1 Model calibration

The completed 2000 micro SAM for Thailand from the previous section is now used to calibrate the CGE model (see section 4.1). The calibration basically means using the 2000 micro SAM for Thailand by running the CGE model to find parameter values that are consistent with the initial equilibrium value in SAM.

Most parameters in the model are calibrated from the 2000 micro SAM of Thailand. The other numbers from outside the micro SAM of Thailand: number of employed workers and the value of net capital stock of Thailand in each sector in the year 2000, are introduced into the CGE model (see Appendix M). These numbers are used to calculate the average factor return (wage and rent) of workers and capital respectively.

In terms of calibration, it is assumed that all initial prices at equilibrium in the CGE model are equal to one. Therefore, the demand and supply of goods are obtained as the base year solution of the model that must equal the initial equilibrium captured by SAM. After obtaining the base year values for variables in the CGE model, parameters are derived from equations in the model. For example, in equation 4.7, three parameters, the production function efficiency parameter (ad_a) and two production function share parameters for factor *f* in activity A (α_{fa} and $1-\alpha_{fa}$) are derived. With the first order conditions for profit maximization, the demand for factor inputs is derived as equation 4.8 that can solve for the share parameter (α_{fa} and $1-\alpha_{fa}$).

4.2.2.2 Walras' law

Before adding the Walras variable into equation 4.27, the model has 756 equations but 755 variables. That means the model was not yet square. If the model satisfies Walras' law, any one of the equations that is functionally independent may be dropped. However, Lofgren et al. (2002) claim that adding one more variable to the macroeconomic balance (equation 4.27) is an alternative way of satisfying Walras' law. Therefore, the Walras variable is added into equation 4.27 and no equation is dropped. The Walras variable should return to zero if the equilibrium solution is met unless one or more equations are not satisfied and no equilibrium solution is found.

4.2.2.3 Equilibrium condition, macro closure and base run

There are three main equilibrium conditions: the market equilibrium (equation 4.25), current account balance (equation 4.26), and the saving-investment balance (equation 4.27). Since the model has neoclassical closure based on Walrasian models, it is assumed that at equilibrium, there is a full employment in the factor market in the economy. All investment is determined by savings or, in other words it is a savings driven model (Thissen, 1998). The exchange rate is flexible. The model must satisfy Walras' law as discussed above. The number of endogenous variables equals the number of equations. The model is fully closed and all markets are cleared when the $WALRAS$ variable is zero at equilibrium.

The last two parameters, Armington elasticity (σ_c^q) and elasticity of transformation between domestic sales and exports for commodity c (σ_t^q), are needed to run the CGE model. Because there is limited time series data on elasticity estimation in Thailand, the elasticity of substitution between domestic goods and imports for commodity c or Armington elasticity (σ_c^q) is taken from Warr and Lapiz (1994). Similarly, the elasticity of transformation between domestic sales and exports for commodity c (σ_t^q) is obtained from Warr and Lapiz (1994) and Wattanakuljarus and Coxhead (2006). Both elasticities are presented in Appendix N.

Following model calibration and closure assumptions, the model is ready to run for the base year 2000. To ensure there is only one solution for the equilibrium, the Consumer Price Index: CPI (equation 4.28) is fixed and functions as numéraire. All prices in the model are homogeneous of degree zero. Therefore, if the value of the numéraire is doubled, all prices should be doubled with no change in real quantities. Consequently, when doing a simulation, the changes in simulated prices and incomes should be interpreted as changes vis-à-vis the numéraire price index.

Since elasticity, the number of employed workers, and the value of net capital stock of Thailand year 2000 in each sector have been introduced into the model, the values of variables and parameters are obtained from the 2000 micro SAM of Thailand. Finally, the

CGE model is run by GAMS using all the above information. Since the value of the initial prices of commodities and factors are unity, the base year solution from running the CGE model duplicates the initial values as captured by SAM. The GAMS codes of the CGE model are based on, and extend, those given in Lofgren et al. (2002) and Lofgren (2003). The core GAMS code for CGE model is provided in Appendix O.

4.3 Simulation design

The main hypothesis of this study is to examine the impact of capital-intensive farming in Thailand. In order to measure this impact, this study applied the non-neutral technological change concept from Jackson (1998). Jackson (1998) follows Salter's (as discussed in Chapter 3) production functions definition as follows:

$$Q = ZL^{a}K^{b} \tag{4.50}$$

Where:

Q = quantity output per period;

Z = adjustment factor (or ad_a in the CGE model);

L = quantity of input of labour;

K = the acquisition cost at constant price of the fixed capital stock;

a = the partial elasticity of Q with respect to L (when K is constant) or production function share parameter for factor L in activity a (or α_{fa} in this CGE model) and

b = the partial elasticity of Q with respect to K (when L is constant) or production function share parameter for factor K in activity a (or $1-\alpha_{fa}$ in this CGE model).

$a + b = 1$

Equation (4.50) can be expressed in K as a function of Q and L:

$$K = \left(Q/Z\right)^{\frac{1}{b}} L^{\frac{-a}{b}} \tag{4.51}$$

If we take derivative of equation (4.51) with respect to L, $\frac{dK}{dL}$:

$$\frac{dK}{dL} = -\left(a/b\right)\left(Q/Z\right)^{\frac{1}{b}} L^{\left(\frac{-a}{b}-1\right)} = -\left(a/b\right)\left(Q/Z\right)^{\frac{1}{b}} L^{-\left(\frac{1}{b}\right)} \tag{4.52}$$

The condition for cost minimization is given as follows:

$$\frac{dK}{dL} = -\frac{p_L}{P_K} \tag{4.53}$$

Where:

P_L = wage rate per labour and

P_K = price of a unit of capital.

Therefore, equation 4.52 is equal to equation 4.53:

$$-\left(a/b\right)\left(Q/Z\right)^{\frac{1}{b}} L^{-\left(\frac{1}{b}\right)} = -\left(\frac{P_L}{P_K}\right) \qquad 4.54$$

If we solve equation 4.54 for the minimum cost quantity of input of labour (L^*):

$$L^* = \left[\frac{\left(a/b\right)}{\left(p_L/p_K\right)}\right]^b \left(\frac{Q}{Z}\right) \qquad 4.55$$

Similarly, the value of the minimum cost quantity of capital input (K^*) can be derived as follows:

$$K^* = \left[\frac{\left(a/b\right)}{\left(p_L/p_K\right)}\right]^{-a} \left(\frac{Q}{Z}\right) \qquad 4.56$$

If equation 4.56 is divided by equation 4.55, we obtain the minimum cost of the capital-labour ratio $\left(K/L\right)^*$ as follows:

$$\left(K/L\right)^* = \left[\frac{p_L/p_K}{a/b}\right] \qquad 4.57$$

Jackson (1998) calls a non-neutral technological change as “capital-using” or “labour saving” if the ratio of exponents $\left(\frac{a}{b}\right)$ falls and then the capital-labour ratio at minimum cost $\left(K/L\right)^*$ increases, which means capital is substituted for labour. In contrast, he defines a non-neutral technological change as “capital-saving” or “labour-using” if the ratio of exponents $\left(\frac{a}{b}\right)$ rises and then the capital-labour ratio at minimum cost $\left(K/L\right)^*$ decreases, which means labour is substituted for capital (see Table 4.3). This capital-using concept is applied into the CGE model when running the simulation.

Table 4.3: A synopsis of possibilities of non-neutral technical change

Source: Jackson (1998)

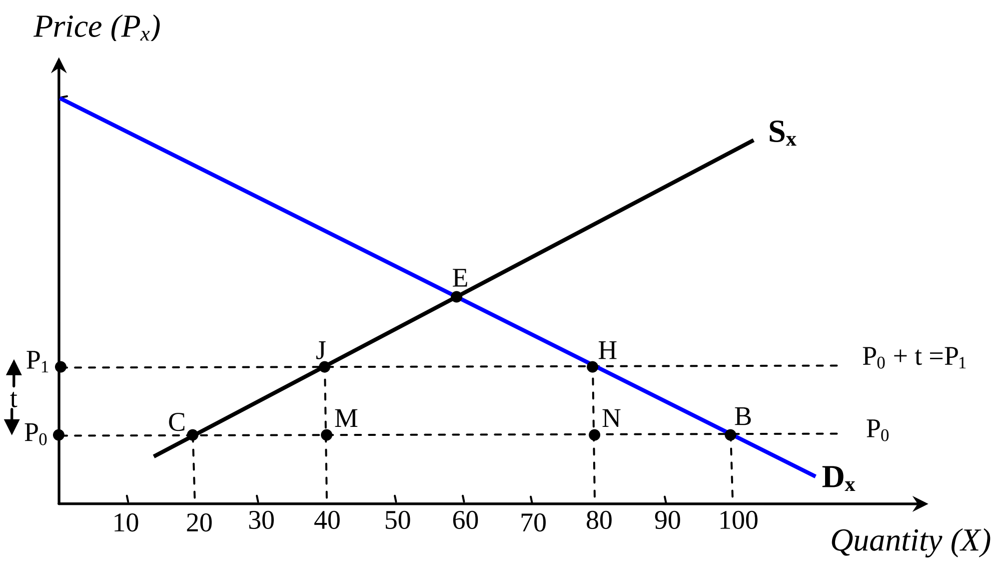
Four main simulations and 25 Sub-simulations are to be conducted to address the research objectives as follows: (see Table 4.4).

Simulation 1, the ratio of exponents a/b is decreased, following Jackson's concept, to answer the question: What are the impacts of capital-using in agricultural sector? In this experiment, we assume that the production function share parameters of capital (b in Jackson's concept or $1-\alpha_{fa}$ in the CGE model) in agricultural sectors (Sector ACT01 – 08) are increased by 5%. The increase in b resulted in a or (α_{fa} in the model) decreasing. This is because the constant return to scale in the production function assumed that $a+b=1$ (or $\alpha_{fa}+(1-\alpha_{fa})=1$ in the CGE model). In the end, the ratio of exponents a/b fell.

The second simulation deals with the direct increase in capital- labour ratio in agricultural sectors. According to Chung (1994), in a Cobb-Douglas production function, $y = f(x_1,...,x_n) = A\prod_{i=1}^{n} x_i^{a_i}$, "each parameter ($a_i$) directly indicates the share of output paid to the respective input". In addition, Chung points out that "if the value of parameter a_i is greater than the value of parameter a_j, that means the output (y) share of input i is greater than the share of input j". Moreover, he explains that if there are only two inputs, let x_i and x_j be capital (K) and labour (L) respectively, then "if the capital-labour ratio (K/L) of output y_1 is greater than that of output y_2 for the given wage-rental ratio, output y_1 is called ***capital-intensive goods*** whereas output y_2 is called labour-intensive goods". Therefore, in this experiment, the model is shocked by increasing net capital stock (K) in agricultural sectors (Sector ACT01 – 08) by 5% in order to increase the K/L ratio directly which is also causing capital intensity in agricultural sectors.

The third simulation deals with an import tariff. According to international economics and trade theory, an effect of a tariff in a small nation can be described as follows (see Figure 4.1). Curves D_x and S_x represent the small nation's demand and supply of commodity X in the economy. At the tariff barrier of *t*, the import price of X is P_1. The country consumes 80X (P_1H) which is produced domestically by 40X (P_1J) and imported by 40X (JH). However, when there is no tariff, the free trade price is P_0, which drops by *t*. The nation consumes 100X (P_0B) of which 20X is produced domestically. The country can import more of commodity X which is 80X (CB) (Figure 4.1).

Figure 4.1: The effect of a tariff in a small country



Source: Modified from Salvatore (2005) and Kreinin (1998)

With free trade, a country can import more goods or services when there is no tariff barrier. Therefore, the Agricultural Machinery sector (Sector 16) is disaggregated especially for this simulation. The reason is that Thailand imported only some quality equipment of agricultural machinery. Therefore, if there is no import tariff on sector 16, it is expected that Thailand would import more agricultural machinery. The consequence of the increase in this import might be to affect other economic variables in the model.

The last simulation is the combination of the above simulations 1, 2 and 3 in order to test the *total* impact of capital intensive farming if Thailand implemented *all* the above simulations' actions combined (see Table 4.4).

Table 4.4: The list of CGE simulations for capital intensive farming

Simulation	Description
Simulation 1	Production function share parameter for input capital in agricultural sectors (ACT01 – ACT08) increased by 5%
Simulation 1.1	Production function share parameter for input capital in sector ACT01 increased by 5%
Simulation 1.2	Production function share parameter for input capital in sector ACT02 increased by 5%
Simulation 1.3	Production function share parameter for input capital in sector ACT03 increased by 5%
Simulation 1.4	Production function share parameter for input capital in sector ACT04 increased by 5%
Simulation 1.5	Production function share parameter for input capital in sector ACT05 increased by 5%
Simulation 1.6	Production function share parameter for input capital in sector ACT06 increased by 5%
Simulation 1.7	Production function share parameter for input capital in sector ACT07 increased by 5%
Simulation 1.8	Production function share parameter for input capital in sector ACT08 increased by 5%
Simulation 2	Capital stock (CAP) in agricultural sectors (ACT01 – 08) increased by 5%
Simulation 2.1	Capital stock (CAP) in sector ACT01 increased by 5%
Simulation 2.2	Capital stock (CAP) in sector ACT02 increased by 5%
Simulation 2.3	Capital stock (CAP) in sector ACT03 increased by 5%
Simulation 2.4	Capital stock (CAP) in sector ACT04 increased by 5%
Simulation 2.5	Capital stock (CAP) in sector ACT05 increased by 5%
Simulation 2.6	Capital stock (CAP) in sector ACT06 increased by 5%
Simulation 2.7	Capital stock (CAP) in sector ACT07 increased by 5%
Simulation 2.8	Capital stock (CAP) in sector ACT08 increased by 5%
Simulation 3	The removal of import tariff on COM 16
Simulation 4	The combination of Simulations 1, 2 and 3
Simulation 4.1	Simulation 1.1 + Simulation 2.1
Simulation 4.2	Simulation 1.2 + Simulation 2.2
Simulation 4.3	Simulation 1.3 + Simulation 2.3
Simulation 4.4	Simulation 1.4 + Simulation 2.4
Simulation 4.5	Simulation 1.5 + Simulation 2.5
Simulation 4.6	Simulation 1.6 + Simulation 2.6
Simulation 4.7	Simulation 1.7 + Simulation 2.7
Simulation 4.8	Simulation 1.8 + Simulation 2.8
Simulation 4.9	Simulation 4.1 +…+ 4.8

Source: Author’s study

Chapter 5
Research Results and Findings

This chapter reports and discusses the results of a non-neutral technological change as "capital-using" in the agricultural sectors of Thailand compared with the base year. This chapter is organized as follows: Section 5.1 – 5.3 discuss the results of simulation 1 – 3, respectively, including their sub-simulations. The combination simulation 1, 2, and 3, is discussed in Section 5.4. Section 5.5 concludes the results and findings of this study.

The impact of all policy experiments in Sections 5.1–5.4 are divided into five effects: input factor effects, sectoral output effects, income effects, price effects and macroeconomic effects. The main results of simulation 1 to 4 are presented in Sections 5.1 – 5.4. Other results are displayed in Appendices P – T.

5.1 The results of Simulation 1: production function share parameters of capital input (α_{fa}) in agricultural sectors (ACT01 – ACT08) are increased by 5 %

In simulation 1, it is assumed that there is a 5% increase in the production function share parameter of capital input (α_{fa}) in the agricultural sectors (ACT01 – ACT08). Because simulations 1.1 – 1.8 are sub-simulations of Simulation 1, the discussion in this section is based on overall results from Simulation 1. Then the sub-simulations, Simulations 1.1 – 1.8, will be described to support Simulation 1 as well as an among simulation comparison.

5.1.1 Input factor effects of Simulation 1

Before discussing the detailed simulation results, it is best to understand the basic role of the production share parameter for factors. According to Chung (1994), in a Cobb-Douglas production function, $y = f(x_1,...,x_n) = A\prod_{i=1}^{n} x_i^{a_i}$, "each parameter ($a_i$) directly indicates the share of output paid to the respective input". In addition, Chung points out that "if the value of parameter a_i is greater than the value of parameter a_j, that means the output (y) share of input i is greater than the share of input j". Moreover, he explains that if there are only two inputs, let x_i and x_j be capital (K) and labour (L) respectively, then "if the capital-labour ratio (K/L) of output y_1 is greater than that of output y_2 for the given wage-rental ratio, output y_1 is called capital-intensive goods whereas output y_2 is called labour-intensive goods.

Considering the base year value of the production function share parameter (α_{fa}) of factor input obtained from the model (see Table 5.1), it can be seen that the output of every sector paid to capital rather than labour (α_{fa} of capital is greater than α_{fa} of labour in each sector). In other words, the share of capital input is greater than the share of labour input in each sector in the Thai economy especially in the Livestock (Sector 6) and Paper Industry sectors (Sector 12). Only Service Transportation and Communication (Sector 20) and agricultural machinery (Sector 16) have the share of labour greater than the share of capital. That means the output of these two sectors paid to labour input rather than capital input. Simulation 1 tried to put a bigger share of output paid to capital rather than labour in the agricultural sectors (Sectors 1 – 8). That means outputs of agricultural sectors are going to be paid more on capital input compared with the base year (Table 5.1).

Since this study used the Cobb-Douglas production function, the increase in α_{fa} of capital by approximately 5% in all agricultural sectors (Sectors 1 – 8) (Simulation 1) resulted in a decrease in α_{fa} of labour in its sectors by 8 – 21%. The decrease of α_{fa} of labour depends on its original α_{fa} of capital parameters. The higher number of α_{fa} of capital leads to a greater decrease of α_{fa} of labour when there is a change in α_{fa} of capital. Therefore, the α_{fa} of labour input in the Livestock (Sector 6) decreased more than in other agricultural sectors. On the other hand, the least drop of the share parameter of labour input was in Paddy and Maize (Sector 1) when there was an increase in α_{fa} of capital by approximately 5% in the agricultural sector (see Table 5.1).

Table 5.1: Percentage changes of share parameter of factor input (α_{fa}) in the production functions from Simulations 1 and 1.1 – 1.8 compared with the base year

Sectors	α_{fa} (Base year)		α_{fa} SIM 1(%Δ)		α_{fa} SIM 1.1(%Δ)		α_{fa} SIM 1.2(%Δ)		α_{fa} SIM 1.3(%Δ)	
	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital
1. Paddy and Maize	0.381	0.619	-7.87	4.85	-7.87	4.85	-	-	-	-
2. Cassava, Beans and Nuts	0.353	0.647	-9.07	4.95	-	-	-9.07	4.95	-	-
3. Vegetables, Sugarcane and Fruits	0.248	0.752	-15.32	5.05	-	-	-	-	-15.32	5.05
4. Rubber and Latex	0.217	0.783	-17.97	4.98	-	-	-	-	-	-
5. Other Crops	0.228	0.772	-17.11	5.05	-	-	-	-	-	-
6. Livestock	0.194	0.806	-21.13	5.09	-	-	-	-	-	-
4. Forestry	0.367	0.633	-8.72	5.06	-	-	-	-	-	-
8. Fishery	0.266	0.734	-13.53	4.90	-	-	-	-	-	-
9. Mining and Quarrying	0.349	0.651	-	-	-	-	-	-	-	-
10. Food Manufacturing	0.343	0.657	-	-	-	-	-	-	-	-
11. Textile Industry	0.428	0.572	-	-	-	-	-	-	-	-
12. Paper Industries and Printing	0.182	0.818	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum Industries	0.341	0.659	-	-	-	-	-	-	-	-
14. Non Metallic Products	0.342	0.658	-	-	-	-	-	-	-	-
15. Metal Product and Machinery	0.37	0.63	-	-	-	-	-	-	-	-
16. Agricultural Machinery	0.536	0.464	-	-	-	-	-	-	-	-
17. Other Manufacturing	0.381	0.619	-	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	0.532	0.468	-	-	-	-	-	-	-	-
19. Construction and Trade	0.214	0.786	-	-	-	-	-	-	-	-
20. Service Transportation and Communication	0.604	0.396	-	-	-	-	-	-	-	-

Table 5.1: Percentage changes of share parameter of factor input (α_{fa}) in the production functions from Simulations 1 and 1.1-1.8 compared with base year (cont.)

Sectors	α_{fa} SIM 1.4(%Δ)		α_{fa} SIM 1.5(%Δ)		α_{fa} SIM 1.6 (%Δ)		α_{fa} SIM 1.7(%Δ)		α_{fa} SIM 1.8(%Δ)	
	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital
1. Paddy and Maize	-	-	-	-	-	-	-	-	-	-
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	-
4. Rubber and Latex	-17.97	4.98	-	-	-	-	-	-	-	-
5. Other Crops	-	-	-17.11	5.05	-	-	-	-	-	-
6. Livestock	-	-	-	-	-21.13	5.09	-	-	-	-
7. Forestry	-	-	-	-	-	-	-8.72	5.06	-	-
8. Fishery	-	-	-	-	-	-	-	-	-13.53	4.90
9. Mining and Quarrying	-	-	-	-	-	-	-	-	-	-
10. Food Manufacturing	-	-	-	-	-	-	-	-	-	-
11. Textile Industry	-	-	-	-	-	-	-	-	-	-
12. Paper Industries and Printing	-	-	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum Industries	-	-	-	-	-	-	-	-	-	-
14. Non Metallic Products	-	-	-	-	-	-	-	-	-	-
15. Metal Product and Machinery	-	-	-	-	-	-	-	-	-	-
16. Agricultural Machinery	-	-	-	-	-	-	-	-	-	-
17. Other Manufacturing	-	-	-	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	-	-	-	-	-	-	-	-	-	-
19. Construction and Trade	-	-	-	-	-	-	-	-	-	-
20. Service Transportation and Communication	-	-	-	-	-	-	-	-	-	-

Source: Model Simulations 1 and 1.1 – 1.8

Since the quantity of labour and net capital stock in each sector has been introduced into the model for 2000 (see Appendix M), which is the base year inputs of the model as shown in Table 5.2, it can be seen that the number of workers in five of the eight agricultural sectors are in the top eight number of workers in the Thai economy (Sectors 1, 3, 4, 5 and 6). No agricultural sector is in the top eight in the quantity of capital in Thailand. Most capital stock in the agricultural sector is ranked at the bottom compared with other sectors.

The effect of Simulation 1 in terms of quantity demand for factors is shown in Table 5.2. Since we assumed that capital is fixed and labour is mobile and fully employed, Simulation 1 led to a decrease in demand for labour in four agricultural sectors (Sectors 3, 4, 6 and 7) and some non agricultural sectors (Sectors 9, 10, 13, 16 and 20). The excess demand for labour in these sectors moved to other sectors in the economy, for example, Sectors 1, 2, 5, 8, 11 – 12, 14 – 15 and 17 – 19 (see Table 5.2).

Sub-simulations 1.1 – 1.8 attempt to explain the phenomenon in Simulation 1. A 5% rise in capital input parameters (α_{fa}) in production functions 5% in the agricultural sectors (Sectors 1 – 8) generally resulted in a fall in the demand for labour in those sectors. As discussed, when the share of output is paid more on capital input (α_{fa} of capital is increased) that means the role of labour is less than capital in production. This reduces labour demand in those sectors. The demand for labour in the Forestry sector (Sector 7) in Sub-simulation 1.7 seems to decline most followed by Cassava, Beans and Nuts (Sector 2) in Sub-simulation 1.2 compared with other sectors in other sub-simulations. The demand for labour in Vegetables, Sugarcane and Fruits (Sector 3) in Sub-simulation 1.3, Rubber and Latex (Sector 4) in Sub-simulation 1.4 and Livestock (Sector 6) in Sub-simulation 1.6 fell around 9% when α_{fa} of capital increased by 5%. Those excess demands for labour are absorbed by other sectors because we assumed that there is full employment at equilibrium (see Table 5.2). Other sectors with the same situation can be explained similarly as done for this sector.

Table 5.2: Percentage changes in the quantity of demand of factor (QF) from Simulations 1 and 1.1 – 1.8 compared with the base year

Sectors	QF Base year[1/]		QF SIM 1 (%Δ)		QF SIM 1.1 (%Δ)		QF SIM 1.2 (%Δ)		QF SIM 1.3 (%Δ)	
	Labour(LAB)	Capital (CAP)	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital
1. Paddy and Maize	43,020 (3)	2,115.26 (11)	1.51	-	-6.06	-	1.61	-	3.37	-
2. Cassava, Beans and Nuts	5,706 (13)	317.19 (18)	10.11	-	12.34	-	-10.05	-	6.05	-
3. Vegetables, Sugarcane and Fruits	27,690 (4)	2,554.77 (9)	-2.42	-	4.11	-	1.02	-	-8.58	-
4. Rubber and Latex	9,972 (7)	1,095.24 (16)	-8.87	-	0.06	-	0.08	-	0.31	-
5. Other Crops	9,623 (8)	989.21 (17)	5.66	-	2.12	-	0.24	-	1.17	-
6. Livestock	11,465 (6)	1,450.24 (14)	-7.58	-	1.32	-	-0.11	-	0.27	-
7. Forestry	2,523 (15)	132.52 (19)	-6.09	-	3.45	-	0.98	-	1.70	-
8. Fishery	4,420 (14)	1,813.24 (12)	0.90	-	2.72	-	0.12	-	0.98	-
9. Mining and Quarrying	687 (19)	2,296.49 (10)	-2.39	-	-0.55	-	-0.34	-	-1.03	-
10. Food Manufacturing	9,295 (9)	5,893.72 (5)	-1.73	-	0.46	-	-0.05	-	0.88	-
11. Textile Industry	8,602 (11)	3,807.67 (8)	2.91	-	1.01	-	0.06	-	0.52	-
12. Paper Industries and Printing	1,018 (17)	1,524.06 (13)	1.44	-	0.48	-	-0.02	-	0.54	-
13. Rubber Chemical and Petroleum Industries	6,903 (12)	4,354.73 (7)	-2.07	-	-0.33	-	-0.44	-	0.06	-
14. Non Metallic Products	2,003 (16)	1,285.73 (15)	0.55	-	0.70	-	-0.41	-	-0.47	-
15. Metal Products and Machinery	14,838 (5)	8,144.78 (4)	0.80	-	0.26	-	-0.22	-	0.11	-
16. Agricultural Machinery	51 (20)	14.64 (20)	-20.57	-	-18.23	-	-7.34	-	-11.41	-
17. Other Manufacturing	8,691 (10)	4,699.45 (6)	0.46	-	0.16	-	-0.25	-	0.08	-
18. Electricity, Water Work and Public Utilities	1,016 (18)	12,535.77 (3)	3.38	-	0.50	-	-0.27	-	0.69	-
19. Construction and Trade	65,881 (2)	19,121.44 (2)	1.07	-	0.10	-	-0.20	-	0.07	-
20. Service Transportation and Communication	71,043 (1)	92,473.25 (1)	-0.11	-	-0.06	-	-0.30	-	0.18	-

Table 5.2: Percentage changes in the quantity of demand of factor (QF) from the results Simulations 1 and 1.1 – 1.8 compared with the base year (cont.)

Sectors	QF SIM 1.4 (%Δ)		QF SIM 1.5 (%Δ)		QF SIM 1.6 (%Δ)		QF SIM 1.7 (%Δ)		QF SIM 1.8 (%Δ)	
	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital
1. Paddy and Maize	0.27	-	0.82	-	0.80	-	0.27	-	0.49	-
2. Cassava, Beans and Nuts	1.06	-	1.38	-	0.54	-	0.59	-	0.30	-
3. Vegetables, Sugarcane and Fruits	0.28	-	0.62	-	0.25	-	0.17	-	0.20	-
4. Rubber and Latex	-8.84	-	-0.68	-	0.28	-	0.12	-	-0.29	-
5. Other Crops	-0.13	-	1.68	-	-0.15	-	0.09	-	0.21	-
6. Livestock	0.28	-	-0.81	-	-8.89	-	-0.01	-	0.06	-
7. Forestry	0.88	-	-0.16	-	0.21	-	-12.14	-	-0.17	-
8. Fishery	-0.21	-	0.59	-	0.48	-	0.02	-	-3.80	-
9. Mining and Quarrying	1.41	-	-1.75	-	0.29	-	0.11	-	-0.48	-
10. Food Manufacturing	0.26	-	-3.97	-	0.65	-	0.02	-	0.12	-
11. Textile Industry	0.61	-	0.08	-	0.42	-	0.10	-	-0.15	-
12. Paper Industries and Printing	0.01	-	0.08	-	0.15	-	0.01	-	0.03	-
13. Rubber Chemical and Petroleum Industries	0.28	-	-1.82	-	0.23	-	-	-	-0.03	-
14. Non Metallic Products	0.25	-	0.26	-	0.28	-	0.16	-	-0.29	-
15. Metal Products and Machinery	0.17	-	0.06	-	0.26	-	0.05	-	-0.02	-
16. Agricultural Machinery	-2.25	-	23.91	-	-0.19	-	-1.38	-	0.01	-
17. Other Manufacturing	0.24	-	-0.32	-	0.33	-	0.11	-	-0.07	-
18. Electricity, Water Work and Public Utilities	0.42	-	1.36	-	0.45	-	-0.04	-	-0.13	-
19. Construction and Trade	0.36	-	0.35	-	0.27	-	0.02	-	-0.06	-
20. Service Transportation and Communication	0.27	-	-0.52	-	0.23	-	0.06	-	-0.07	-

Source: Model simulation 1 and 1.1 – 1.8
Note: Figures in parentheses indicate the ranks of sectors in respective inputs (Capital or Labour),
1/ from Appendix M

However, only the Other Crop sector (Sector 5), had a positive demand for labour because, given the approximate 1.6% increase in the price for capital input (rent) in this sector's activity and with capital assumed fixed labour became relatively cheaper than capital.

If we consider the capital-labour ratio (K/L) in each sector in the base year (see Table 5.3), most K/L of the non-agricultural sectors (Sectors 9 – 20) are greater than the agricultural sectors (Sectors 1 – 8). This means that the non agricultural sector is the capital-intensive sector compared with the agricultural sector, which is labour-intensive.

The result of the Simulation 1 had a positive effect on the K/L ratio in some agricultural sectors (Sectors 3 – 4, and 6 – 7) and some non-agricultural sectors (Sectors 9 – 10, 13, 16 and 20). This means that these sectors are likely to be more capital intensive sectors when there is a 5% increase in share parameter (α_{fa}) of capital in the agricultural sector (Simulation 1).

Simulation 1's results on the K/L ratio can be described by the results of Sub-simulation 1.1 – 1.8 as follows. Generally, a 5% increase in the α_{fa} of capital input on each sector in agricultural sectors catalyses capital-intensive farming in those respective sectors. As can be seen from the Table 5.3, the K/L ratio in Paddy and Maize (Sector 1) in Sub-simulation 1.1 rose by 6.45% when the α_{fa} of capital input in this sector increased by 5%. In the same way, the K/L ratio of Sub-simulations 1.2 – 1.8 increased by 4 – 14% when there was a rise on the α_{fa} of capital input on those respective sectors of 5%. However, there was also a decline in the K/L ratio of other sectors caused by a 5% rise in α_{fa} of capital input in a sub-simulation. For example, a 5% rise in α_{fa} of capital input in Sector 1 resulted in an increase in K/L ratio in its sector by 6.45% but it resulted in a decrease in K/L ratio in other sectors (Sub-simulation 1.1).

Table 5.3: Percentage changes of the capital-labour ratio (K/L) from the results of Simulations 1 and 1.1 – 1.8 compared with the base year

Sector	K/L									
	Base year[1/]	SIM1 (%Δ)	SIM1.1 (%Δ)	SIM1.2 (%Δ)	SIM1.3 (%Δ)	SIM1.4 (%Δ)	SIM1.5 (%Δ)	SIM1.6 (%Δ)	SIM1.7 (%Δ)	SIM1.8 (%Δ)
1. Paddy and Maize	0.049	-1.49	6.45	-1.58	-3.26	-0.27	-0.82	-0.79	-0.27	-0.49
2. Cassava, Beans and Nuts	0.056	-9.19	-10.99	11.18	-5.71	-1.04	-1.36	-0.53	-0.59	-0.30
3. Vegetables, Sugarcane and Fruits	0.092	2.48	-3.95	-1.01	9.39	-0.27	-0.62	-0.25	-0.17	-0.20
4. Rubber and Latex	0.110	9.73	-0.06	-0.08	-0.31	9.70	0.68	-0.28	-0.12	0.29
5. Other Crops	0.103	-5.36	-2.08	-0.24	-1.15	0.13	-1.65	0.15	-0.09	-0.21
6. Livestock	0.126	8.21	-1.31	0.11	-0.27	-0.28	0.82	9.75	0.01	-0.06
7. Forestry	0.053	6.48	-3.33	-0.97	-1.67	-0.88	0.16	-0.21	13.82	0.17
8. Fishery	0.410	-0.90	-2.65	-0.12	-0.97	0.21	-0.58	-0.48	-0.02	3.95
9. Mining and Quarrying	3.341	2.45	0.55	0.34	1.04	-1.39	1.78	-0.29	-0.11	0.48
10. Food Manufacturing	0.634	1.76	-0.45	0.05	-0.87	-0.26	4.14	-0.65	-0.02	-0.12
11. Textile Industry	0.443	-2.82	-1.00	-0.06	-0.52	-0.60	-0.08	-0.42	-0.10	0.15
12. Paper Industries and Printing	1.497	-1.42	-0.48	0.02	-0.54	-0.01	-0.08	-0.15	-0.01	-0.03
13. Rubber Chemical and Petroleum Industries	0.631	2.11	0.33	0.44	-0.06	-0.28	1.85	-0.23	-	0.03
14. Non Metallic Products	0.642	-0.54	-0.70	0.42	0.47	-0.25	-0.26	-0.28	-0.16	0.29
15. Metal Product and Machinery	0.549	-0.80	-0.26	0.22	-0.11	-0.17	-0.06	-0.26	-0.05	0.02
16. Agricultural Machinery	0.289	25.90	22.30	7.92	12.87	2.30	-19.30	0.19	1.40	-0.01
17. Other Manufacturing	0.541	-0.46	-0.16	0.25	-0.08	-0.24	0.33	-0.33	-0.11	0.07
18. Electricity, Water Work and Public Utilities	12.335	-3.27	-0.49	0.27	-0.69	-0.42	-1.34	-0.44	0.04	0.13
19. Construction and Trade	0.290	-1.06	-0.10	0.20	-0.07	-0.36	-0.35	-0.27	-0.02	0.06
20. Service Transportation and Communication	1.302	0.11	0.06	0.30	-0.18	-0.27	0.53	-0.23	-0.06	0.07

Source: Model Simulations 1 and 1.1 – 1.8
Note [1/] 100 million baht/100 persons

The reason for the increase in the K/L ratio in Sector 1 was a decrease in demand for labour in its sector as shown in Table 5.1. Other sectors can be described in the same way except for Sub-simulation 1.5 because in this sub-simulation there was a rise in supply of labour in the sector. Therefore, it brought about a decrease in the K/L ratio of 1.65% (see Table 5.3).

5.1.2 Sectoral output effects of Simulation 1

Due to the constant return to scale technology, the increase of α_{fa} of capital input in the production function by 5% in agricultural sectors (Simulation 1) caused the decrease in production function share parameter of labour of 8 – 21% in respective sectors. That led to the relocation of demand for labour in both the agricultural sectors and non-agricultural sectors. The excess demand for labour in a sector moved to other sectors in the economy as discussed in section 5.1.1. As a consequence of the input effect on simulation 1, sectoral output effect will be presented in this section.

As a result of the labour demand relocation from Simulation 1, generally, it can be concluded that there was a decline in almost all output, i.e. the level of activity (QA), quantity of domestic output (QX), quantity of export (QE), output sold domestically (QD), composite commodity (QQ) and quantity of import (QM) in almost all sectors, especially in the agricultural sectors (Sectors 1 – 8). It seems that there were significant decreases in QA, especially in the agricultural sectors when α_{fa} of capital input of those sectors was increased by 5%. Only the output from Paper Industries and Printing (Sector 12) and Electricity and Water Work and Public Utilities (Sector 18) had positive effects when Simulation 1 was conducted (see Table 5.4).

The significant decrease in the level of activity (QA) in the agricultural sectors (Sectors 1 – 8) are documented in Sub-simulations 1.1 – 1.8. Appendix P.1 shows the percentage changes of all outputs in the model from Sub-simulations 1.1 – 1.8. According to Appendix P.1, a 5% increase in α_{fa} of capital input in production functions in the agricultural sectors resulted in a drop in the level of activity (QA) in the respective sectors. The 5% increase in α_{fa} of capital input in the production function in Forestry sector (Sector 7) (Sub-simulation 1.7) caused the decline of QA by 12.77%, which is more than the effect of a 5% increase in α_{fa} on Sub-simulations 1.2, 1.1, 1.3, 1.4, 1.5, 1.6 and 1.8.

A 5% increase in α_{fa} of capital input in an agricultural production function was not only able to decrease the level of activity (QA) but also reduced other output types (QX, QE, QD, QQ and QM) in its sector. In addition, it appears that in Sub-simulations 1.1 – 1.8, QA decreased more significantly than other output types in the model. For example, in Sub-simulation 1.1, QA in Paddy and Maize (Sector 1) decreased by 10.87% but other output types dropped by 0.2 – 1.51%. Although there was a decrease in QA in Sector 4 in Sub-simulation 1.4, some output, as mentioned above, increased very slightly (see Appendix P.1).

Even though there was a decrease in almost all output when simulating the increase in α_{fa} of capital input in agricultural production functions in each sub-simulation, there were some sectors that had a rise of all output types. These latter sectors comprise Sectors 2, 7 and 12 in Sub-simulation 1.1, Sectors 6, 7, 11, 12 and 17 in Sub-simulation 1.3, Sector 1, 2, 6, 7, 9 17, 19 and 20 in Sub-simulation 1.4, Sectors 4, 9, 13, 14, 15 and 19 in Sub-simulation 1.6 and Sectors 10 and 11 in Sub-simulation 1.7. However, in all these the outputs increased only slightly.

5.1.3 Income effects of Simulation 1

This section discusses the simulation results effects particularly on income of domestic institutions (household, enterprise and government). The base year values of labour and capital income were 1,607,749.5 and 2,488,845.5 million baht. Household income and enterprise income were 3,320,133.9 and 834,770.6 million baht, respectively. Finally, government income in the base year was 776,031.9 million baht (see Table 5.5).

Simulation 1 brought negative income effects to domestic institutions. The increase in α_{fa} of capital input by 5% resulted in a decrease in α_{fa} of labour in all agricultural sectors (Sectors 1 – 8) by 8 – 21% while the α_{fa} of capital and labour in other sectors remained the same. This resulted in a decline of the average price (WF_f) of labour in the economy. Considering equation 4.15, section 4.1.3 ($YF_f = \sum_{a \in A} WF_f \cdot WFDIST_{fa} \cdot QF_{fa}$), there was a decrease in income of factor f (YF_f). This factor income is divided into household and enterprise in fixed share ($shryid_{id,f}$) in equation 4.16 ($YFID_{id,f} = shryid_{id,f} \cdot \left[\left(1 - tcap_f\right) \cdot YF_f\right]$). Labour and capital incomes belong to household whereas only capital income flows to enterprise. Finally, the overall labour and capital income dropped by 0.84 and 0.82%, respectively (see Table 5.5).

Table 5.4: Percentage changes in the level of activity (QA), quantity of domestic output (QX), quantity of export (QE), output sold domestically (QD), quantity of import (QM) and composite commodity (QQ) from result of Simulation 1 compared with the base year 1/

Sector	Simulation 1 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	-8.41	-3.30	-8.46	-2.65	4.14	-2.60
2. Cassava, Beans and Nuts	-6.06	-4.48	-6.42	-3.87	1.45	-2.57
3. Vegetables, Sugarcane and Fruits	-9.05	-2.53	-2.76	-2.51	1.66	-2.35
4. Rubber and Latex	-9.79	-0.98	-3.42	-0.71	2.38	-0.71
5. Other Crops	-7.45	-1.48	-0.09	-1.69	-12.13	-3.91
6. Livestock	-9.10	-1.40	-1.51	-1.39	-0.41	-1.37
7. Forestry	-10.80	-2.40	-2.57	-2.36	-1.57	-2.13
8. Fishery	-3.02	-0.65	6.67	-0.75	-0.65	-0.75
9. Mining and Quarrying	-0.84	-0.18	0.07	-0.20	-0.50	-0.28
10. Food Manufacturing	-0.60	-3.84	-4.03	-3.74	1.15	-2.73
11. Textile Industry	1.23	0.54	0.57	0.53	-0.10	0.40
12. Paper Industries and Printing	0.26	0.02	0.01	0.02	0.11	0.04
13. Rubber Chemical and Petroleum Industries	-0.71	-0.96	-0.89	-0.98	-1.66	-1.18
14. Non Metallic Products	0.19	-0.07	-0.04	-0.10	-0.43	-0.17
15. Metal Product and Machinery	0.30	0.24	0.26	0.22	-0.18	-0.01
16. Agricultural Machinery	-11.61	-3.04	-3.16	-3.03	-9.35	-5.97
17. Other Manufacturing	0.17	-0.21	-0.21	-0.21	-0.21	-0.21
18. Electricity, Water Work and Public Utilities	1.78	0.32	0.24	0.32	0.26	0.32
19. Construction and Trade	0.23	0.07	0.12	0.07	-0.04	0.07
20. Service Transportation and Communication	-0.07	-0.53	-0.55	-0.52	-0.32	-0.50

Source: Model Simulation 1
1/ Base year presented in Appendix U

Household and enterprise own input factors, therefore, when there is a decrease in labour and capital income that means these institutions earn less income. For this reason, Simulation 1 simultaneously affected household income and enterprise income negatively by 0.82 and 0.79%, respectively. Finally, government revenue was decreased by 0.69% because the government received less income tax from both household and enterprise (see Table 5.5).

Because Simulation 1 is the combination of Sub-simulations 1.1 to 1.8, it can be seen from Table 5.5 that the decline of institution income was mainly from Sub-simulation 1.5 followed by Sub-simulation 1.1. This means that the increase in α_{fa} of capital input by 5% in other crops (Sector 5) affected institution income negatively more than the increase in α_{fa} of capital input of 5% in Other Agricultural sectors (Sector 5). The second cause of the decrease in institution income was Sub-simulation 1.1, which resulted in approximately a 0.2% decrease in those domestic incomes.

However, Sub-simulations 1.4, 1.6 and 1.7 brought some positive effects to institution income but these effects were slight. For instance, labour, household and government income rose by 0.04, 0.02 and 0.1% respectively in Sub-simulation 1.4, and by 0.05, 0.01 and 0.06%, respectively, in Sub-simulation 1.6., but in Sub-simulation 1.7, no institution income rose by more than 0.01% (see Table 5.5).

Table 5.5: Percentage changes in factor income (*YF*), enterprise income (*YENT*), household income (*YH*), and government income (*YG*) from the results of Simulations 1 and 1.1 – 1.8 compared with the base year

Variables	Base year (Million baht)	SIM 1 (%Δ)	SIM 1.1 (%Δ)	SIM 1.2 (%Δ)	SIM 1.3 (%Δ)	SIM 1.4 (%Δ)	SIM 1.5 (%Δ)	SIM 1.6 (%Δ)	SIM 1.7 (%Δ)	SIM 1.8 (%Δ)
Factor income (*YF*)										
Labour (*L*)	1,607,749.5	-0.84	-0.26	-0.15	-0.04	0.04	-0.40	0.05	0.01	-0.08
Capital (*K*)	2,488,845.5	-0.82	-0.14	-0.11	-0.13	-0.01	-0.30	-0.02	0.004	-0.10
Enterprise income (*YENT*)	834,770.6	-0.79	-0.14	-0.10	-0.13	-0.01	-0.29	-0.01	0.003	-0.09
Household income (*YH*)	3,320,133.9	-0.82	-0.20	-0.13	-0.08	0.02	-0.35	0.01	0.01	-0.09
Government income (*YG*)	776,031.9	-0.69	-0.20	-0.14	-0.08	0.10	-0.35	0.06	-0.001	-0.07

Source: Model Simulations 1 and 1.1 – 1.8

5.1.4 Price effects of Simulation 1

The price system of the model was defined in section 4.1.1 and there are seven different kinds of prices: price of activity (PA), producer price (PX), export price (PE), domestic price (PD), import price (PM), composite commodity price (PQ) and value added price (PVA). It is assumed that, at equilibrium, all initial prices in the model equal one including the exchange rate.

Overall, there was an increase in PA, PX, PD, PQ and PVA mostly in the agricultural sectors but the PE and PM decreased by 0.5% in every sector when there was a 5% increase in α_{fa} of capital input in the agricultural sectors (Simulation 1). The significant increase was in Rubber and Latex (Sector 4), particularly PX, PD and PQ, which increased by 27.70, 31.20 and 31.20 % respectively. However, these three prices decreased by 12 – 15 % in Other Crops (Sector 5) (see Table 5.6).

In contrast, prices decreased in the non-agricultural sectors (Sector 9 – 20) in Simulation 1. However, there was only a small percentage increase in PA, PX, PD, PQ in Food Manufacturing (Sector 10). Apart from this, there was a 0.61 and 0.32% increase in PVA in the Textile Industries (Sector 11) and Electricity and Public Utilities (Sector 18), respectively (see Table 5.6). These price effects in Simulation 1 are affected by Sub-simulations 1.1 – 1.8.

The price effects in Sub-simulations 1.1 – 1.8 are given in Appendix P.2. In general, when there was an increase in α_{fa} of capital input in production functions, in each sub-simulation in the agricultural sectors (Sector 1 – 8), PA, PX, PD, PQ and PVA increased, but PE and PM decreased in those respective sectors. The increase and decrease in these prices can be explained by the nature of their price functions as described in section 4.1.1. For example, both PE and PM are related to the exchange rate. At the new equilibrium of Sub-simulations 1.1, 1.2, 1.3 and 1.5, the exchange rate decreased. Therefore, PE and PM in these simulations decreased. It is interesting to note that in Sub-simulations 1.4, 1.7 and 1.8, PE and PM remained unchanged. This means the 5% increase in α_{fa} of capital input in Sectors 4, 7 and 8 (Sub-simulations 1.4, 1.7 and 1.8) was not likely to affect the exchange rate in the model.

The most significant price effect in Simulation 1 is probably in Sub-simulation 1.5. The result is that a 5% increase in α_{fa} of capital input in Other Crops (Sector 5) significantly affects not only an improvement in PA and PVA in its sector but also increases PX, PD and PQ in the four main agricultural sectors, Paddy and Maize (Sector 1), Cassava, Beans and Nuts (Sector 2), Vegetables, Sugarcane and Fruits (Sector 3) and Rubber and Latex (Sector 4) (Appendix P.2).

In Sub-simulation 1.5, the PA (in Sector 5) increased by 2.80% because of a decrease in QA by 8.12% in its sector as described in section 5.1.2. The increase in PA simultaneously affected an increase in PVA (in its sector) by 10.40%. The increase in output price associated with the decrease in output quantity supports the 'law of demand'. This concept also explains the increase in PX, PD and PQ in Sectors 1 to 4 in Sub-simulation 1.5 but in the opposite direction (Appendix P.2).

5.1.5 Macroeconomic effects of Simulation 1

Based on the CGE model of year 2000, private and government consumption of Thai economy were 2,223,860 and 555,841 million baht, respectively. Investment stood at 1,156,525 million baht. Export and Import values were at 3,625,078 and 2,972,099 million baht, respectively. The GDP of Thailand in 2000 was 4,614,222 million baht (see Table 5.7).

The last impact of Simulation 1 is on the macroeconomic indicators shown in Table 5.7. In general, Simulation 1 had a negative effect on private consumption ($PRVCON$), government consumption ($GOVCON$), Investment ($INVEST$), Export (EXP), Import (IMP) and Gross Domestic Product (GDP).

In Simulation 1, private consumption is calculated from the summation of household consumption (QH_{ch}) multiplied by the composite commodity price (PQ_c). Nevertheless, household's consumption levels are also based on their income (YH_h) in equation 4.18: $QH_{ch} = \dfrac{\beta_{ch} \cdot (1 - mps_h) \cdot (1 - ty_h) \cdot (1 - \mathrm{int}_{ent,h}) \cdot YH_h}{PQ_c}$). Because of a decline in household income (described in Section 5.1.3), private consumption decreased by 0.82%. Government consumption decreased by 0.31% because government revenue declined due to the less income tax collected. The overall investment demand decreased by 1.04% because of a decrease in PQ_c in almost all sectors of the economy. Simulation 1 also showed a drop of imports and exports by 0.98 and 0.96% respectively because the exchange rate depreciated. As a result of the decrease in private consumption, government consumption, investment, exports and imports in Simulation 1, Gross Domestic Product (GDP) decreased by 0.80% (see Table 5.7).

Table 5.6: Percentage changes in the price of activity (PA), producer price (PX), export price (PE), domestic price (PD), import price (PM), composite commodity price (PQ), value added price (PVA) from the results of Simulation 1 compared with the base year

Sector	Simulation 1 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	1.80	5.30	-0.50	6.00	-0.50	5.90	9.45
2. Cassava, Beans and Nuts	1.40	1.70	-0.50	2.40	-0.50	1.70	15.97
3. Vegetables, Sugarcane and Fruits	0.60	2.00	-0.50	2.10	-0.50	2.00	6.03
4. Rubber and Latex	-1.10	27.70	-0.50	31.20	-0.50	31.20	-
5. Other Crops	2.00	-13.40	-0.50	-15.30	-0.50	-12.50	12.75
6. Livestock	1.20	0.80	-0.50	0.80	-0.50	0.80	0.65
7. Forestry	-0.40	1.30	-0.50	1.70	-0.50	1.10	4.41
8. Fishery	0.90	-0.40	-0.50	-0.40	-0.50	-0.40	2.98
9. Mining and Quarrying	-1.10	-3.00	-0.50	-3.10	-0.50	-2.40	-3.16
10. Food Manufacturing	0.50	1.50	-0.50	2.60	-0.50	2.00	-2.30
11. Textile Industry	-0.70	-0.70	-0.50	-0.90	-0.50	-0.80	0.61
12. Paper Industries and Printing	-0.40	-0.40	-0.50	-0.40	-0.50	-0.40	-
13. Rubber, Chemical and Petroleum Industries	-0.40	-1.10	-0.50	-1.30	-0.50	-1.10	-2.72
14. Non Metallic Products	-1.00	-0.70	-0.50	-1.10	-0.50	-1.00	-0.74
15. Metal Product and Machinery	-0.70	-0.60	-0.50	-0.90	-0.50	-0.60	-0.47
16. Agricultural Machinery	-3.60	-8.90	-0.50	-9.20	-0.50	-5.30	-11.56
17. Other Manufacturing	-0.60	-0.50	-0.50	-0.50	-0.50	-0.50	-0.69
18. Electricity, Water Work and Public Utilities	-0.70	-0.50	-0.50	-0.50	-0.50	-0.50	0.32
19. Construction and Trade	-0.30	-1.40	-0.50	-1.40	-0.50	-1.40	-0.22
20. Service Transportation and Communication	-0.90	-0.30	-0.50	-0.20	-0.50	-0.30	-1.06

Source: Model Simulation 1
Note: In the base year (2000) all prices set equal to 1

The macroeconomic effects in Sub-simulations 1.1 – 1.8 in simulation 1 were mainly influenced by Sub-simulation 1.5. This means that a 5% increase in α_{fa} of capital input in Other Crops (Sector 5) affected the macroeconomic indicator more strongly than a 5% increase in α_{fa} of capital input in other agricultural sectors (Sub-simulations 1.1 – 1.4 and 1.6 – 1.8). The effect of Sub-simulations 1.1 – 1.3 also affected these macroeconomic indicators but less than Sub-simulation 1.5. Only Sub-simulations 1.4, and 1.6 – 1.8 caused a slight improvement in the macroeconomic variables other than government consumption (see Table 5.7).

Table 5.7: Percentage changes in macroeconomic indicators from the results of Simulations 1 and 1.1 – 1.8 compared with the base year

Variables	Base year (Million baht)	SIM 1 (%Δ)	SIM 1.1 (%Δ)	SIM 1.2 (%Δ)	SIM 1.3 (%Δ)	SIM 1.4 (%Δ)	SIM 1.5 (%Δ)	SIM 1.6 (%Δ)	SIM 1.7 (%Δ)	SIM 1.8 (%Δ)
Private Consumption (*PRVCON*)	2,223,860	-0.82	-0.20	-0.13	-0.08	0.02	-0.35	0.01	0.01	-0.09
Government Consumption (*GOVCON*)	555,841	-0.31	-0.37	0.02	0.21	-0.04	0.02	-0.09	-0.02	0.01
Investment (*INVEST*)	1,156,525	-1.04	-0.10	-0.21	-0.25	0.09	-0.54	0.07	0.01	-0.14
Exports (*EXP*)	3,625,078	-0.96	-0.21	-0.17	-0.19	0.11	-0.46	0.09	-0.03	-0.11
Imports (*IMP*)	2,972,099	-0.98	-0.21	-0.17	-0.19	0.12	-0.47	0.09	-0.03	-0.11
Gross Domestic Product (*GDP*)	4,614,222	-0.80	-0.19	-0.13	-0.09	0.03	-0.35	0.02	0.004	-0.09

Source: Model Simulations 1 and 1.1 – 1.8

5.2 The results of Simulation 2: Capital stock (CAP) in agricultural sectors (ACT01 – 08) increased by 5%

The capital intensive farming concept of Jackson (1998) leads to our second simulation, where the capital-labour ratio at minimum cost $\left(K/L\right)^*$ increases in the agricultural sectors. In this experiment, we shock the model by increasing the net capital stock (CAP) in the agricultural sectors (Sectors 1 – 8) by 5%. This affects the capital-labour ratio $\left(K/L\right)^*$, causing it to also increase.

5.2.1 Input factor effects of Simulation 2

Since it was assumed that the production function share parameters (α_{fa}) remain the same in Simulation 2, the 5% increase in the net capital stock in the agricultural sectors does not affect these share parameters. Hence, there are only two input factor effects: demand of factors and the capita-labour ratio $\left(K/L\right)^*$, which are discussed in this section.

When capital stock is injected into the agricultural sectors (Sectors 1–8), it results in either a rise or a drop of labour demand in those sectors. For example, there was a drop in demand for labour in Sectors 1, 2 and 5 whereas the demand for labour in other agricultural sectors increased. Furthermore, there were both increases and decreases in demand for labour in non-agricultural sectors especially an increase in the demand for labour in agricultural machinery (Sector 16) of 10% (see Table 5.8). These effects can be described by Sub-simulations 2.1 – 2.8.

Changes in inputs and/or in technology within a sector may affect the reallocation of factors as intermediate inputs of other sectors (Hayami & Ruttan, 1985). Therefore, the results of Sub-simulations 2.1 to 2.8 in terms of demand for labour either increase or decrease. Generally, there was an increase in demand for labour in each sub-simulation between 1.89 and 4.57% in the agricultural sectors when a 5% increase of capital input was injected into each sector (Sub-simulations 2.1 – 2.8).

The increase in demand for labour following an increase in capital input was explained in Figure 3.4 in Section 3.2.2. According to Hall (1994), if capital input is increased while labour is held constant, output will increase. In our Thai CGE model, QA in each agricultural sector increased when Sub-simulations 2.1 – 2.8 were conducted (the output effects will be presented in the next section). Therefore, from the isoquant map in Figure 3.4, it can be concluded that if output is increased, one of any two inputs must be increased while another input can either increase or decrease. This supports the Sub-simulations 2.1 – 2.8 results regarding the increase in the demand for labour in Sub-simulations 2.1 – 2.8. However, there was less than a 1% decrease in demand for labour when there was a 5% increase in capital input in Sector 5 (Sub-simulation 5).

An interesting finding is that there was an increase in demand for labour in Agricultural Machinery (Sector 16) in each Sub-simulation 2.1 – 2.8 (except Sub-simulation 2.5). The increase in supply for labour in this sector would raise the QA in its sector, the details of which are described in the next section (5.2.2 Sectoral output effects).

Due to the assumption that labour is mobile and fully employed, when labour demand in one sector increases because of the increase in capital stock in its sector, there must be a decrease in demand for labour in other sectors. For example, Sub-simulation 2.1 resulted in 1.89, 0.23, 0.18, 7.37 and 0.06% increases in labour demand in Sectors 1, 9, 13, 16 and 20 respectively. This increased labour demand moved from other sectors in the economy; the total number of labour units remained the same (see Table 5.8).

Table 5.8: Percentage changes in the quantity demand of factor (QF) from the results of Simulations 2 and 2.1 – 2.8 compared with the base year

Sectors	QF Base year[1/]		QF SIM 2 (%Δ)		QF SIM 2.1 (%Δ)		QF SIM 2.2 (%Δ)		QF SIM 2.3 (%Δ)	
	Labour(LAB)	Capital (CAP)	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital
1. Paddy and Maize	43,020 (3)	2,115.26 (11)	-1.83	5.00	1.89	5.00	-0.60	-	-1.52	-
2. Cassava, Beans and Nuts	5,706 (13)	317.19 (18)	-5.27	5.00	-4.15	-	3.68	5.00	-2.72	-
3. Vegetables, Sugarcane and Fruits	27,690 (4)	2,554.77 (9)	1.14	5.00	-1.41	-	-0.38	-	3.80	5.00
4. Rubber and Latex	9,972 (7)	1,095.24 (16)	4.61	5.00	-0.01	-	-0.04	-	-0.14	-
5. Other Crops	9,623 (8)	989.21 (17)	-2.22	5.00	-0.67	-	-0.06	-	-0.49	-
6. Livestock	11,465 (6)	1,450.24 (14)	4.18	5.00	-0.46	-	-	-	-0.16	-
7. Forestry	2,523 (15)	132.52 (19)	1.91	5.00	-1.16	-	-0.35	-	-0.75	-
8. Fishery	4,420 (14)	1,813.24 (12)	2.76	5.00	-0.88	-	-0.03	-	-0.42	-
9. Mining and Quarrying	687 (19)	2,296.49 (10)	1.28	-	0.23	-	0.13	-	0.48	-
10. Food Manufacturing	9,295 (9)	5,893.72 (5)	0.62	-	-0.12	-	0.03	-	-0.38	-
11. Textile Industry	8,602 (11)	3,807.67 (8)	-0.98	-	-0.33	-	-0.03	-	-0.24	-
12. Paper Industries and Printing	1,018 (17)	1,524.06 (13)	-0.53	-	-0.15	-	0.01	-	-0.25	-
13. Rubber Chemical and Petroleum Industries	6,903 (12)	4,354.73 (7)	0.88	-	0.18	-	0.19	-	0.01	-
14. Non Metallic Products	2,003 (16)	1,285.73 (15)	0.30	-	-0.15	-	0.19	-	0.27	-
15. Metal Product and Machinery	14,838 (5)	8,144.78 (4)	-0.22	-	-0.06	-	0.09	-	-0.04	-
16. Agricultural Machinery	51 (20)	14.64 (20)	10.03	-	7.37	-	3.17	-	5.88	-
17. Other Manufacturing	8,691 (10)	4,699.45 (6)	-0.10	-	-0.03	-	0.08	-	-0.04	-
18. Electricity, Water Work and Public Utilities	1,016 (18)	12,535.77 (3)	-1.12	-	-0.14	-	0.08	-	-0.32	-
19. Construction and Trade	65,881 (2)	19,121.44 (2)	-0.34	-	-0.01	-	0.07	-	-0.03	-
20. Service Transportation and Communication	71,043 (1)	92,473.25 (1)	0.15	-	0.06	-	0.12	-	-0.07	-

Table 5.8: Percentage changes in the quantity demand of factor (QF) from the results of Simulations 2 and 2.1–2.8 compared with base year (cont.)

Sectors	QF SIM 2.4 (%Δ)		QF SIM 2.5 (%Δ)		QF SIM 2.6 (%Δ)		QF SIM 2.7 (%Δ)		QF SIM 2.8 (%Δ)	
	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital
1. Paddy and Maize	-0.13	-	-0.34	-	-0.42	-	-0.10	-	-0.58	-
2. Cassava, Beans and Nuts	-0.50	-	-0.53	-	-0.26	-	-0.20	-	-0.32	-
3. Vegetables, Sugarcane and Fruits	-0.13	-	-0.24	-	-0.13	-	-0.06	-	-0.23	-
4. Rubber and Latex	4.30	5.00	0.31	-	-0.16	-	-0.05	-	0.34	-
5. Other Crops	0.09	-	-0.91	5.00	0.11	-	-0.01	-	-0.22	-
6. Livestock	-0.19	-	0.30	-	4.63	5.00	-0.04	-	-0.14	-
7. Forestry	-0.41	-	0.06	-	-0.09	-	4.57	5.00	0.23	-
8. Fishery	0.12	-	-0.24	-	-0.24	-	0.01	-	4.54	5.00
9. Mining and Quarrying	-0.69	-	0.75	-	-0.16	-	-0.04	-	0.56	-
10. Food Manufacturing	-0.12	-	1.72	-	-0.34	-	-	-	-0.13	-
11. Textile Industry	-0.31	-	-0.02	-	-0.23	-	-0.05	-	0.16	-
12. Paper Industries and Printing	-0.01	-	-0.03	-	-0.08	-	-0.01	-	-0.04	-
13. Rubber Chemical and Petroleum Industries	-0.12	-	0.70	-	-0.10	-	0.02	-	0.07	-
14. Non Metallic Products	-0.09	-	-0.03	-	-0.12	-	-0.03	-	0.39	-
15. Metal Product and Machinery	-0.08	-	-0.02	-	-0.14	-	-0.02	-	0.03	-
16. Agricultural Machinery	1.42	-	-7.84	-	0.39	-	0.79	-	0.41	-
17. Other Manufacturing	-0.13	-	0.13	-	-0.19	-	-0.06	-	0.06	-
18. Electricity, Water Work and Public Utilities	-0.23	-	-0.49	-	-0.26	-	-0.01	-	0.11	-
19. Construction and Trade	-0.18	-	-0.13	-	-0.15	-	-0.01	-	0.06	-
20. Service Transportation and Communication	-0.13	-	0.21	-	-0.12	-	-0.02	-	0.09	-

Source: Model Simulations 2 and 2.1 – 2.8

Note: Figures in parentheses indicate the ranks of sectors in respective inputs (K or L)

Regarding the capital-labour ratio (K/L), the result of Simulation 2 affected the increase in the K/L ratio in all agricultural sectors (Sectors 1 – 8). The biggest increase in the K/L ratio was in the Cassava, Beans and Nuts sector (Sector 2) followed by Other Crops sector (Sector 5), which increased by 10.84 and 7.39%, respectively. However, half of the non-agricultural sectors showed an increase of K/L, whereas the other half showed a decrease. These results showed that a 5% increase in capital stock in the agricultural sectors (Simulation 2) brought more capital intensive farming into the Thai economy (see Table 5.9).

Considering Sub-simulations 2.1 – 2.8, each sub-simulation gave the same directions of changes as the main Simulation 2 result, that is, a rise in the K/L ratio in its respective sub-simulation. Sub-simulations 2.1 – 2.3 showed an increase in the K/L ratio, not only in its sector but also in other agricultural sectors. In a similar manner, Sub-simulations 2.4 – 2.8 resulted in an increase of the K/L ratio in its sectors but each of Sub-simulations 2.4 – 2.8 brought a decrease in the K/L ratio in other agricultural sectors. However, every Sub-simulation 2.1 – 2.8 caused either a decrease or increase in the K/L ratio in some non-agricultural sectors (Sectors 9 to 20). Among sub-simulation 2.1 to 2.8, a 5 % increase in net capital stock (CAP) in other crops (Sub-simulation 5) was the most effective policy in turning its sector to be more capital intensive sector followed by sub-simulation 2.1 and 2.3. Meanwhile there was not much change in K/L in Sub-simulation 2.4, 2.6, 2.7 and 2.8 (see Table 5.9). The increase in capital stock by 5 % in sectors 4, 6, 7 and 8 were not an effective policy to turn these sectors to be more capital-intensive sectors.

Table 5.9: Percentage changes of the capital-labour ratio (K/L) from the results of Simulations 2 and 2.1 – 2.8 compared with the base year

Sector	Capital-Labour Ratio (K/L)									
	Base year[1/]	SIM2 (%Δ)	SIM2.1 (%Δ)	SIM2.2 (%Δ)	SIM2.3 (%Δ)	SIM2.4 (%Δ)	SIM2.5 (%Δ)	SIM2.6 (%Δ)	SIM2.7 (%Δ)	SIM2.8 (%Δ)
1. Paddy and Maize	0.049	6.95	3.06	0.61	1.55	0.13	0.35	0.42	0.10	0.58
2. Cassava, Beans and Nuts	0.056	10.84	4.33	1.27	2.80	0.50	0.53	0.26	0.20	0.32
3. Vegetables, Sugarcane and Fruits	0.092	3.82	1.43	0.38	1.16	0.13	0.24	0.13	0.06	0.23
4. Rubber and Latex	0.110	0.37	0.01	0.04	0.14	0.67	-0.31	0.16	0.05	-0.33
5. Other Crops	0.103	7.39	0.67	0.06	0.50	-0.09	5.96	-0.11	0.01	0.22
6. Livestock	0.126	0.79	0.46	-	0.16	0.19	-0.30	0.35	0.04	0.14
7. Forestry	0.053	3.03	1.17	0.35	0.76	0.41	-0.06	0.09	0.41	-0.23
8. Fishery	0.410	2.17	0.89	0.03	0.42	-0.12	0.24	0.24	-0.01	0.44
9. Mining and Quarrying	3.341	-1.27	-0.23	-0.13	-0.48	0.69	-0.74	0.16	0.04	-0.56
10. Food Manufacturing	0.634	-0.61	0.12	-0.03	0.38	0.12	-1.69	0.34	-	0.13
11. Textile Industry	0.443	0.99	0.33	0.03	0.24	0.31	0.02	0.23	0.05	-0.16
12. Paper Industries and Printing	1.497	0.53	0.15	-0.01	0.25	0.01	0.03	0.08	0.01	0.04
13. Rubber Chemical and Petroleum Industries	0.631	-0.87	-0.18	-0.19	-0.01	0.12	-0.70	0.10	-0.02	-0.07
14. Non Metallic Products	0.642	-0.30	0.15	-0.19	-0.26	0.09	0.03	0.12	0.03	-0.39
15. Metal Product and Machinery	0.549	0.22	0.06	-0.09	0.04	0.08	0.02	0.14	0.02	-0.03
16. Agricultural Machinery	0.289	-9.12	-6.87	-3.07	-5.55	-1.40	8.50	-0.39	-0.78	-0.41
17. Other Manufacturing	0.541	0.10	0.03	-0.08	0.04	0.13	-0.13	0.19	0.06	-0.06
18. Electricity, Water Work and Public Utilities	12.335	1.13	0.14	-0.08	0.33	0.23	0.49	0.26	0.01	-0.11
19. Construction and Trade	0.290	0.34	0.01	-0.07	0.03	0.18	0.13	0.15	0.01	-0.06
20. Service Transportation and Communication	1.302	-0.15	-0.06	-0.12	0.07	0.13	-0.21	0.12	0.02	-0.09

Source: Model Simulations 2 and 2.1 – 2.8, [1/] 100 million baht/100 persons

5.2.2 Sectoral output effects of Simulation 2

An increase in 5% of capital stock in every agricultural sector (Simulation 2) resulted in, first, a substantial increase of QA in all agricultural sectors, then a simultaneous increase in other outputs (QX, QE, QD, QQ and QM). In non-agricultural sectors, some of these outputs either slightly increased or decreased (see Table 5.10). Another key finding from Simulation 2 was the increase in all types of output in non-agricultural sectors (Sectors 13, 14, 16 and 20), especially the substantial increase of QA in agricultural machinery (Sector 16). This implies that the 5% increase in capital stock in the agricultural sector (Simulation 2) had a strong positive effect not only on QA in agricultural sectors but also in non-agricultural sectors, i.e., Agricultural Machinery (Sector 16). These output improvements in the agricultural sectors and increases or decreases in non-agricultural output are explained by Sub-simulations 2.1 – 2.8.

Each sub-simulation 2.1 – 2.8 resulted in an increase in all output types in its sector especially QA (see Appendix Q.1). For example, in Sub-simulation 2.3 – 2.4 and 2.6 – 2.8, QA rose by approximately 5% from the base year whereas there was a rise in QA of 3.8, 4.53 and 3.62% in Sub-simulations 2.1 – 2.2 and 2.5, respectively. The increase in QA can be easily explained by the production function theory. In this theory, total output can increase if inputs such as labour or machinery increase. Moreover, technological change and improvements in the process for producing goods and services can shift production functions upward (Samuelson & Nordhaus, 2005). Therefore, QA in each sub-simulation increased because of a 5% increase in capital stock in each sub-simulation.

Each Sub-simulation 2.1 – 2.8, except 2.5, could generate a rise in the supply of labour in Agricultural Machinery (Sector 16). Therefore, it is not surprising that Sub-simulations 2.1 – 2.8 brought about an increase in QA in Agricultural Machinery (Sector 16) (see Appendix Q.1).

One interesting finding is that each Sub-simulation 2.1 – 2.8 could stimulate exports in Fishery (Sector 8) by approximately 7% (see Appendix Q.1). The main reason for this increase is that there was a slight devaluation of domestic currency per unit of foreign currency. Therefore, the export price increased, which will be discussed in Section 5.2.4.

Table 5.10: Percentage changes in the level of activity (QA), quantity of domestic output (QX), quantity of export (QE), output c sold domestically (QD), quantity of import (QM) and composite commodity (QQ) from the results of Simulation 2 compared with the base year1/

Sector	Simulation 2 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	2.34	1.28	3.51	0.98	-1.71	0.96
2. Cassava, Beans and Nuts	1.25	1.62	2.45	1.36	-0.79	0.83
3. Vegetables, Sugarcane and Fruits	4.03	1.12	1.22	1.11	-0.58	1.05
4. Rubber and Latex	4.92	0.45	1.55	0.30	-0.99	0.30
5. Other Crops	3.31	0.66	0.18	0.73	4.64	1.49
6. Livestock	4.84	0.69	0.75	0.68	0.22	0.67
7. Forestry	3.86	0.95	1.02	0.94	0.63	0.84
8. Fishery	4.40	0.42	7.80	0.32	0.81	0.32
9. Mining and Quarrying	0.45	0.12	0.03	0.13	0.24	0.16
10. Food Manufacturing	0.21	1.85	1.92	1.80	-0.15	1.39
11. Textile Industry	-0.42	-0.14	-0.16	-0.14	0.14	-0.08
12. Paper Industries and Printing	-0.10	0.01	0.01	0.01	0.02	0.01
13. Rubber Chemical and Petroleum Industries	0.30	0.50	0.48	0.51	0.82	0.61
14. Non Metallic Products	0.10	0.10	0.09	0.12	0.29	0.15
15. Metal Product and Machinery	-0.08	-0.06	-0.07	-0.05	0.15	0.06
16. Agricultural Machinery	5.26	1.42	0.03	1.46	4.39	2.77
17. Other Manufacturing	-0.04	0.11	0.11	0.12	0.17	0.14
18. Electricity, Water Work and Public Utilities	-0.60	-0.04	-0.11	-0.03	-0.04	-0.03
19. Construction and Trade	-0.07	0.04	-0.09	0.04	0.09	0.04
20. Service Transportation and Communication	0.09	0.32	0.33	0.31	0.17	0.30

Source: Model Simulation 2
1/ Base year presented in Appendix U

5.2.3 Income effects of Simulation 2

Table 5.11 shows the income effects of simulation 2 in terms of the percentage change on factor income (YF), enterprise income ($YENT$), household income (YH), and government income (YG). The income effect results of Simulation 2 were completely opposite to Simulation 1. When the 5% of capital stock was injected into the agricultural sectors, it caused an increase in the supply of agricultural input capital (QF of capital) in total but the overall supply of labour in economy was the same.

Table 5.11: Percentage changes in factor income (YF), enterprise income ($YENT$), household income (YH), and government income (YG) from the results of Simulations 2 and 2.1 – 2.8 compared with the base year

Variables	Base year (million baht)	SIM 2 (%Δ)	SIM 2.1 (%Δ)	SIM 2.2 (%Δ)	SIM 2.3 (%Δ)	SIM 2.4 (%Δ)	SIM 2.5 (%Δ)	SIM 2.6 (%Δ)	SIM 2.7 (%Δ)	SIM 2.8 (%Δ)
Factor income (YF)										
Labour (L)	1,607,749.5	0.41	0.11	0.06	0.02	-0.02	0.17	-0.02	-0.002	0.10
Capital (K)	2,488,845.5	0.43	0.06	0.04	-0.10	0.01	0.13	0.01	-0.001	0.12
Enterprise income ($YENT$)	834,770.6	0.41	0.06	0.04	0.06	0.004	0.13	0.01	-0.001	0.11
Household income (YH)	3,320,133.9	0.41	0.08	0.05	0.04	-0.01	0.15	-0.01	-0.001	0.11
Government income (YG)	776,031.9	0.34	0.09	0.05	0.04	-0.05	0.15	-0.03	0.002	0.09

Source: Model Simulations 2 and 2.1 – 2.8

Considering equation 4.15, ($YF_f = \sum_{a \in A} WF_f \cdot WFDIST_{fa} \cdot QF_{fa}$), as a result of a 5% increase in QF, there was an increase in factor income (YF). Similar reasons were attributed to Simulation 1 but in the opposite direction. That is, the increase in factor income (0.41% from labour income and 0.43% from capital income) brought about the increase in enterprise and household income of 0.41%. Finally, it also brought about the increase in government income of 0.34% (see Table 5.11).

The increases in domestic income were mostly from Sub-simulations 2.1, 2.2, 2.5 and 2.8. In particular, Sub-simulation 2.5 showed that all domestic income rose over 0.13%. Domestic income rose between 0.09 and 0.12% in Sub-simulation 2.8, 0.06 and 0.11% in Sub-simulation 2.1 and 0.04 and 0.06 % in Sub-simulation 2.2.

Although the 5% increase in capital input in a sector generally brings a positive effect on domestic income, there was a mild decrease in income in Sub-simulations 2.3, 2.4, 2.6 and 2.7. This can be explained as follows. For instance, Sub-simulation 2.7, as discussed in section 5.2.1, caused an increase in supply for labour (QF) in its sector but that resulted in a decrease in supply of labour in other sectors. Because one component of YF is QF (Equation 4.15: $YF_f = \sum_{a \in A} WF_f \cdot WFDIST_{fa} \cdot QF_{fa}$) and the supply for labour in Forestry sector (Sector 7) is only 252,300 persons (see Table 5.8), an increase in supply for labour in the Forestry sector (Sector 7) did not have much effect on YF compared with a slight decrease in supply for labour in other sectors (that have more labour than the Forestry sector). For this reason, factor income in Sub-simulation 2.7 dropped slightly from the base year. The fall in factor income later resulted in a decrease in the enterprise and household incomes. However, the fall of factor, enterprise and household income did not impact much on the government income (YG) because its sources of income (equation 4.22, Section 4.13) are from other variables especially from import tariffs (tm_c). If we refer to Section 2.2.2 and Appendix Q.1, it is clear that the quantity of imports (QM) in Sub-simulation 2.7 has increased. Therefore, government income in Sub-simulation 2.7 rose slightly, about 2%.

5.2.4 Price effects of Simulation 2

Simulation 2 resulted in the opposite direction to Simulation 1 in terms of the changes in all prices in the model. As can be seen in Table 5.12, non-agricultural prices, i.e. (PA), producer price (PX), export price (PE), domestic price (PD), import price (PM), composite commodity price (PQ), and value added price (PVA), rose from the base year, especially in the agricultural machinery sector (Sector 16). Additionally, Simulation 2 caused an increase in PE and PM in every sector. On the other hand, agricultural prices mostly decreased in Simulation 2 (see Table 5.12).

Appendix Q.2 details the percentage changes of the price effect of Sub-simulations 2.1 – 2.8. There is not much change in terms of price effect in each sub-simulation. Only five main sectors, Sectors 1, 2, 4, 5 and 16, were impacted most by Sub-simulations 2.1 2.2, 2.3 and 2.5 with percentage changes in PX , PD and PQ over 1%. The other sub-simulations (Sub-simulations 2.4 and 2.6, 2.7 and 2.8) produced percentage changes of less than 0.7%.

Sub-Simulation 2.1 – 2.3 mainly showed an increase in PX , PD and PQ between 1.0 and 2.4% in the Other Crop sector (Sector 5). Sub-simulation 2.5 resulted in a decrease in these prices in Sectors 1 – 3 and, especially, sector 4 but showed a rise in these same prices in the Agricultural Machinery sector (Sector 16). Those price changes were adjusted in the model to clear the market at equilibrium. The price changes can be traced through the price system in the model as described in Section 4.1.1.

In summary, the price effects of Sub-simulations 2.1 – 2.8 and Sub-simulation 5 realised the strongest price decrease in the Rubber and Latex sector (Sector 4) in terms of PX , PD and PQ (see Appendix Q.2).

Table 5.12: Percentage changes in price of activity (PA), producer price (PX), export price (PE), domestic price (PD), import price (PM), composite commodity price (PQ), value added price (PVA) from the results of Simulation 2 compared with the base year

Sector	Simulation 2 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	-0.70	-2.00	0.20	-2.30	0.20	-2.30	-3.67
2. Cassava, Beans and Nuts	-0.50	-0.70	0.20	-0.90	0.20	-0.70	-6.25
3. Vegetables, Sugarcane and Fruits	-0.30	-0.80	0.20	-0.90	0.20	-0.80	-2.37
4. Rubber and Latex	0.50	-10.20	0.20	-11.50	0.20	-11.50	0.22
5. Other Crops	-0.80	5.10	0.20	5.80	0.20	4.70	-5.03
6. Livestock	-0.50	-0.40	0.20	-0.40	0.20	-0.40	-0.33
7. Forestry	0.20	-0.50	0.20	-0.70	0.20	-0.40	-1.47
8. Fishery	-0.40	0.50	0.20	0.50	0.20	0.50	-1.19
9. Mining and Quarrying	0.40	1.10	0.20	1.20	0.20	0.90	1.27
10. Food Manufacturing	-0.20	-0.60	0.20	-1.00	0.20	-0.80	0.66
11. Textile Industry	0.30	0.30	0.20	0.40	0.20	0.30	-
12. Paper Industries and Printing	0.20	0.20	0.20	0.20	0.20	0.20	-0.46
13. Rubber Chemical and Petroleum Industries	0.20	0.50	0.20	0.50	0.20	0.40	0.68
14. Non Metallic Products	0.50	0.30	0.20	0.50	0.20	0.40	0.74
15. Metal Product and Machinery	0.30	0.30	0.20	0.40	0.20	0.30	0.47
16. Agricultural Machinery	1.60	4.00	0.20	4.10	0.20	2.30	4.76
17. Other Manufacturing	0.30	0.20	0.20	0.20	0.20	0.20	0.46
18. Electricity, Water Work and Public Utilities	0.30	0.20	0.20	0.20	0.20	0.20	-0.32
19. Construction and Trade	0.10	0.70	0.20	0.70	0.20	0.70	0.11
20. Service Transportation and Communication	0.30	-	0.20	-	0.20	-	0.45

Source: Model Simulation 2
Note: In the base year (2000) all prices set equal to 1

5.2.5 Macroeconomic effects of Simulation 2

The results of Simulation 2 for the six macroeconomic indicators; $PRVCON$, $GOVCON$, $INVEST$, EXP , IMP and GDP had completely opposite direction of changes compared with Simulation 1. As discussed, Simulation 1 resulted in the negative effects on these macroeconomic indicators. However, Simulation 2 showed positive effects on all macro economic variables with a slight increase in those macro indicators. Private consumption rose by 0.41% because of a rise in household income. Government consumption increased 0.08% from the base year due to government revenue increasing. Investment increased by 0.57%, whereas exports and imports increased by 0.48 and 0.49%, respectively. These effects increased GDP by 0.41% (see Table 5.13).

Table 5.13: Percentage changes of macroeconomic indicators from the results of Simulations 2 and 2.1 – 2.8 compared with the base year

Variables	Base year (million baht)	SIM 2 (%Δ)	SIM 2.1 (%Δ)	SIM 2.2 (%Δ)	SIM 2.3 (%Δ)	SIM 2.4 (%Δ)	SIM 2.5 (%Δ)	SIM 2.6 (%Δ)	SIM 2.7 (%Δ)	SIM 2.8 (%Δ)
Private Consumption (*PRVCON*)	2,223,8600	0.41	0.08	0.05	0.04	-0.01	0.15	-0.01	-0.002	0.11
Government Consumption (*GOVCON*)	555,841	0.08	0.12	-0.01	-0.10	0.02	-0.002	0.05	0.007	-0.01
Investment (*INVEST*)	1,156,525	0.57	0.06	0.08	0.12	-0.04	0.23	-0.04	-0.005	0.16
Export (*EXP*)	3,625,078	0.48	0.09	0.07	0.09	-0.06	0.20	-0.05	0.01	0.13
Import (*IMP*)	2,972,099	0.49	0.09	0.07	0.09	-0.06	0.20	-0.05	0.01	0.13
Gross Domestic Product (*GDP*)	4,614,222	0.41	0.08	0.05	0.05	-0.01	0.15	-0.01	-0.002	0.11

Source: Model Simulations 2 and 2.1 – 2.8

The results of Sub-simulations 2.1 – 2.8 were very similar to Sub-simulations 1.1 – 1.8 but in the opposite direction. For example, Sub-simulation 2.1 brought positive macroeconomic effects to the country (see Table 5.12). On the other hand, Sub-simulation 1.1 resulted in negative effects on the same macroeconomic variables (see Table 5.7). The other respective pairs of sub-simulations, i.e., Sub-simulation 2.2 and 1.2, 2.3 and 1.3 and etc., contradict each other in their results.

Sub-simulation 2.1 showed a positive effect in all macro variables whereas other sub-simulations (Sub-simulations 2.2 – 2.8) can be categorised into three groups based on the result direction. The first group, Sub-simulations 2.2, 2.3, 2.5 and 2.8, have similar results on the macroeconomic variables in the direction of positive changes in these macroeconomic variables, especially Sub-simulations 2.2 and 2.3. However, it seems that Sub-simulations 2.5 and 2.8 were the major cause of the positive impact on the macroeconomic variables in Simulation 2. In Sub-simulation 2.5, private consumption and GDP increased by 0.15% and investment, exports and imports rose by approximately 0.20%. In the meantime, private consumption and GDP increased by 0.11% in Sub-simulation 2.8 but investment, exports and imports rose by 0.13 –0.16% (see Table 5.13).

The second group contains Sub-simulations 2.4 and 2.6. These two sub-simulations had mostly negative effects on the macro variables except government consumption. However, these negative effects resulted in a minor percentage change from the base year. The last group, Sub-simulation 2.7, had a negative effect on private consumption, investment and GDP but positive effects on government consumption, imports and exports. However, the percentage changes were very small.

5.3 The results of Simulation 3: the removal of import tariffs on the Agricultural Machinery sector (COM 16)

Another way to increase capital stock in agricultural sectors in the economic system is from imports. As discussed in the simulation design (Chapter 4), the introduction of free trade in the agricultural machinery sector may produce more imports of these goods, which might affect other economic variables. Therefore, Simulation 3 performs a different task from Simulations 1 and 2. In this simulation, it is assumed that there is no import tariff on the agricultural machinery sector (COM 16), which is disaggregated particularly for this simulation. The results of Simulation 3 affected other variables as follows.

5.3.1 Input factor effects of Simulation 3

Since all macro closures were set the same as in Simulations 1 and 2, the share parameters of factor input are the same as in the base year. Only two input factor effects, demand of factors and the capital-labour ratio are discussed in this section.

First, for the demand factors, Simulation 3 resulted in an increase in the demand for labour in almost all agricultural sectors (Sectors 1 – 8) but there was a decrease in this demand in non-agricultural sectors except Agricultural Machinery sector (Sector 16) (Table 5.14). The reason is because, when there is no tariff barrier on the Agricultural Machinery sector, the country is likely to import more of these goods because the import price (PM) of Sector 16 decreased (see Table 5.18, Section 5.3.4). Therefore, the quantity of imports (QM) in Sector 16 was increased by 0.17%, which is explained in the following section (see Table 5.16, Section 5.3.2). Because of the decrease in import price, other prices in sector 16 declined. From the law of demand, this leads to an increase in output including QA. Consider equation 4.8, $WF_f \cdot WFDIST_{fa} = \dfrac{\alpha_{fa} \cdot PVA_a \cdot QA_a}{QF_{fa}}$, an increase in QA results in a rise of QF . However, input capital is fixed and treated as an exogenous variable. Therefore, the quantity demand for labour in the Agricultural Machinery sector (Sector 16) increased by 2.11%. The increase in demand for labour for other sectors can be explained as for Sector 16 (see Table 5.14).

Secondly, the removal of import tariffs on the Agricultural Machinery sector (Sector 16) affected the less capital-intensive sectors, not only its sector but almost all agricultural sectors. In simulation 3, the capital-labour ratio (K/L) in most agricultural sectors decreased but this ratio increased in the non-agricultural sector as a consequence of either an increase or decrease in the demand for labour (see Table 5.15). Because the demand for labour in the Agricultural Machinery sector had increased somewhat, the capital-labour ratio in this sector declined by 2.06%.

Table 5.14: Percentage changes in the quantity demand of factor (QF) from the results of Simulation 3 compared with the base year

Sectors	QF Base year[1/]		QF SIM 3 (%Δ)	
	Labour (L)	Capital (K)	Labour	Capital
1. Paddy and Maize	43,020 (3)	2,115.26 (11)	0.05	-
2. Cassava, Beans and Nuts	5,706 (13)	317.19 (18)	0.12	-
3. Vegetables, Sugarcane and Fruits	27,690 (4)	2,554.77 (9)	0.11	-
4. Rubber and Latex	9,972 (7)	1,095.24 (16)	0.04	-
5. Other Crops	9,623 (8)	989.21 (17)	0.30	-
6. Livestock	11,465 (6)	1,450.24 (14)	-0.04	-
4. Forestry	2,523 (15)	132.52 (19)	0.22	-
8. Fishery	4,420 (14)	1,813.24 (12)	0.10	-
9. Mining and Quarrying	687 (19)	2,296.49 (10)	-0.03	-
10. Food Manufacturing	9,295 (9)	5,893.72 (5)	0.02	-
11. Textile Industry	8,602 (11)	3,807.67 (8)	-0.06	-
12. Paper Industries and Printing	1,018 (17)	1,524.06 (13)	-0.04	-
13. Rubber Chemical and Petroleum Industries	6,903 (12)	4,354.73 (7)	-0.01	-
14. Non Metallic Products	2,003 (16)	1,285.73 (15)	-0.14	-
15. Metal Product and Machinery	14,838 (5)	8,144.78 (4)	-0.10	-
16. Agricultural Machinery	51 (20)	14.64 (20)	2.11	-
17. Other Manufacturing	8,691 (10)	4,699.45 (6)	-0.05	-
18. Electricity, Water Work and Public Utilities	1,016 (18)	12,535.77 (3)	-0.17	-
19. Construction and Trade	65,881 (2)	19,121.44 (2)	-0.06	-
20. Service Transportation and Communication	71,043 (1)	92,473.25 (1)	-0.05	-

Source: Model Simulation 3
Note: Figures in parentheses indicate the ranks of sectors in respective inputs (K or L)
1/ from Appendix M

Table 5.15: Percentage changes in the capital-labour ratio (K/L) from the results of Simulation 3

Sector	Capital-Labour Ratio (K/L)	
	Base year[1/]	SIM3 (%Δ)
1. Paddy and Maize	0.049	-0.05
2. Cassava, Beans and Nuts	0.056	-0.12
3. Vegetables, Sugarcane and Fruits	0.092	-0.11
4. Rubber and Latex	0.110	-0.04
5. Other Crops	0.103	-0.30
6. Livestock	0.126	0.04
7. Forestry	0.053	-0.22
8. Fishery	0.410	-0.10
9. Mining and Quarrying	3.341	0.03
10. Food Manufacturing	0.634	-0.02
11. Textile Industry	0.443	0.06
12. Paper Industries and Printing	1.497	0.04
13. Rubber Chemical and Petroleum Industries	0.631	0.01
14. Non Metallic Products	0.642	0.14
15. Metal Product and Machinery	0.549	0.10
16. Agricultural Machinery	0.289	-2.06
17. Other Manufacturing	0.541	0.05
18. Electricity, Water Work and Public Utilities	12.335	0.17
19. Construction and Trade	0.290	0.06
20. Service Transportation and Communication	1.302	0.05

Source: Model Simulation 3
[1/] 100 million baht/100 persons

5.3.2 Sectoral output effects of Simulation 3

The removal in import tariffs on the Agricultural Machinery sector resulted in the more imports of these goods because the import price (PM) of Sector 16 decreased (see Table 5.18, Section 5.3.4). Therefore, the quantity of imports (QM) in Sector 16 increased by 0.17%. As discussed in the previous section, the decrease in import price (PM) in Sector 16 led to the decline of other prices (PD, PX , PQ and PA) in its sector. Therefore, QD, QX and QQ increased by 0.31, 0.29 and 0.24%, respectively. The greatest increased output in the non-agricultural sector was QA in Agricultural Machinery sector, which increased by 1.12% (see Table 5.16). The only decreased output was QE , which decreased by 0.31 % because there was a rise in PE (see Table 5.18).

Table 5.16: Percentage changes of the level of activity (QA), quantity of domestic output (QX), quantity of export (QE), output c sold domestically (QD), quantity of import (QM) and composite commodity (QQ) from the results of Simulation 3 compared with the base year1/

Sector	Simulation 3 (%Δ)					
	QA	QX	QE	QD	QM	QQ
1. Paddy and Maize	0.02	0.02	0.07	0.01	-0.04	0.01
2. Cassava, Beans and Nuts	0.04	0.04	0.07	0.03	-0.03	0.02
3. Vegetables, Sugarcane and Fruits	0.03	0.02	0.03	0.02	-0.04	0.02
4. Rubber and Latex	0.01	-	0.06	-	-	-
5. Other Crops	0.07	0.03	0.03	0.03	-	0.02
6. Livestock	-0.01	-	0.01	-	-	-
7. Forestry	0.08	0.01	0.01	0.01	-	-
8. Fishery	0.03	-	7.36	-0.10	0.18	-0.10
9. Mining and Quarrying	-0.01	-0.02	-0.03	-0.02	-0.01	-0.02
10. Food Manufacturing	0.01	0.01	0.01	0.01	-0.02	-
11. Textile Industry	-0.02	-0.02	-0.02	-0.02	-0.01	-0.02
12. Paper Industries and Printing	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
13. Rubber Chemical and Petroleum Industries	-	-0.01	-0.01	-0.01	-	-0.01
14. Non Metallic Products	-0.05	-0.03	-0.03	-0.03	-0.03	-0.03
15. Metal Product and Machinery	-0.04	-0.03	-0.03	-0.03	-0.02	-0.03
16. Agricultural Machinery	1.12	0.29	-0.31	0.31	0.17	0.24
17. Other Manufacturing	-0.02	-0.02	-0.02	-0.02	-0.01	-0.02
18. Electricity, Water Work and Public Utilities	-0.09	-0.04	-0.12	-0.04	-0.02	-0.04
19. Construction and Trade	-0.01	-0.03	-0.10	-0.03	-0.04	-0.03
20. Service Transportation and Communication	-0.03	-0.02	-0.02	-0.02	-	-0.01

Source: Model Simulation 3
1/ Base year presented in Appendix U

In the previous section, there was a rise in demand for labour in almost all agricultural sectors (Sectors 1 – 8) but there was a drop in this demand in the non-agricultural sectors except Agricultural Machinery sector (Sector 16). Consequently, this led to the increase in almost all output types i.e. QA, QX, QD and QQ in the agricultural sectors and the decrease in those outputs in non-agricultural sectors (see Table 5.16).

The changes in the outputs were less than 0.1% from the base year except for exports (QE) in the Fishery sector, which increased considerably by 7.36% due to an increase in export price in that sector (see Table 5.16).

5.3.3 Income effects of Simulation 3

The removal of import tariffs on the Agricultural Machinery sector (Sector 16) resulted in the negative effects in domestic income. Table 5.17 shows the percentage changes in domestic income in Simulation 3 compared with the base year where the domestic income decreased slightly from the base year.

Overall, labour income decreased slightly by about 0.02%, because there was a movement of the supply of labour from the non-agricultural sectors to the agricultural sectors. The wages in non-agricultural sectors are higher than in agricultural sectors. Regarding capital income, although capital input is fixed, capital income decreased by 0.10% because rents declined in some non-agricultural sectors (Sectors 6, 14, 15, 19 and 20). The decline of these factor incomes resulted in a decrease of enterprise and household income by 0.01 and 0.02%. Government income eventually decreased by 0.07% (see Table 5.17).

Table 5.17: Percentage changes in factor income (YF), enterprise income ($YENT$), household income (YH), and government income (YG) from the results of Simulation 3 compared with the base year

Variables	Base year (million baht)	SIM 3 (%Δ)
Factor income (YF)		
Labour (L)	1,607,749.5	-0.02
Capital (K)	2,488,845.5	-0.10
Enterprise income ($YENT$)	834,770.6	-0.01
Household income (YH)	3,320,133.9	-0.02
Government income (YG)	776,031.9	-0.07

Source: Model Simulation 3

5.3.4 Price effects of Simulation 3

Overall, the price effects from the removal of import tariffs on Agricultural Machinery sector (Sector 16) were considerable, bringing about increases in price of activity (PA), producer price (PX), domestic price (PD), import price and commodity price (PQ) in the sector. However, the price effects on other sectors were very small.

The price effects of Simulation 3 started from the decrease of the import price (PM) of Sector 16 by 3.90% because there is no tariff barrier on this sector. Therefore, Thailand's agricultural machinery imports would increase as already discussed in Section 5.3.2.

As a result of the decrease in import price in Sector 16, other prices in this sector, for instance, PA, PX, PD and PQ, decreased by 1.10, 4.10, 4.20 and 4.20%, respectively (see Table 5.18).

The cause of price changes in other sectors was mainly from the changes in output, which was simultaneously affected by the changing demand for labour as described in Sections 5.3.1 and 5.3.2. The result of Simulation 3 in terms of PA, PX, PD and PQ in the agricultural sectors remained unchanged or decreased. However, PX, PD and PQ in Sectors 9 and 10 increased slightly from the base year. In regard to PE and PM in other sectors except Sector 16, they increased by 0.1% because of an increase in the exchange rate by 0.1 %

5.3.5 Macroeconomic effects of Simulation 3

Free trade in the Agricultural Machinery sector (Simulation 3) generally harmed macroeconomics variables as shown in Table 5.19. Investment ($INVEST$) decreased by 0.06%. Private consumption ($PRVCON$), export (EXP), import (IMP) and Gross Domestic Product (GDP) decreased by 0.02%. Government consumption increased by only 0.005%

The reasons for the above macroeconomic changes are that investment decreased because of the overall decrease in PQ and the investment demand for commodities (see Appendix R.4). Private consumption decreased due to the decline in household income. Although there was an increase in exports in the agricultural sectors, there was also a decrease in total exports and imports because the quantity of exports and imports in non-agricultural sector is much larger than in the agricultural sectors. Finally, the macro variables caused a drop in GDP by 0.02% even though there was a positive change in government consumption but not strong enough to raise the GDP (see Table 5.19).

Table 5.18: Percentage changes in the price of activity (PA), producer price (PX) ,export price (PE), domestic price (PD), import price (PM), composite commodity price (PQ), value added price (PVA) from the results of Simulation 3 compared with the base year

Sector	Simulation 3 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	-	-0.10	0.10	-0.10	0.10	-0.10	-
2. Cassava, Beans and Nuts	-	-	0.10	-	0.10	-	-
3. Vegetables, Sugarcane and Fruits	-	-	0.10	-	0.10	-	0.22
4. Rubber and Latex	-	-0.60	0.10	-0.70	0.10	-0.70	-
5. Other Crops	-0.10	-	0.10	-	0.10	-	-
6. Livestock	-	-	0.10	-	0.10	-	-
7. Forestry	-	-	0.10	-	0.10	-	0.49
8. Fishery	-	0.20	0.10	0.20	0.10	0.20	0.30
9. Mining and Quarrying	-	0.10	0.10	0.10	0.10	0.10	-
10. Food Manufacturing	-	-	0.10	-	0.10	-	-
11. Textile Industry	-	-	0.10	-	0.10	-	-
12. Paper Industries and Printing	-	-	0.10	-	0.10	-	-
13. Rubber Chemical and Petroleum Industries	-	-	0.10	-	0.10	-	-
14. Non Metallic Products	-	-	0.10	-	0.10	-	-
15. Metal Product and Machinery	-	-	0.10	-	0.10	-	-
16. Agricultural Machinery	-1.10	-4.10	0.10	-4.20	-3.90	-4.20	0.68
17. Other Manufacturing	-	-	0.10	-	0.10	-	-
18. Electricity, Water Work and Public Utilities	-	-	0.10	-	0.10	-	-
19. Construction and Trade	-	-	0.10	-	0.10	-	-
20. Service Transportation and Communication	-	-	0.10	-	0.10	-	0.15

Source: Model Simulation 3
Note: In the base year (2000) all prices set equal to 1

Table 5.19: Percentage changes of macroeconomic indicators from the results of Simulation 3 compared with the base year

Variables	Base year (million baht)	SIM 3 (%Δ)
Private Consumption ($PRVCON$)	2,223,860	-0.02
Government Consumption ($GOVCON$)	555,841	0.005
Investment ($INVEST$)	1,156,525	-0.06
Export (EXP)	3,625,078	-0.02
Import (IMP)	2,972,099	-0.02
Gross Domestic Product (GDP)	4,614,222	-0.02

Source: Model Simulation 3

5.4 The results of Simulation 4: The combination of Simulations 1, 2 and 3

The last simulation in this study, Simulation 4, is the combination of Simulations 1, 2 and 3 in order to investigate the extreme case of capital intensive farming in each agricultural sector. It assumes that there is an increase in the production function share parameter of input capital (α_{fa}) by 5%, plus a 5% increase in capital stock in the agricultural sectors and the removal of import tariffs on Agricultural Machinery sector (Sector 16). There are nine Sub-simulations of Simulation 4 (Sub-simulations 4.1 – 4.9), as discussed in Section 4.3. The closure rules are similar to those in Simulations 1 – 3. Simulation 4 results are organised similar to the other simulations.

5.4.1 Input factor effects of Simulation 4

The first input factor effect is the share parameter of factor input (α_{fa}) in the production functions. Comparing 4 to Simulation 1, the result of Simulation 4 regarding α_{fa} was the same as for Simulation 1, an increase in the α_{fa} of labour in the agricultural sectors of between 8 and 21% (see Appendix S.1). The mechanism adjustments of α_{fa} on labour input were explained in Section 5.1.1.

The second input factor effect is the change in the demand for labour (QF) (see Table 5.20). As capital input is assumed to be fixed and labour is mobile and fully employed, the effect of Simulation 4 in terms of capital input was similar to that of Simulation 2, an increase in capital input in the agricultural sectors by 5%. However, the results of the demand for labour changed due to the combination of the impacts of Simulations 1, 2 and 3.

As discussed in Sections 5.1.1, 5.2.1 and 5.3.1, Simulation 1 mostly resulted in a fall in demand for labour in the agricultural sectors, whereas Simulations 2 and 3 led to a rise in labour demand. Therefore, the results of Simulation 4 in terms of demand for labour are a mix of those three simulations. From Table 5.20 (Simulation 4) and Table 5.2 (Simulation 1), it can be seen that labour demand in Simulation 4's results increased or decreased in the same direction as Simulation 1.

The main support for the results of Simulation 4 in terms of labour demand is the results of each Sub-simulation 4.1 – 4.8, which combines Sub-simulations 1.1 – 1.8 and 2.1 – 2.8. However, it seems that the results of Sub-simulations 4.1 – 4.8 are more influenced by Sub-simulations 1.1 – 1.8 than Sub-simulations 2.1 – 2.8. Considering Tables 5.2, 5.8 and 5.20, the effects on demand for labour in Sub-simulations 1.1 – 1.8 was opposite the matching Sub-simulations 2.1 – 2.8. For example, Sub-simulation 1.1 showed a decrease in demand for labour in Sector 1 by 6.06% (see Table 5.2). In contrast, Sub-simulation 2.1 showed an increase in labour demand in the same sector by 1.89% (see Table 5.8). Because of the decrease and increase in demand for labour in Sub-simulations 1.1 and 2.1, there was a drop in this demand in Sub-simulation 4.1 by 3.95% (see Table 5.20). The changes in demand for labour in other sectors in other sub-simulations can be explained in a similar manner.

Sub-simulation 4.9 examines the impact of capital-intensive farming as a whole. This simulation is the same as Simulation 4 except for the removal of import tariffs on agricultural machinery (Simulation 3), which is added to Simulation 4. The results of Simulation 3 in Table 5.14 (Section 5.3.1) show an increase in demand for labour in most agricultural sectors and a decrease in demand in the non-agricultural sectors. However, these changes were minimal compared with those same effects in Simulations 1 and 2. Therefore, Sub-simulation 2.9 results were quite similar to Simulation 4 (see Table 5.20).

Although the increase in capital stock in the agricultural sectors (Simulation 2) and the removal of import tariff on Agricultural Machinery sector (Simulation 3) produced opposite results with an increase in the share parameter of capital input (α_{fa}) in the agricultural production functions (Simulation 1), the result of Simulation 4 in terms of demand for labour was in similar to that in Simulation 1. Therefore, it can be concluded that Simulation 1 has the strongest effect on labour demand in the economy.

The last input effect on Simulation 4 in this section, the capital-labour ratio (K/L), is presented in Table 5.21. In general, Simulation 4 produced more capital-intensive sectors especially in the agricultural sectors. Simulation 4 results are a mix of Simulations 1, 2 and 3, and the results' directions in terms of the K/L ratio are similar to Simulation 2 in the agricultural sectors (See Tables 5.21 and 5.9) but it is possible that the K/L ratio are similar to Simulation 1's output in non-agricultural sectors (see Tables 5.21 and 5.3).

However, considering the detail of Sub-simulations 4.1 – 4.8 in Table 5.21, each sub-simulation resulted in more capital intensity in their respective sector; for example, there were rises in the K/L ratios by 9.31, 12.37, 10.47, 10.33, 3.93, 10.06, 12.43 and 4.38% in Sub-simulations 4.1 – 4.8. These positive changes in the K/L ratios were similar to that in Sub-simulations 1.1 – 1.8 and 2.1 – 2.8 as discussed in Sections 5.1.1 and 5.2.1, respectively. Nevertheless, though there was an increase in each K/L ratio in their respective sectors; there was also an increase or decrease in other sectors in Sub-simulations 4.1 – 4.8, which showed the same direction as in Sub-simulations 1.1 – 1.8.

Therefore, we conclude that, considering each Sub-simulation 4.1 – 4.8, the change in the K/L ratio depends more on the respective Sub-simulations 1.1 – 1.8 than on Sub-simulations 2.1 – 2.8. However, if considering the overall results of Simulation 4, an increase in agricultural capital stock (Simulation 2) seems to have a stronger effect than a rise of the share parameter of capital input in the agricultural sectors (α_{fa}, Simulation 1) but it has a lesser effect than Simulation 1 in the non-agricultural sectors.

Sub-simulation 4.9 differs from Simulation 4 only that it excludes the removal of import tariffs on Sector 16 (Simulation 3). The results of Sub-simulation 4.9 were similar to Simulation 4. This is because the K/L ratio in each sector did not change much in the Simulation 3 (see Table 5.15). Therefore, the results of Sub-simulation 4.9 and Simulation 4 of the K/L ratio were very similar to each other (see Table 5.21).

Table 5.20: Percentage changes in the quantity demand of factor (QF) from the results of Simulations 4 and 4.1 – 4.9 compared with the base year

Sectors	QF Base year[1/]		QF SIM 4 (%Δ)		QF SIM 4.1 (%Δ)		QF SIM 4.2 (%Δ)		QF SIM 4.3 (%Δ)	
	Labour (L) (00 persons)	Capital (K) (00 million baht)	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital
1. Paddy and Maize	43,020 (3)	2,115.26 (11)	0.25	5.00	-3.95	5.00	1.06	-	1.96	-
2. Cassava, Beans and Nuts	5,706 (13)	317.19 (18)	6.24	5.00	8.20	-	-6.56	5.00	3.53	-
3. Vegetables, Sugarcane and Fruits	27,690 (4)	2,554.77 (9)	-0.94	5.00	2.74	-	0.67	-	-4.95	5.00
4. Rubber and Latex	9,972 (7)	1,095.24 (16)	-4.62	5.00	0.03	-	0.05	-	0.17	-
5. Other Crops	9,623 (8)	989.21 (17)	3.57	5.00	1.40	-	0.16	-	0.68	-
6. Livestock	11,465 (6)	1,450.24 (14)	-3.82	5.00	0.85	-	-0.09	-	0.14	-
4. Forestry	2,523 (15)	132.52 (19)	-3.83	5.00	2.30	-	0.65	-	0.99	-
8. Fishery	4,420 (14)	1,813.24 (12)	3.63	5.00	1.80	-	0.08	-	0.57	-
9. Mining and Quarrying	687 (19)	2,296.49 (10)	-1.19	-	-0.39	-	-0.23	-	-0.61	-
10. Food Manufacturing	9,295 (9)	5,893.72 (5)	-0.97	-	0.29	-	-0.03	-	0.51	-
11. Textile Industry	8,602 (11)	3,807.67 (8)	1.74	-	0.66	-	0.04	-	0.30	-
12. Paper Industries and Printing	1,018 (17)	1,524.06 (13)	0.77	-	0.31	-	-0.02	-	0.31	-
13. Rubber Chemical and Petroleum Industries	6,903 (12)	4,354.73 (7)	-1.24	-	-0.24	-	-0.29	-	0.04	-
14. Non Metallic Products	2,003 (16)	1,285.73 (15)	0.29	-	0.44	-	-0.27	-	-0.27	-
15. Metal Product and Machinery	14,838 (5)	8,144.78 (4)	0.32	-	0.16	-	-0.15	-	0.06	-
16. Agricultural Machinery	51 (20)	14.64 (20)	-13.81	-	-12.49	-	-4.83	-	-6.71	-
17. Other Manufacturing	8,691 (10)	4,699.45 (6)	0.20	-	0.08	-	-0.17	-	0.04	-
18. Electricity, Water Work and Public Utilities	1,016 (18)	12,535.77 (3)	1.69	-	0.30	-	-0.19	-	0.39	-
19. Construction and Trade	65,881 (2)	19,121.44 (2)	0.51	-	0.05	-	-0.13	-	0.04	-
20. Service Transportation and Communication	71,043 (1)	92,473.25 (1)	-0.14	-	-0.06	-	-0.20	-	0.10	-

Table 5.20: Percentage changes in the quantity demand of factor (QF) from the results of Simulations 4 and 4.1 – 4.9 compared with the base year (cont.)

Sectors	QF SIM 4.4 (%Δ)		QF SIM 4.5 (%Δ)		QF SIM 4.6 (%Δ)		QF SIM 4.7 (%Δ)		QF SIM 4.8 (%Δ)		QF SIM 4.9 (%Δ)	
	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital
1. Paddy and Maize	0.15	-	0.45	-	0.41	-	0.18	-	-0.07	-	0.19	5.00
2. Cassava, Beans and Nuts	0.59	-	0.75	-	0.28	-	0.40	-	-0.03	-	6.13	5.00
3. Vegetables, Sugarcane and Fruits	0.15	-	0.34	-	0.13	-	0.11	-	-0.03	-	-1.04	5.00
4. Rubber and Latex	-4.83	5.00	-0.39	-	0.14	-	0.08	-	0.04	-	-4.66	5.00
5. Other Crops	-0.06	-	1.03	5.00	-0.07	-	0.06	-	-0.01	-	3.31	5.00
6. Livestock	0.14	-	-0.46	-	-4.59	5.00	-0.02	-	-0.05	-	-3.82	5.00
4. Forestry	0.49	-	-0.07	-	0.12	-	-8.08	5.00	0.04	-	-4.02	5.00
8. Fishery	-0.11	-	0.33	-	0.25	-	0.02	-	0.59	5.00	3.54	5.00
9. Mining and Quarrying	0.77	-	-0.97	-	0.15	-	0.07	-	0.07	-	-1.16	-
10. Food Manufacturing	0.14	-	-2.19	-	0.34	-	0.01	-	-0.01	-	-0.99	-
11. Textile Industry	0.33	-	0.03	-	0.21	-	0.06	-	0.01	-	1.79	-
12. Paper Industries and Printing	0.01	-	0.04	-	0.07	-	0.01	-	-0.01	-	0.80	-
13. Rubber Chemical and Petroleum Industries	0.16	-	-0.96	-	0.12	-	-	-	0.02	-	-1.22	-
14. Non Metallic Products	0.15	-	0.13	-	0.16	-	0.12	-	0.07	-	0.45	-
15. Metal Product and Machinery	0.09	-	0.03	-	0.13	-	0.04	-	-	-	0.41	-
16. Agricultural Machinery	-1.16	-	12.39	-	-0.01	-	-0.86	-	0.22	-	-15.68	-
17. Other Manufacturing	0.13	-	-0.19	-	0.17	-	0.07	-	-	-	0.24	-
18. Electricity, Water Work and Public Utilities	0.22	-	0.70	-	0.22	-	-0.04	-	-	-	1.84	-
19. Construction and Trade	0.20	-	0.18	-	0.14	-	0.01	-	-	-	0.56	-
20. Service Transportation and Communication	0.15	-	-0.28	-	0.12	-	0.04	-	0.01	-	-0.09	-

Source: Model Simulations 4 and 4.1 – 4.9
Note: Figures in parentheses indicate the ranks of sectors in respective inputs (K or L)

Table 5.21: Percentage changes in the capital-labour ratio (K/L) from the results of Simulations 4 and 4.1 – 4.9 compared with the the base year

Sector	Capital-Labour Ratio (K/L)										
	Base year[1/]	SIM4 (%Δ)	SIM4.1 (%Δ)	SIM4.2 (%Δ)	SIM4.3 (%Δ)	SIM4.4 (%Δ)	SIM4.5 (%Δ)	SIM4.6 (%Δ)	SIM4.7 (%Δ)	SIM4.8 (%Δ)	SIM4.9 (%Δ)
1. Paddy and Maize	0.049	4.74	9.31	-1.05	-1.92	-0.15	-0.45	-0.41	-0.18	0.07	4.80
2. Cassava, Beans and Nuts	0.056	-1.17	-7.58	12.37	-3.41	-0.58	-0.74	-0.28	-0.40	0.03	-1.07
3. Vegetables, Sugarcane and Fruits	0.092	5.99	-2.67	-0.67	10.47	-0.15	-0.34	-0.13	-0.11	0.03	6.11
4. Rubber and Latex	0.110	10.08	-0.03	-0.05	-0.17	10.33	0.39	-0.14	-0.08	-0.04	10.13
5. Other Crops	0.103	1.38	-1.38	-0.16	-0.67	0.06	3.93	0.07	-0.06	0.01	1.63
6. Livestock	0.126	9.18	-0.85	0.09	-0.14	-0.14	0.46	10.06	0.02	0.05	9.17
4. Forestry	0.053	9.18	-2.25	-0.65	-0.98	-0.49	0.07	-0.12	14.23	-0.04	9.39
8. Fishery	0.410	1.32	-1.77	-0.08	-0.57	0.11	-0.33	-0.25	-0.02	4.38	1.41
9. Mining and Quarrying	3.341	1.21	0.39	0.23	0.61	-0.76	0.98	-0.15	-0.07	-0.07	1.18
10. Food Manufacturing	0.634	0.98	-0.29	0.03	-0.51	-0.14	2.24	-0.34	-0.01	0.01	1.00
11. Textile Industry	0.443	-1.71	-0.65	-0.04	-0.30	-0.33	-0.03	-0.21	-0.06	-0.01	-1.76
12. Paper Industries and Printing	1.497	-0.76	-0.31	0.02	-0.31	-0.01	-0.04	-0.07	-0.01	0.01	-0.80
13. Rubber Chemical and Petroleum Industries	0.631	1.26	0.24	0.29	-0.04	-0.16	0.97	-0.12	0.00	-0.02	1.24
14. Non Metallic Products	0.642	-0.29	-0.44	0.27	0.27	-0.15	-0.13	-0.16	-0.12	-0.07	-0.45
15. Metal Product and Machinery	0.549	-0.32	-0.16	0.15	-0.06	-0.09	-0.03	-0.13	-0.04	-	-0.41
16. Agricultural Machinery	0.289	16.02	14.27	5.07	7.19	1.17	-11.02	0.01	0.87	-0.21	18.59
17. Other Manufacturing	0.541	-0.20	-0.08	0.17	-0.04	-0.13	0.19	-0.17	-0.07	-	-0.24
18. Electricity, Water Work and Public Utilities	12.335	-1.67	-0.30	0.19	-0.39	-0.22	-0.69	-0.22	0.04	-	-1.81
19. Construction and Trade	0.290	-0.50	-0.05	0.13	-0.04	-0.20	-0.18	-0.14	-0.01	0.00	-0.56
20. Service Transportation and Communication	1.302	0.14	0.06	0.20	-0.10	-0.15	0.28	-0.12	-0.04	-0.01	0.09

Source: Model Simulations 4 and 4.1 – 4.9, Note: [1/] 100 million baht/100 persons

5.4.2 Sectoral output effects of Simulation 4

The sectoral output effects of Simulation 4 (which combines Simulation 1 – 3) are similar to Simulation 1, in that there was a decline in almost all outputs in both the agricultural and non-agricultural sectors (see Table 5.22). As discussed in Sections 5.1.2, 5.2.2 and 5.3.2, Simulation 1 led to a decrease in almost all outputs in the agricultural sectors and some outputs in the non-agricultural sectors (see Table 5.4). On the other hand, Simulations 2 and 3 produced more output in the agricultural sectors and some outputs in the non-agricultural sectors (see Tables 5.10 and 5.16). The effects of Simulations 2 and 3 on outputs were not strong enough to turn the outputs in the model into positive changes. Therefore, it can be concluded that the output effects of Simulation 4 are dominated by Simulation 1 rather than Simulations 2 or 3.

The output results of Sub-simulations 4.1 – 4.8 (see Appendix S.2), in terms of the direction of changes, are similar to those in Sub-simulations 1.1 – 1.8. Although the output results of each Sub-simulation 1.1 – 1.8 and the respective Sub-simulations 2.1 – 2.8, for example, Sub-simulation 1.1 and 2.1, 1.2 and 2.2, 1.3 and 2.3 and etc. were in the opposite directions to each other, the output changes in Sub-simulations 4.1 – 4.8 corresponded to Sub-simulations 1.1 – 1.8. Therefore, it can be concluded that the increase in the production share parameter of input capital (α_{fa}) has more influence than the increase in capital stock on the output effects in the agricultural sectors.

Regarding Sub-simulation 4.9, there was not much change in the outputs between Sub-simulation 4.9 and Simulation 4. This is because the removal of import tariffs on the Agricultural Machinery sector did not have a strong effect other sector outputs.

5.4.3 Income effects of Simulation 4

The domestic income effects in Simulation 4 are similar to Simulation 1's results. The negative effect on domestic income in Simulation 4 was approximately half that of Simulation 1's results. For example, there was a decrease in all domestic income by 0.4% from the base year. The main reason is because the negative income effects were compensated for by the positive income effects of Simulation 2 (see Table 5.23).

Table 5.22: Percentage changes in the level of activity (QA), quantity of domestic output (QX), quantity of export (QE), output c sold domestically (QD), quantity of import (QM) and composite commodity (QQ) from results of Simulation 4 compared with the base year[1/]

Sector	Simulation 4 (%Δ)					
	QA	QX	QE	QD	QM	QQ
1. Paddy and Maize	-5.88	-2.02	-5.00	-1.63	2.20	-1.60
2. Cassava, Beans and Nuts	-4.00	-2.66	-3.76	-2.31	0.67	-1.57
3. Vegetables, Sugarcane and Fruits	-5.17	-1.45	-1.58	-1.44	0.95	-1.35
4. Rubber and Latex	-5.33	-0.58	-1.88	-0.43	1.19	-0.42
5. Other Crops	-4.08	-0.89	-	-1.02	-7.85	-2.44
6. Livestock	-4.69	-0.71	-0.77	-0.71	-0.25	-0.70
7. Forestry	-7.13	-1.54	-1.65	-1.51	-1.02	-1.37
8. Fishery	1.32	-0.26	7.09	-0.36	-0.15	-0.36
9. Mining and Quarrying	-0.42	-0.14	-0.01	-0.15	-0.30	-0.19
10. Food Manufacturing	-0.34	-2.01	-2.12	-1.95	0.81	-1.38
11. Textile Industry	0.74	0.32	0.34	0.31	-0.03	0.24
12. Paper Industries and Printing	0.14	-0.01	-0.02	-0.01	0.08	0.01
13. Rubber Chemical and Petroleum Industries	-0.42	-0.52	-0.49	-0.53	-0.88	-0.63
14. Non Metallic Products	0.10	-0.06	-0.05	-0.08	-0.27	-0.12
15. Metal Product and Machinery	0.12	0.09	0.10	0.08	-0.13	-0.04
16. Agricultural Machinery	-7.65	-2.05	-2.25	-2.05	-5.06	-3.43
17. Other Manufacturing	0.08	-0.16	-0.17	-0.16	-0.12	-0.14
18. Electricity, Water Work and Public Utilities	0.90	0.15	0.07	0.15	0.12	0.15
19. Construction and Trade	0.11	-	-0.01	-	-0.04	-
20. Service Transportation and Communication	-0.08	-0.28	-0.29	-0.28	-0.18	-0.26

Source: Model Simulation 4
1/ Base year presented in Appendix U

The income effects of Sub-simulations 4.1 – 4.8 also moved the same direction (both positive and negative effects) as Sub-simulations 1.1 – 1.8. However, the increase or decrease in domestic income in Sub-simulations 4.1 – 4.8 was lower than that in Sub-simulations 1.1 – 1.8 due to the positive income effect by Sub-simulations 2.1 – 2.8. The income effect of Sub-simulation 4.9 was similar to the Simulation 4 due to the small changes in income affected by the removal of import tariffs in Sector 16 (Simulation 3) (see Table 5.23).

5.4.4 Price effects of Simulation 4

The price effects of Simulation 4 are still more influenced by Simulation 1 than by Simulations 2 or 3. In comparisons of Tables 5.6 (Simulation 1), 5.12 (Simulation 2), 5.18 (Simulation 3) and 5.24 (Simulation 4), the direction of change of all prices in Simulation 4 are similar to Simulation 1's results. The only difference is that the percentage change in price in Simulation 4 was less than in Simulation 1 because of the opposite price effects of Simulations 2 and 3.

In each Sub-simulation 4.1 – 4.8, the direction of the percentage changes in prices were similar to the respective Sub-simulations 1.1 – 1.8. However, only a few sectors showed small changes in prices in Sub-simulation 4.8 compared with Sub-simulation 1.8. This is because the percentage changes in prices in Sub-simulation 1.8 were compensated by Sub-simulation 2.8. This confirms that Sub-simulations 1.8 and 2.8 affected the prices by a similar amount but in opposite directions (see Appendix S.3).

The price effects in Simulation 4 and Sub-simulation 4.9 were much closer to each other because Simulation 3, which is included in Simulation 4 but not included in Sub-simulation 4.9, plays a less significant role in price changes in the model (see Appendix S.3).

Table 5.23: Percentage changes in the factor income (YF), enterprise income ($YENT$), household income (YH), and government income (YG) from the results of Simulations 4 and 4.1 – 4.9 compared with the base year

Variables	Base year (million baht)	SIM 4 (%Δ)	SIM4.1 (%Δ)	SIM4.2 (%Δ)	SIM4.3 (%Δ)	SIM4.4 (%Δ)	SIM4.5 (%Δ)	SIM4.6 (%Δ)	SIM4.7 (%Δ)	SIM4.8 (%Δ)	SIM4.9 (%Δ)
Factor income (YF)											
Labour (L)	1,607,749.50	-0.48	-0.18	-0.10	-0.02	0.02	-0.22	0.02	0.01	0.01	-0.46
Capital (K)	2,488,845.50	-0.44	-0.10	-0.07	-0.08	-0.01	-0.17	-0.01	-0.10	0.02	-0.42
Enterprise income ($YENT$)	834,770.60	-0.42	-0.10	-0.07	-0.08	-0.004	-0.16	-0.01	0.002	0.01	-0.41
Household income (YH)	3,320,133.90	-0.45	-0.14	-0.08	-0.05	0.01	-0.19	0.01	0.005	0.01	-0.44
Government income (YG)	776,031.90	-0.45	-0.14	-0.09	-0.05	0.06	-0.19	0.03	-0.0005	0.01	-0.39

Source: Model Simulations 4 and 4.1 – 4.9

Table 5.24: Percentage changes of the price of activity (PA), producer price (PX) ,export price (PE), domestic price (PD), import price (PM), composite commodity price (PQ), value added price (PVA) from the results of Simulation 4 compared with the base year

Sector	Simulation 4 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	1.00	2.90	-0.30	3.40	-0.30	3.30	5.77
2. Cassava, Beans and Nuts	0.80	0.90	-0.30	1.30	-0.30	0.90	10.07
3. Vegetables, Sugarcane and Fruits	0.30	1.10	-0.30	1.20	-0.30	1.20	3.88
4. Rubber and Latex	-0.60	13.70	-0.30	15.50	-0.30	15.50	0.22
5. Other Crops	0.90	-8.80	-0.30	-10.00	-0.30	-8.10	7.05
6. Livestock	0.70	0.30	-0.30	0.30	-0.30	0.30	0.33
7. Forestry	-0.20	0.90	-0.30	1.10	-0.30	0.70	2.94
8. Fishery	0.50	-0.10	-0.30	-0.10	-0.30	-0.10	1.79
9. Mining and Quarrying	-0.60	-1.60	-0.30	-1.60	-0.30	-1.30	-1.90
10. Food Manufacturing	0.20	0.90	-0.30	1.50	-0.30	1.10	-1.31
11. Textile Industry	-0.40	-0.40	-0.30	-0.50	-0.30	-0.40	0.61
12. Paper Industries and Printing	-0.20	-0.20	-0.30	-0.20	-0.30	-0.20	-
13. Rubber Chemical and Petroleum Industries	-0.30	-0.60	-0.30	-0.70	-0.30	-0.60	-1.36
14. Non Metallic Products	-0.50	-0.40	-0.30	-0.60	-0.30	-0.50	-0.37
15. Metal Product and	-0.40	-0.40	-0.30	-0.50	-0.30	-0.40	-0.47
16. Agricultural Machinery	-3.20	-8.00	-0.30	-8.30	-0.30	-6.50	-7.48
17. Other Manufacturing	-0.30	-0.20	-0.30	-0.20	-0.30	-0.20	-0.46
18. Electricity, Water Work and Public Utilities	-0.40	-0.30	-0.30	-0.30	-0.30	-0.30	-
19. Construction and Trade	-0.20	-0.70	-0.30	-0.70	-0.30	-0.70	-0.22
20. Service Transportation and Communication	-0.50	-0.20	-0.30	-0.10	-0.30	-0.20	-0.61

Source: Model Simulation 4
Note: In the base year (2000) all prices set equal to 1

5.4.5 Macroeconomic effects of Simulation 4

The last results from Simulation 4, macroeconomic effects, are shown in Table 5.25. A comparison of the three macroeconomic results from each main simulation, Tables 5.7, 5.13, 5.19 and 5.25, seen clearly that the macroeconomic indicators in Simulation 4 were still somewhat analogous to those in Simulation 1. Overall, private consumption, exports and imports declined by around 0.5%. Government consumption and investment decreased by approximately 0.2 and 0.6%, respectively. Because of these falls, GDP dropped by 0.5%.

Table 5.25: Percentage changes in macroeconomic indicators from the results of Simulations 4 and 4.1 – 4.9 compared with the base year

Variables	Base year (million baht)	SIM 4 (%Δ)	SIM 4.1 (%Δ)	SIM 4.2 (%Δ)	SIM 4.3 (%Δ)	SIM 4.4 (%Δ)	SIM 4.5 (%Δ)	SIM 4.6 (%Δ)	SIM 4.7 (%Δ)	SIM 4.8 (%Δ)	SIM 4.9 (%Δ)
Private Consumption (*PRVCON*)	2,223,860	-0.45	-0.14	-0.08	-0.05	0.01	-0.19	0.01	0.004	0.01	-0.44
Government Consumption (*GOVCON*)	555,841	-0.19	-0.24	0.02	0.12	-0.02	0.01	-0.05	-0.01	-0.001	-0.20
Investment (*INVEST*)	1,156,525	-0.61	-0.08	-0.14	-0.15	0.05	-0.30	0.04	0.01	0.02	-0.55
Export (*EXP*)	3,625,078	-0.54	-0.15	-0.11	-0.11	0.06	-0.25	0.05	-0.02	0.02	-0.53
Import (*IMP*)	2,972,099	-0.55	-0.15	-0.11	-0.11	0.06	-0.26	0.05	-0.02	0.02	-0.53
Gross Domestic Product (*GDP*)	4,614,222	-0.46	-0.14	-0.09	-0.05	0.01	-0.19	0.01	0.003	0.01	-0.43

Source: Model Simulations 4 and 4.1 – 4.9

The results of each Sub-simulation 4.1 – 4.8 are more influenced by Sub-simulations 1.1 – 1.8 than by Sub-simulations 2.1 – 2.8 as occurred in other effects (output, price and income effects) in Sub-simulations 4.4 – 4.8. However, the degree of macroeconomic variables' changes in each Sub-simulation 4.1 – 4.8 was not the same as in Sub-simulations 1.1 – 1.8 due to the opposite effects of Sub-simulations 2.1 – 2.8. Sub-simulation 4.9 did not show much change from Simulation 4 because of the small change in Simulation 3 in macroeconomic effects.

5.5 Summary of findings

The results of the three main policy simulations were quite different in terms of sectoral input and output effects, institution income effects, price effects and macroeconomic effects. The results of Simulation 1 (increase in the share parameter (α_{fa}) of capital in the agricultural sectors, Sectors 1 – 8), were mostly in opposite directions to those in Simulation 2 (increase in agricultural capital stock) and Simulation 3 (removal of import tariffs on Agricultural Machinery sector or sector 16).

5.5.1 Summary of Simulation 1's findings

Simulation 1 automatically resulted in a decrease in the share parameter (α_{fa}) of labour in the agricultural sectors by about 8 – 21% due to the constant return to scale production functions. It led to a decrease in labour demand in four agricultural sectors; Vegetables, Sugarcane and Fruit (Sector 3), Rubber and Latex (Sector 4), Livestock (Sector 6) and Forestry (Sector 7). Because of these decreases, there were more capital-intensive sectors in these four agricultural sectors.

Because of the decrease in the share parameter (α_{fa}) of labour and demand for labour in the agricultural sectors, there was a decline in almost all output (the level activity (QA), domestic output (QX), export (QE), import (QD) and composite supply (QQ)) in the economy especially in the agricultural sectors. The significant decrease in QA was particularly noticeable in the agricultural sectors.

The decrease in the share parameter (α_{fa}) of labour and the demand for labour in the agricultural sectors resulted in a drop of average price (WF_f) in the model. Thus, the factor income (YF_f) decreased. In fact, factor income belongs to the domestic institutions: household and enterprise sector. Therefore, household and enterprise incomes decreased by approximately 0.8%. Finally, government revenue decreased by about 0.7% due to less income tax received.

The decline in almost all outputs in the agricultural sectors simultaneously resulted in a rise of relevant prices in the economy (PA, PX, PD, PQ, PVA). In contrast, there was a price decrease in the non-agricultural sectors. However, this decrease was not very significant. Import and export prices (PM, PE) also were decreased due to the drop in the exchange rate.

These negative effects produced no improvement in macroeconomic variables. A drop in household income caused a decrease in private consumption by 0.82%. The reduction of income tax caused a decrease in government consumption by 0.31%. There was also a decrease in investment demand by 1.04%. Imports and exports decreased because the exchange rate depreciated. Finally, the GDP declined by 0.8%.

5.5.2 Summary of Simulation 2's findings

The 5% increase in agricultural capital stock (Simulation 2) resulted in a reallocation of intermediate inputs of other sectors. It resulted in an increase in demand for labour, mostly in the agricultural sectors. However, in this simulation, capital input increased more than labour input. Therefore, Simulation 2 spurred a rise in the capital intensity in all agricultural sectors.

Because of the increase in both capital and labour in the agricultural sectors, all kinds of output increased in these sectors. This brought about an increase in some non-agricultural sector outputs due to their use of agricultural products as intermediate inputs.

Simulation 2 involves direct capital input injected into the production functions, therefore factor income must increase. Two factors in the model; capital and labour, belong to household and enterprise. Hence, these domestic institutions income increased by 0.41%. Additional tax revenue was collected by government because the increase in domestic income. Finally, government income also increased by 0.34%.

The increase in commodity outputs caused a decrease in its prices. In Simulation 2, there was a minimal drop of most agricultural prices and a slight increase in non-agricultural prices. These prices (PA, PX, PD, PQ, PVA) were adjusted to clear the market at equilibrium. Most price changes in Simulation 2 were opposite in direction to Simulation 1.

Thanks to the positive effects, the input, output and income effects, which were simulated by Simulation 2, the macroeconomic variables improved. An increase in household income brought about an increase in private consumption by 0.41%. Government consumption increased by 0.08% due to increased income tax receipts. There was also an increase in investment demand by 0.57%, while imports and exports increased by 0.5%. Finally, the GDP rose by 0.41%.

5.5.3 Summary of Simulation 3's findings

The results of the removal of import tariffs on Sector 16 (Simulation 3) showed the weakest effects compared with the results in Simulations 1 and 2. Demand for labour increased slightly, mostly in the agricultural sectors, but decreased in the non-agricultural sectors. Consequently, capital-intensive sectors were expected in the non-agricultural sectors but not in the agricultural sectors.

An increase in labour supply in the agricultural sectors also catalysed an increase in sectoral outputs. In contrast, a drop in labour in the non-agricultural sector reduced output quantity in the sectors. However, the degree of output changes in Simulation 3 was much less than in Simulations 1 and 2.

Although there was an increase in supply of labour in the agricultural sectors, that labour was drawn from the non-agricultural sectors. The fact that agricultural wages are always less than industrial wages meant that the overall labour income decreased by 0.02%. The total capital income also declined due to a drop of rent in some key industrial sectors. Finally, household income, enterprise and government income decreased by 0.01, 0.02 and 0.07%, respectively.

The price system in Simulation 3 was hardly changed compared with other simulations. The most significant price changes were in the agricultural sector (Sector 16), especially the import price because of the free trade in that sector.

As a result of the decrease in domestic income and PQ, there was a decrease in private consumption and investment demand by 0.02 and 0.06%, respectively. Imports and exports decreased due to the shrinking of industrial imports and exports. Finally, GDP decreased by 0.02%.

5.5.4 Summary of Simulation 4's findings

Simulation 4 results are a little more complicated than the three previous simulations because it combines all simulations. Therefore, the effects of either Simulations 1, 2 and/or 3 may either reduce or increase Simulation 4's effects.

The share parameters of capital input in Simulation 4 were similar to Simulation 1 and the capital input was identical to Simulation 2. However, there is no change in the share parameters of capital input and the capital stock in Simulation 3. These three policy simulations affect the demand for labour unequally. Simulation 1's conditions seem to be more influential than those in the other simulations. Therefore, the direction of changes in the demand for labour in Simulation 4 was the same as in Simulation 1 - that is an increase in the demand for labour in the four agricultural sectors. However, this increased demand for labour was less than the increase in capital stock injected into Simulation 2. Hence, in Simulation 4, the direction of the capital-labour ratio (K/L), which is a proxy measure for of capital intensity, were similar to Simulation 2 in the agricultural sectors but this ratio's direction of change was similar to those in Simulation 1 in the non-agricultural sectors.

The output effects, income effect, price effect and macroeconomic effects in Simulation 4 were influenced more strongly by Simulation 1 rather than Simulations 2 or 3. Almost all prices in Simulation 4 increased, consequently there was a decrease in almost all outputs. All factor incomes dropped. Therefore, other domestic income reduced by 0.4 %. Finally, these effects brought about a decline in all macroeconomic variables.

Chapter 6
Summary, Conclusions and Policy Implications

A summary of the findings of the study are presented in this final chapter which comprise five sections. Section 6.1 provides an overall summary of the research, whereas Section 6.2 discusses the conclusions of the research. Section 6.3 draws possible policy implications for Thai agriculture regarding capital-intensive farming. Section 6.4 discusses some limitations of the study, while recommendations for future study are presented in Section 6.5.

6.1 Summary

The agricultural sector still plays a significant role in economic growth and development in Thailand. Although the share of agriculture in GDP was only 10% in 2005, it is still the main source of employment in the country. These farm workers are the majority of the poor. There is an increase in the outflow of workers (younger workers in particular) from agricultural sectors to non-agricultural sectors. Therefore, the number of farmers over 45 years old has increased substantially. Agricultural machinery is expected to substitute for the labour shortage in Thai agricultural sectors.

There were three objectives in this research. First, it aimed to review the status of the relationship between agricultural labour and capital in Thailand. The second objective was to construct a 2000 Social Accounting Matrix (SAM) that emphasises Thai agriculture. Based on SAM, a Computable General Equilibrium (CGE) model was developed with 20 production sectors. Finally, the CGE model used the 2000 SAM as a database to evaluate the impacts of various policies to promote capital-intensive farming in the Thai economy.

In 1960 – 80, land and labour were the major inputs that contributed to agricultural growth in Thailand, since the mid-1980s, capital has played a more important role after the closing of the land frontiers. Capital contributed around 60% of agricultural growth during 1981 – 2003. Many studies showed that, in the Thai agricultural sector, machinery is positively related with land demand but negatively with labour demand. In addition, agricultural labour can be clearly substituted for by agricultural machinery.

The total labour force in Thailand was around 34.26 million in 2002 and it had increased to 36.43 million in 2006. The number of workers in the non-agricultural sector also rose, from 19 million to approximately 22 million in the same period. Although there was an upward trend in the total number in the labour force and the number of workers in the non-agricultural sector, there was a downward trend in the number of agricultural workers in Thailand between 2002 and 2006. One reason is that there had been an outflow of labour from the agricultural sector to the non-agricultural sector.

The number of unemployed labour decreased substantially between 2002 and 2006. However, there was a gradual increase in the proportion of unemployed who have never worked. Meanwhile, there was a slight decrease in the proportion of unemployed who used to work in this period. More importantly, the proportion of unemployed workers who used to work in the agricultural sectors decreased slightly. On the other hand, the proportion of unemployed workers who used to work in non-agricultural sectors increased steadily.

Age structure in the Thai agricultural workforce is likely to be different from other economic sectors. The median age of the Thai agricultural workforce was higher than other industries. From 1958 to 2003, the proportion of the agricultural workforce under 40 years went down nearly 20%. Conversely, the proportion of the agricultural workforce aged over 60 was doubled in the same period.

Ageing and education in the Thai agricultural sector are related to each other. The study shows that young Thai farmers (aged 15 – 39 years old) working in agriculture had higher education than older farmers. The proportion of tertiary graduates (with bachelors' degree or technical education) working in the agricultural sector doubled over the period 1996 – 2001. Therefore, the new generation of Thai farmers has a higher education.

The starting point for agricultural capital was the large investment in irrigation in the 1950s. As of 2006, the total capacity of irrigation systems was 74,318 million cubic metres, which covered nearly 28 million rais or around 20% of arable land (139,800,119 rais) in Thailand. An increase in arable land may cause a rise of agricultural capital input. Since 1981, there has been an increase in agricultural equipment growth. The agricultural capital input growth rate was faster than the growth rate of irrigated land and labour in the period 1981 – 1995.

Thai farmers who have a farm ranging between 10 – 19 and 20 – 29 rais, mostly own agricultural machinery and equipment. These farmers are the core agricultural land users in Thailand particularly for planting rice, field crops, permanent crops and para rubber trees. Most agricultural machinery and equipment used in Thailand is manufactured domestically, but tends to be of lower quality and somewhat inefficient. Therefore, higher quality equipment, such as machinery for poultry and bee keeping and four-wheel tractors, is increasingly imported every year. Consequently, Thai agriculture is forecast to become more capital-intensive farming.

There are many ways to study the economic impacts of increasingly capital-intensive farming. However, CGE modelling seems to be the most suitable methodology because it is a set of simultaneous equations describing an economy as a complete system of the economic interactions among agents. A CGE model can measure the economy-wide impact because it can trace the distributional impact of income changes both in factor and commodity markets. Furthermore, CGE models include a broad scope of households, firms, government, other institutions and production sectors. This study is the first attempt to primarily combine and synthesise a CGE model and capital- using biases in the non-neutral technical change concept in order to investigate the impact of capital intensive farming in Thailand. The relevant literature and theories were reviewed exhaustively in Chapter 3.

The context of factor biases can be classified in the economic approach into three different types: factor-saving (or using) biases, factor augmentation and other dimensions of bias pertaining to economic models. The concept of factor-saving (or using) biases was first introduced by Hicks (1963), in the Theory of Wages in 1932. Hicks said that labour-saving (or capital-using) means “inventions increase the marginal product of capital more than they increase the marginal product of labour”. However, Salter (1966) concludes that his technical advance concept and Hicks’ concept are not much different in terms of labour-saving and capital-saving. This concept has been applied to various economic studies both in CGE and non-CGE models.

The factor augmentation concept is captured by an increase in factors of production called technological process. There are three types of technological process: pure capital augmenting, pure labour augmenting and equal capital and labour augmenting. Many studies have applied this concept to CGE models.

Other dimensions of bias are in forms relating to scale or substitutability or scope. An increasing return to scale was integrated into a CGE model to investigate the effect of a tourism boom in the study of Gooroochurn and Blake (2005). Another factor bias, Total Factor Productivity (TFP), is also applied in the context of CGE models, for example, the investigation of TFP bias in the agricultural sector in the African, Asian and Latin American archetype by Janvry and Sadoulet (2002) and the impact of the increase in TFP in the agricultural sector on rural income in Uganda by Dorosh, El-Said, and Lofgren (2002).

Since 1980, a number of Thai CGE models have been constructed and these can be grouped into three categories depending on the time of construction: 1980s, 1990s and 2000s. The first Thai CGE model, Grais (1981), was Siam 1, which was constructed to measure the effect of the oil price shock in the 1970s. This model was modified by several economists depending on their objectives and base year data.

In the 1990s, various policy interventions were incorporated into Thai CGE models - for example, an increase in government consumption and government demand for infrastructure in Bangkok, a decrease in the rate of protection in commodities, in the rate of return to capital and rediscount and the removal of all foreign labour and tax on foreign labour. Some CGE models in this decade belonged to the Johansen class of General Equilibrium models. The equations in this type of CGE model are written as percentage change of variables. Most CGE models in this decade used CES functions both in the demand and supply sides and were static models.

In the current decade, the 2000s, Thai CGE models mainly focused on tax and tariff policies due to the boom of free trade agreements between Thailand and other countries around the world. The minor CGE simulation in this period was non-tax and tariff policies. There were also a few multipurpose CGE models that can be easily adapted for other specific policy simulations. The multi-regional and multi-sector CGE model, called the Global Trade Analysis Project or GTAP, was also introduced in this period. Although CES functions were still used frequently, some studies used the Cobb-Douglas and LES functions. All Thai CGE models in this period were static except the study of the impact of the increase in power imports by Watcharejyothin and Ram (2007). Only a few parts of Siksamat (2002) and Thaiprasert (2006) models were simulated to measure structural changes in their CGE models. Unfortunately, these two models did not rely on any economic theory in terms of input bias.

Therefore, this study is the first CGE model that fills this gap by applying the original factor using concept of Salter (1966) modified by Jackson (1998) into a CGE model that focuses especially on inputs in the agricultural sectors.

The database for the CGE model is a SAM, a square matrix, where entries represent spending from column accounts to row accounts. The sum of each row must balance with the corresponding column sums. A SAM represents the double-entry, receipt-expenditure accounts, which include various economic factors. Different disaggregations in a SAM lead to different policy simulations in a CGE model. A SAM of Thailand is constructed by TDRI. Many Thai economists have modified a general SAM from TDRI into their specific CGE models because a SAM construction is time-consuming. The latest SAM for Thailand is based on 1998.

The new database for this study, the 2000 micro SAM for Thailand, was constructed employing the latest available input-output table and National Income year 2000 data. This SAM contains 50 x 50 matrices. The SAM has 20 activities and commodities (with eight agricultural sectors); two input factors (capital and labour); three institutions (household, enterprise and government); three types of taxes (income tax, indirect tax and tariff); saving-investment and the rest of the world. The SAM is balanced by the cross-entropy (CE) technique using the software called General Algebraic Modelling System or GAMS.

The 20 sector CGE model was constructed based on the above 2000 micro SAM of Thailand. The model satisfies Walras' law by adding a Walras variable into the saving and investment equation. The model is square and the number of endogenous variables equals the number of equations. Finally, Armington elasticity (σ_c^q), the elasticity of transformation between domestic sales and exports for commodity c (σ_t^q), the number of employed workers and the value of net capital stock of Thailand in each sector in the year 2000, were introduced into the model. The model was run and calibrated by GAMS. The base year solution of the CGE model; including parameters and variables, have to equal to the original SAM equilibrium because it is assumed that all initial prices at equilibrium in the model are homogeneous with degree zero.

The main objective of this study was to examine the impact of capital-intensive farming in Thailand. The simulation design was inspired by two different concepts from Jackson (1998). A supplementary simulation regarding the removal of agricultural machinery import tariffs was also added. There were four main simulations with 25 sub-simulations in the model. The first main shock was generated by increasing the share parameter (α_{fa}) of capital in agricultural sectors by 5%. The second simulation is a direct 5% increase in capital stock in agricultural sectors. The third simulation was the removal of import tariffs in Agricultural Machinery sector (Sector 16). The final simulation was the combination of all main Simulations 1–3.

6.2 Simulation conclusions

6.2.1 Conclusions from the main policy simulations

The results of the first two policy simulations were opposite from each other in terms of input and sectoral output effects, institutional income effects, price effects and macroeconomic effects. Simulation 1 mostly harmed the economic system. In contrast, Simulation 2 resulted in a positive effect on the economic variables. The direction of Simulation 3's results was similar to Simulation 2 but its effects were much weaker. The combination of the three main simulations, Simulation 4, revealed the influential factors affecting capital-intensive farming in Thailand. All the main policy simulations conclusions are shown in Appendix T (T.1 – T.7) by the analysis of five effects: input factor effects, sectoral output effects, income effects, price effects and macroeconomic effects.

There are three indicators for input factor effects: the share parameter of factor input (α_{fa}), quantity demand (supply) of input (QF) and capital-labour ratio (K/L). Simulations 1 and 4 resulted in a decrease in α_{fa} of labour in its sectors by 8 – 21% whereas Simulations 2 and 3 did not cause any change in α_{fa} (see Appendix T.1).

The changes in α_{fa} in Simulations 1 and 4 led to the reallocation in the supply of labour (QF) in the economy. Specifically, the levels of QF in four agricultural sectors (Sectors 3, 4, 6 and 7) and some non-agricultural sectors (Sectors 9, 10, 13, 16 and 20) decreased. However, Simulation 2 resulted in a decrease in the supply of labour in only three agricultural sectors (Sectors 1, 2 and 3) and some non-agricultural sectors (Sectors 11, 12, 15, and 17 – 19). However, there was an increase in the supply of labour in almost all agricultural sectors but there was a decrease in this supply in the non-agricultural sectors except Agricultural Machinery sector (Sector 16) in Simulation 3 (see Appendix T.2).

The reallocation of the supply of labour in each simulation leads to different changes in the K/L ratio, which is the measure of capital intensity. Simulation 1 led to capital intensification in four agricultural sectors (Sectors 3, 4, 6, and 7), and five non-agricultural sectors (Sectors 9, 10, 13, 16 and 20). In contrast, Simulation 2 spurred a rise in the capital-intensive sectors in all agricultural sectors and six non-agricultural sectors (Sectors 11, 12, 15 and 17 – 19). However, Simulation 3 resulted in less capital-intensive in most agricultural sectors but more capital-intensive sectors in the non-agricultural sectors. Simulation 4 resulted in more capital-intensive farming except Sector 2. In addition, Simulation 4 produced more capital- intensive sectors in non-agricultural sectors like Simulation 2 (see Appendix T.3).

The input changes directly affect sectoral outputs in the economy. Simulations 1 and 4 led to a fall of almost all outputs in agricultural sectors. On the contrary, Simulations 2 and 3 resulted in an increase in agricultural output. However, Simulation 2 caused a decrease in non-agricultural outputs in only a few sectors but the other simulations mostly showed negative output growth in non-agricultural sectors (see Appendix T.4).

Regarding institutional income effects, Simulation 1 led to a drop in factor income belonging to household and enterprise because the average price of labour (WF_f) decreased. Consequently, government income declined due to less collected tax. In contrast, Simulation 2 resulted in an increase in the income of household, enterprise, and government sectors due to the increase in factor incomes. However, in Simulation 3, institutional incomes decreased slightly from the base year. The directions of change in domestic income effects in Simulation 4 were similar to Simulation 1 results' but the negative effect on domestic income in Simulation 4 was approximately half that in Simulation 1 due to the positive income effects of Simulation 2 (see Appendix T.5).

The overall price effect of Simulation 1 was an increase in all prices (except the import and export price) in the agricultural sectors but the price in non-agricultural sectors generally decreased slightly. In contrast, Simulation 2 mostly resulted in decreased agricultural prices but an increase in non-agricultural prices. The price effects of Simulation 3 were very small compared with those two simulations. The only significant price change in Simulation 3 was in the Agricultural Machinery sector. Therefore, the final price effects of Simulation 4 were influenced more by Simulation 1 than Simulations 2 or 3. This implies that there was an increase in agricultural prices but a decrease in non-agricultural prices (see Appendix T.6).

The last effect, the macroeconomic effects, the policy simulation was simultaneously impacted by the four effects. In Simulation 1, all macroeconomic variables, such as private consumption, government consumption, investment, export, import and Gross Domestic Product (GDP), decreased nearly 1%. Simulation 2 had a positive impact on the above variables of around 0.5%. Simulation 3 had a slight negative effect on the macro variables. Lastly, in simulation 4, the negative effects on the macro variables from Simulation 1 were stronger than those in Simulation 2. Therefore, all macro variables decreased. However, the decrease was less than those in Simulation 1 because of the positive effects from Simulation 2 (see Appendix T.7).

6.2.2 Conclusions from the sub-policy simulations

Sub-simulations 1.1 – 1.8, 2.1 – 2.8, and 4.1 – 4.9 simulated the effects of capital-intensive farming in each agricultural sector individually. Every sub-simulation can be explained by the five analyses from the main simulations. The results of each sub-simulation were similar to their main simulations in terms of the direction of changes in input, output, income, price and macroeconomic effects. However, some sub-simulations' results are interesting and different from the other simulations as follows:

- Input factor effects
  - In Sub-simulation 1.5, there was an increase in the supply of labour (QF) in Other Crops (Sector 5) and the Agricultural Machinery sector (Sector 16). This resulted in less capital intensity in these two sectors.
  - Sub-simulation 1.7 was the strongest policy simulation generating the highest degree of capital intensity to the Forestry sector (Sector 7) because there was a large decline in supply of labour (QF) in this sector compared with other Sub-simulations 1.1 – 1.8.
  - Between Sub-simulations 1.5 and 2.5, Sub-simulation 2.5 was more influential than 1.5 in making Sector 5 into a capital-intensive sector. This conclusion was reflected by Sub-simulation 4.5 (the combination of Sub-simulations 1.5 and 2.5), which showed the increase in the K/L ratio in Sector 5, although Sub-simulation 1.5 showed a decrease in the ratio in Sector 5.
  - Among Sub-simulations 2.1 – 2.8, Sub-simulations 2.1 – 2.3 resulted in more capital intensity in all agricultural sectors.
  - Among Sub-simulations 2.1 – 2.8, only Sub-simulation 2.5 showed a drop in the supply of labour (QF) in its sector. Consequentially, it resulted in the highest degree of capital intensity in the Other Crops sector (Sector 5).
  - There was labour reallocation in almost all non-agricultural sectors to agricultural sectors in Sub-simulations 1.2, 2.4 and 2.6.
- Sectoral output effects
  - Although Simulation 2 resulted in a substantial increase of QA in all agricultural sectors and a simultaneous increase in other outputs (QX , QE , QD , QQ and QM), some of these outputs increased or decreased slightly in non-agricultural sectors. However, Sub-simulations 2.2 and 2.5 had a positive effect on almost all outputs.
  - All sub-simulations revealed an increase in the quantity of exports for fishery because of either a decrease in export price in its sector or the devaluation of the domestic currency per unit of foreign currency.
  - Among Sub-simulations 1.1 – 1.8, Sub-simulation 1.7 caused the largest drop of the level of activity (QA). In contrast, among Sub-simulation 2.1 – 2.8, Sub-simulation 2.6 brought about the greatest rise in this output (QA).
  - Sub-simulation 1.2 showed a negative effect on the outputs in almost every sector.
- Income effects

- The results for domestic income in the respective sub-simulations (for example, Sub-simulations 1.1 and 2.1, 1.2 and 2.2) were almost completely opposite to each other. The only parallel direction was in capital income in Sub-simulations 1.3 and 2.3, which changed negatively from the base year.
- The income effects in both Sub-simulations 1.7 and 2.7 were very similar in that there was no significant change in every domestic income.
- All income changes were positive in Sub-simulations 2.1, 2.2, 2.5 and 2.8.

- Price effects
  - Sub-simulation 1.5 indicated a rise of PA and PVA not only on its sector but also a significant increase in PX, PD and PQ in the four main agricultural sectors (Sectors 1 – 4). Sub-simulation 2.5 resulted in the opposite direction in those prices. In addition, Sub-simulation 2.5 showed a dramatic drop in PX, PD and PQ especially in Sector 4.
  - Sub-simulations 2.2, 2.4 and 2.7 resulted in a drop in all prices in its sector with only a slight change in prices in some sectors.
- Macroeconomic effects
  - Sub-simulation 1.5 was associated with the most negative effect in all macro economic variables (except government consumption) compared with other capital-intensive policies.
  - In contrast, Sub-simulation 2.5 showed the most positive effects for macro economic variables (except government consumption) compared with other capital intensive policies.

6.3 Policy Implications

The findings from this study will aid in the formation of guidelines for capital input policies, especially the agricultural sectors in Thailand. The study results showed that Simulation 1 (5% increase in share parameter of capital input (α_{fa}) in agricultural sectors) brought harmful effects to the economy. However, Simulation 2 (5% increase in agricultural capital stock) mostly resulted in the positive effects on economic variables. The results of these policy simulations suggest the following actions for policy makers.

6.3.1 Policy implication of the 5% increase in the share parameter of capital input (α_{fa}) in agricultural sectors

Although the increase in share parameter (α_{fa}) of capital in agricultural sectors (Simulation 1) brought about depressing effects on outputs in almost all sectors including institutions' income and macro variables, this case may be chosen when the government would like to bring more capital intensity into agricultural sectors, with its negative effects on other economic variables, in order to slow down economic growth in the case of an overheating economy. The question is: How can share parameter (α_{fa}) in agricultural sectors be increased in practice?

From the Cobb-Douglas production function (Chung, 1994, p. 95):

$$y = f(x_1,...,x_n) = A\prod_{i=1}^{n} x_i^{a_i} \qquad 6.1$$

Where:

y = output;

x_i = input;

$A > 0, 0 < a_i < 1$ and $\sum_i a_i = 1$.

Its marginal product (MP) is $\dfrac{\partial y}{\partial x_i} = a_i \dfrac{y}{x_i} > 0$ 6.2

At the optimum, we have $MP_i = \dfrac{w_i}{p}$ 6.3

Where:

w_i = the price of input *i* and

p = the price of output.

From equations 6.2 and 6.3 we obtain:

$$a_i = \frac{w_i \cdot x_i}{p \cdot y} \qquad 6.4$$

Or we can write equation 6.4 as the factor demand equation which is the function of factor prices, output and output price.

$$x_i = \frac{a_i(p \cdot y)}{w_i} \qquad 6.5$$

Hence, we cannot increase x_i without decreasing w_i in order to make a_i increase. This is because a_i is exogenous and represents the technology process of the Cobb-Douglas production function.

Therefore, the share parameter of a Cobb-Douglas is not influenced by w_i or x_i. However, a_i can be increased only if there is a decrease in p or y or both. This means that if the government would like to obtain Simulation 1's results, policies such as a minimum price guarantee for selected agricultural products needs to be determined or a restriction on agricultural production levels would be required.

The results of this study show that there was a negative impact on all macro economic variables of approximately 1% in simulation 1. That means an increase in the share parameter of capital input (α_{fa}) in the agricultural sectors harms the overall economic system. According to Chung (1994), the causes of an increase in α_{fa} are an increase in the price of inputs or a decrease in the price of outputs and production. Therefore, if the policy makers plan to introduce these policies into the economic system, they should be aware of negative effects. Furthermore, other economic policies need to be prepared to compensate for the negative effects.

As discussed previously, there was a labour reallocation from non-agricultural sectors to the agricultural sectors in Sub-simulation 1.2. Therefore, if the Thai government would like to shift labour from the industrial sectors to agricultural sectors (except Sector 2) by using the capital-intensive farming concept, the following policies should be imposed, such as the price guarantee of Sector 2 (Cassava, Bean and Nuts) or a restriction of Sector 2's production level. However, the results of the study show that Sub-simulation 1.2 not only harmed almost all outputs in every sector but also decreased all domestic income and macroeconomic variables. Policy makers must be aware of these negative effects.

Sub-simulations 1.4 and 1.6 resulted in an increase in output in almost every sector except their sectors (Sectors 4 and 6). Therefore, if the Thai government plans to increase output production as a whole by increasing the share parameter of capital input (α_{fa}) in the agricultural sectors the price guarantee of Sector 4 and/or 6 or a restriction of Sector 4 and/or 6's production level would help improve the overall output.

Although there is no significant change in domestic incomes: factor income, enterprise income, household income, and government income in Sub-simulation 1.7, almost all incomes were positive in this sub-simulation. Therefore, if the Thai government focuses on increasing these domestic incomes, this sub-simulation can be applied in order to help improve the above domestic incomes. This means the price guarantee of Sector 7 or a restriction on sector 7's production level should be included in Thai agricultural policies.

Even though most sub-simulations within Simulation 1 caused a negative impact on the macroeconomic variables, Sub-simulations 1.4 and 1.6 brought about positive changes in the macroeconomic variables. Hence, these two sub-simulations may help improve the overall macroeconomic system. To do this, the Thai government needs guarantee the price of Sector 4 or 6 or restrict Sector 4 or 6's production levels.

In conclusion, the policy implications of the increase in the share parameter of capital input (α_{fa}) in the agricultural sectors may not be the proper choice when planning capital-intensive farming. Although, Simulation 1 results showed more capital intensity in some sectors in the economy, there were many negative effects to the economic system, such as the decrease in agricultural output, domestic income and macro economic variables. However, there are a few sub-simulations within the Simulation 1, Sub-simulations 1.4, 1.6 and 1.7, that showed some positive effects to the Thai economy. Therefore these sub-simulations may be chosen when the government is looking to improve economic performance as a whole.

6.3.2 Policy implications of the increase in agricultural capital stock

Capital-intensive farming from increased net capital stock in the agricultural sectors (Simulation 2) had a positive effect on almost every economic variable, in contrast to negative effects from the increase in capital share parameter (α_{fa}) in Simulation 1, or the removal of import tariffs on the agricultural machinery sector (Simulation 3) or the combination of Simulation 1, 2 and 3 (making up Simulation 4). Therefore, among the four main options, Simulation 2 is the most effective policy for the Thai government to implement in order to bring the positive effects on the economic variables of interest. This means agricultural capital stock, for example, tractors, water pumps, harvesting machines and other equipment, needs to be injected into every agricultural sector if the Thai government wanted to bring more capital intensity into the agricultural sectors with positive effects on other economic variables such as outputs, domestic incomes, prices, and macro economic variables.

We assumed that labour is mobile and fully employed, Simulation 2's results point out that the agricultural sector would be more capital-intensive because there was mobility in the labour supply in each sector in the economic system both ways from agricultural sectors to non-agricultural sectors. Therefore, if greater capital intensity in the agricultural sectors is to be achieved, capital stock should be injected into all agricultural sectors. However, the Thai government should be aware of the needs of labour relocation between the agricultural sectors and non-agricultural sectors, such as providing skill training to those workers who would be moving from one sector to another sector.

In some simulations there was a labour supply reallocation either from non-agricultural sectors to agricultural sectors or between agricultural sectors in the economic system. However, in Sub-simulations 2.4 and 2.6, there was a decrease in labour supply in almost all non-agricultural sectors but there was an increase in labour supply in some agricultural sectors. As a result of this, there should be a movement in the supply of labour mostly from non-agricultural sectors to agricultural sectors in these sub-simulations. Therefore, if the Thai government wanted to increase the supply of agricultural labour in the economy without importing them from neighbouring countries, an alternative labour relocation from non-agricultural sector to agricultural sectors is recommended. Sub-simulations 2.4 and 2.6 can be applied to achieve this goal. This means agricultural stock should be injected into the Rubber and Latex sector (Sector 4) and/or the Livestock sector (Sector 6).

Among the Sub-simulations 2.1 – 2.8, Sub-simulations 2.1 – 2.3 showed increasing capital intensity in every agricultural sector whereas Sub-simulations 2.4 – 2.8 resulted in a decrease in capital intensity in some agricultural sectors. This means that agricultural capital stock should be added into these three sectors (i.e., (1) Paddy and Maize, (2) Cassava, Bean and Nuts, and (3) Vegetables, Sugar Cane and Fruits) if the Thai government wanted to see more capital intensity in these sectors without any reduction of capital intensity in other agricultural sectors.

With respect to output effects, Sub-simulations 2.2 and 2.5 brought positive output effects not only in their sectors but also in almost all sectors with only a small negative output effect in a few other sectors. Therefore, if the Thai government wanted to expand outputs such as Cassava, Beans Nuts and Other Crops (Sector 2 and 5), with a small negative effect on other outputs, the policies in Sub-simulations 2.2 and 2.5 would be the most suitable. Agricultural capital stock should be injected into these two sectors (Sectors 2 and 5 (Other Crops)) to achieve this goal.

Sub-simulations 2.1, 2.2, 2.5 and 2.8 revealed no negative domestic income effects (factor income, enterprise income, household income and government income). Hence, if the Thai government wanted to emphasise an increase in these domestic incomes via capital intensive policies, agricultural capital stock should be put into only Sectors 1, 2, 5 and 8 (Fishery).

According to the price effects of Simulation 2, there was a drop in almost all prices in the agricultural sectors while prices in the non-agricultural sectors increased. Therefore, if the Thai government wanted to reduce agricultural prices and increase non-agricultural prices, agricultural capital input should be injected into all agricultural sectors. However, Sub-simulations 2.2, 2.4 and 2.7 resulted in a drop in prices in Sectors 2, 4 and 7 with a slight change on prices in some sectors. Therefore, if the government wanted to reduce agricultural prices in these three specific sectors without any effect on other prices, agricultural input capital should be raised only in Sectors 2, 4 and 7. However, since Sub-simulation 2.5 led to a remarkable drop in PX, PD and PQ in Sectors 1 – 3 and especially in Sector 4, if the government wanted to reduce these prices in the four main agricultural sectors (Sectors 1 – 4), agricultural input capital ought to be added into Sector 5.

The study shows that there was a positive impact on the macroeconomic variables: consumption, investment, export, import and GDP, and these macro economic variables rose approximately by 0.5% in Simulation 2. Therefore, if the Thai government focuses on overall economic performance regarding capital-intensive farming policies, capital stock should be injected into every agricultural sector. However, when the government is interested in improving some particular macroeconomic variables, one or more of Sub-simulations 2.1 – 2.8 may be chosen. For example, if increasing government consumption is not the target goal, one or more of Sub-simulations 2.2, 2.3, 2.5 and 2.8, can be selected, so that agricultural capital stock should be included only into Sectors 2, 3, 5 and 8. Conversely, if increasing government consumption is an important goal and the Thai government would like to slow down the growth in other macroeconomic variables, Sub-simulations 2.4 and 2.6 are the most appropriate. This means capital stock should be injected only into Sectors 4 and 6.

In conclusion, the policy implications in terms of the increase in agricultural capital stock in each agricultural sector can help its sector become more capital-intensive. The increase in agricultural capital stock in a specific sector resulted in different output, income, price and macroeconomic effects. However, the study found that Sub-simulation 2.2 was the most suitable policy simulation regarding capital-intensive farming. This is because it brought a positive effect to almost all economic variables in the economy with only small negative output and price effects in a few sectors. Therefore, the Thai government should pay more attention to Sector 2, covering Cassava, Beans and Nuts. Agricultural capital stock should be injected into this particular sector.

6.3.3 Policy implication on the removal of the import tariffs (Simulation 3) in the agricultural machinery sector (Sector 16)

Although Simulation 3 brought unpleasant results in terms of less capital intensity, negative domestic income and macroeconomic variables, these effects were small compared with other simulations in the study. However, removal of the agricultural machinery tariff could reduce not only its import price but also almost all prices in its sector with a slight change in prices in only a few sectors. Another advantage of Simulation 3 was an increase in agricultural outputs. According to the studies of Kiatwat and Krishnasreni (1998) and Thepent (2005) studies (see Section 2.2), Thailand imports only some quality agricultural equipment and four-wheel tractors. Therefore, if the Thai government considers an increase of overall agricultural production, elimination of import tariffs on agricultural machinery is an alternative policy to chose but the country would face a slight decline on domestic incomes and GDP.

6.3.4 Policy implication of Simulation 4 (combined Simulations 1, 2 and 3)

The results of Simulation 4, a combination of Simulation 1, 2 and 3, showed that every effect was dominated by Simulations 1 and 2. The study also found that the results of Simulations 1 (and the sub-simulations) were mostly opposite to the results of Simulation 2 in almost all effects. Since Sub-simulations 4.1 – 4.8 are combinations of Sub-simulations 1.1 – 1.8 and 2.1 – 2.8, the negative results of each Sub-simulation 4.1 – 4.8 came from Sub-simulations 1.1 – 1.8 compensated for by the positive results of Sub-simulations 2.1 – 2.8. Therefore, the Thai government should consider these issues when planning agricultural policies. It might not be a good idea to inject agricultural capital stock parallel with policies such as an increase in the minimum rent in agricultural capital stock or the price guarantee of selected agricultural products or a restriction on agricultural production in their respective sectors.

However, it is possible to combine a few sub-simulations in Simulation 1 with some sub-simulations in Simulation 2 or Simulation 3 to achieve a specific goal. For example, as discussed before, there was a labour supply reallocation either from non-agricultural sectors to agricultural sectors or between agricultural sectors in the Simulations 1, 2 and 3. Considering Sub-simulations 1.2, 1.8 and Simulation 3, there was a decrease in the labour supply in almost all non-agricultural sectors but most labour supply in the agricultural sectors increased. Because of this, there should be a movement in the supply of labour mostly from non-agricultural sectors to agricultural sectors in these sub-simulations. Therefore, if the Thai government wanted to increase the supply of agricultural labour in the economy without importing them from neighbouring countries, an alternative labour relocation from the non-agricultural sector to agricultural sectors is recommended. Hence, Sub-simulations 1.2, 1.8 or Simulation 3 can be combined and applied to achieve this objective. This means an increase in the minimum rent in agricultural capital stock or the agricultural price guarantee or a restriction of agricultural production in Sectors 2 and 8 should be introduced with the removal of import tariffs in the agricultural sector (Sector 16) in order to reallocate labour from non-agricultural sectors to agricultural sectors.

Another good combination is a mixture of Sub-simulation 1.7 with Sub-simulations 2.1, 2.2, 2.5 and 2.8 to increase the domestic income. All these policy simulations led to an increase in domestic income in the country. Therefore, policy makers should consider this option if they plan to increase domestic income through the capital-intensive farming policies. To do this, policy makers need to determine the higher minimum rent in agricultural capital stock or announce an agricultural price guarantee or restrict production in Sector 7 in parallel with an increase in capital stock in one of the Sectors 1, 2, 5 and 8.

The last possible combinations of capital intensive policies is the mixture of two or more of the Sub-simulations 1.4, 1.6, 2.1, 2.3, 2.5 and 2.8 in order to increase overall economic performance. Policy makers may use these combinations of capital intensive policies to raise the macroeconomic performance either by determining higher minimum rent or guaranteeing the price in Sectors 4 and 6 or restricting the output of Sectors 4 and 6. In parallel with these policies, one or more injections of agricultural capital stock in Sectors 1, 3, 5 or 8 is also needed.

6.4 Limitations of the study

The advantage of the CGE model is that it captures the circular flow of goods and services in an economy including the behaviour of economic agents such as households (maximize their utility), firms (maximize their profit or minimize their cost) and government. The CGE model has flexible choices of closure rules and assumptions that are suitable for each simulation. Like other CGE models, this study has some limitations and assumptions.

First, this study used the Cobb-Douglas production function with a constant return to scale because we wanted to investigate the impact of the technological change concept of Jackson (1998) and factor intensity by Chung (1994), which have not previously been applied to any CGE model. Therefore, the share parameters of in put factors (α_{fa}) are constant and limited to unity. This assumption may be somewhat restrictive. Although the production functions are limited, the literature showed that other function forms such as Constant Elasticity of Substitution (CES), Linear Expenditure System (LES) and Constant Ratios of Elasticity of Substitution (Homothetic) (CRESH) functions can be adopted, but with a significant increase in the computational complexities in solving the model’s equations.

Secondly, the production function share parameters for factor *f* in activities (α_{fa}) are calibrated from the database (the 2000 micro SAM) but the number of employed workers and the value of net capital stock of Thailand (CAP) in year 2000 in each sector are introduced into the model independently. There is a positive relationship between two of them as shown in equation 6.4, therefore, when capital stock in agricultural sectors (CAP) was increased by 5% (in Simulation 2), the share parameters for factor *f* (α_{fa}) should be increased but these two parameters were held fixed in the model. This is because we wanted to investigate the effects of capital-intensive farming policies in each different perspective. However, in Simulation 4, both parameters were allowed to increase to examine the extreme impact of capital-intensive farming.

Thirdly, the latest available database (SAM) for Thailand is for 1998, which is not up to date. Therefore, this study constructed its own database; the 2000 SAM of Thailand. However, the level of sector disaggregation in SAM and the CGE model is restricted due to two things. First, the available elasticity (CES and CET) in each sector, from in the literature, determined the level of disaggregation. Therefore, the disaggregated sectors in the 2000 SAM and the CGE model have to rely on the availability of these elasticities. Second, there are the policy simulation designs in Simulation 3. The Agricultural Machinery sector (Sector 16) is disaggregated to investigate the effect of the cut of import tariffs on this sector because the literature showed that there was an increase in imports of farm machinery. For these reasons, the production side was disaggregated into 20 sectors with eight agricultural sectors and 12 non-agricultural sectors. In the agricultural sectors, two or more commodities had to be aggregated into one sector. For example, Sector 1 is a combination of paddy and maize. Therefore, the model could not simulate the impact of capital-intensive farming in a specific sector that is not disaggregated in this model such as Paddy or Cassava.

Fourthly, a few cells in the 2000 SAM have been ignored for the pertinent account balance purposes and because the data are unavailable. All data entries were drawn from the National Income of Thailand 2000 but intermediate demand, value added and domestic sales are from the 2000 Input-Output table of Thailand. Therefore, this led to slight differences in some macroeconomic variables such as GDP between the real data and the model of approximately 6%. However, some variables are much closer to real sector data, such as household and government income and government consumption. These variables differ from the base year model by less than 1%.

Finally, the data of the model (SAM) was constructed especially for this study. In the model, we have 20 production sectors which are quite different to other Thai CGE models as explained above. The only data we can find for these 20 Sectors are quantity of capital stock and the number of labour. In the data collection stage, we tried to disaggregate land as a factor of the production function. Unfortunately, there is no sufficient data in land use especially in these specific sectors of this Thai CGE model. Therefore, we could not include land as a factor in the model. However, if we included land as another factor in the production function, the effects of policy simulation might less than that the model without land which can be explained as follows:

In the model, we have C-D production function with two input factors (L=Labour, K= Capital) as $y = ZL^{0.4}K^{0.6}$ (Sector 1)
y = output;

α_L the share parameter of labour (0.4)

α_K the share parameter of capital (0.6)

$Z > 0,$ L=Labour, K= Capital
Assumed, if we include land as another input factor in the model, therefore, the share parameter of capital and labour would be reduced for the share parameter of land (α_{land}) in the new C-D production function in the model. In order to see the effect of introducing land as a factor, we supposed that α_{land} is 0.5. Therefore, α_L and α_K need to be decreased, let say 0.2 and 0.3 respectively. Therefore, the new production function would be $y = ZL^{0.2}K^{0.3}Land^{0.5}$ When we shock the model as in Simulation 1, the increase in α_K (at the same rate as when there is no land input) would result in a slight decrease in α_L and α_{land} because there was an extra absorption by α_{land}. Consequently, other variables which were simultaneously affected by the change in α_K, would be changed but these variables would be changed less than the previous model which has only two factors.

6.5 Recommendations for future study

Although capital inputs in agriculture have played a significant role in production economics, this study is the first attempt to integrate the non-neutral technological change concept in terms of capital-using into a CGE model in order to explore the impact of changing capital-labour ratios in the agricultural sectors. Apart from the results of this study, future studies relating to capital-intensive farming using a CGE can be improved in the following areas.

This study used the constant return to scale of the Cobb–Douglas production functions in the CGE model with the integration of the non-neutral technological change concept in policy simulations. Future studies might apply this concept in a CGE model but use different production function and utility function forms such as Constant Elasticity of Substitution (CES) or Stone-Geary for Linear Expenditure System to investigate whether the results will be similar. Applying an increasing return to scale in a CGE model with non-neutral technological change concept could also be of interest for future study.

In this model, it was assumed that there was full employment in the economy and all investment was determined by savings (or neoclassical closure). Therefore, when there was an input change such as in Simulation 1 or 2, there was labour supply relocation among sectors but the total numbers of labour supply were unchanged. The choice of macro closure in future study may switch to other closures such as the Keynes and Johansen closure that allows unemployment in the model.

This study is a static CGE model based on year 2000. The model represents the reaction to policy changes at a time, usually one to five years. In the model, the parameters and exogenous variables were fixed, including production function share parameters (α_{fa}) and agricultural capital stock as discussed in the limitations of the study. An extension of the static model, the dynamic CGE model, can trace variables through time. Generally, there are three ways to make a static CGE into a dynamic CGE: physical capital accumulation, financial/asset liability accumulation and lagged adjustment process (Dixon & Rimmer, 2002). For example, to make the CGE dynamic in terms of physical capital accumulation requires a change in capital for the second time period. This is called the recursive dynamic CGE model. This dynamic model has a process of endogenous capital accumulation (Thurlow & Ernst van Seventer, 2008). Therefore, future study might apply the concept of capital-using in this study with a dynamic CGE model to investigate the effect of capital-intensive farming in a different time period.

Although it is quite a time consuming to construct a SAM, this study constructed its own data base called the 2000 SAM of Thailand. Therefore, this new 2000 SAM of Thailand can be applied to future research. As this new SAM has three types of taxes: income tax, indirect tax and tariffs, any future study may focus on changing taxes by using this 2000 SAM in a CGE model. Furthermore, this SAM can be disaggregated into more detail either in agricultural sectors or non-agricultural sectors for a database of a CGE model in other simulation designs. However, the modellers also need to find some elasticity (CES and CET) in the desired sectors.

This study applied the non-neutral technological change concept and factor intensity concept by incorporating the idea of capital-using (which means capital is substituted for labour) in the agricultural sectors in order to investigate the impact of capital-intensive farming in Thailand. Future study may apply this study to other countries with similar characteristics as

Thailand. Moreover, the concept of this study may be applied to some developed countries where there is capital intensity in some sectors. On the other hand, the opposite to capital-using, labour-using (labour is substituted for capital), may be applied in a CGE model in some developing countries. Therefore, modellers can investigate the effects of changing from capital-intensive industries to labour-intensive industries by an increase in the share parameter of labour input in the production functions or an increase in the labour supply in the desired sectors.

According to Simulation 1 in our study, if policy makers want to increase the share parameters of agricultural capital input (α_{fa}) in practice, there should be policies such as the price guarantee of selected agricultural products or a restriction of agricultural production level (Equation 6.4). These policies have not been applied directly in any CGE model. Therefore, future study should apply these policies in their simulation design into a CGE model. This is because, in production theory, these policies will simultaneously affect the change of share parameters in agricultural capital input (α_{fa}). Future study can either investigate the effect of capital-intensive farming in another perspective or compare the results with this study.

Although the long run closures are more interested, this model has been designed for the short run only. The novelties of this study are the new 20 sector SAM and the simulation design on capital intensive farming into a CGE model. Therefore, the primary focus of the model is to address questions of what happen to the variables and economy if agricultural sector of Thailand become more capital intensity. Another word what happen to the Thai economy if there is more capital intensity in the short run. However, under the long run closure could be done by adding assumption such as fixing the rate of return. To do this, the model may need to be changed some endogenous and exogenous variables. Future study can compare the impact of capital intensity between short run and long run CGE model.

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Appendix A

Sectoral index

Activities	Name	Commodities	Name	Description
01	ACT01	01	COM01	Paddy and Maize
02	ACT02	02	COM02	Cassava Beans and Nuts
03	ACT03	03	COM03	Vegetables Sugarcane and Fruits
04	ACT04	04	COM04	Rubber and Latex
05	ACT05	05	COM05	Other Crops
06	ACT06	06	COM06	Livestock
07	ACT07	07	COM07	Forestry
08	ACT08	08	COM08	Fishery
09	ACT09	09	COM09	Mining and Quarrying
10	ACT10	10	COM10	Food Manufacturing
11	ACT11	11	COM11	Textile Industry
12	ACT12	12	COM12	Paper Industries and Printing
13	ACT13	13	COM13	Rubber Chemical and Petroleum Industries
14	ACT14	14	COM14	Non Metallic Products
15	ACT15	15	COM15	Metal Product and Machinery
16	ACT16	16	COM16	Agricultural Machinery
17	ACT17	17	COM17	Other Manufacturing
18	ACT18	18	COM18	Electricity Water Work Public Utilities
19	ACT19	19	COM19	Construction and Trade
20	ACT20	20	COM20	Service Transportation and Communication

Appendix B

Variables and parameters in the model

B.1 Set

$a \in A$	a set of activities with Cobb-Douglas function
$c \in C$	commodities
$c \in CM(\subset C)$	imported commodities
$c \in CE(\subset C)$	exported commodities
$f \in F$	factors (Labour and Capital)
$h \in H(\subset ID)$	household
$ent \in ENT(\subset ID)$	enterprise
$i \in ID(\subset I)$	institutions (ID = household, enterprise), (I = household, enterprise, government and the rest of the world.)

B.2 Parameters

ad_a	production function efficiency parameter
ag_a	government subsidy for activity a
aq_c	shift parameter for composite supply (Armington) function
at_c	shift parameter for output transformation (CET) function
$capital_a$	net capital stock at 2000 cost (million baht)
$\cos tgap_{fa}$	gap calibrated factor cost-SAM value (should be zero)
cpi	consumer price index
$cwts_c$	commodity weight in cpi
$finv$	Thailand's foreign investment
ica_{ca}	quantity of c as intermediate input per unit of activity a
$\text{int}_{ent,h}$	rate of interest and insurance payments from household to enterprises
$labour_a$	quantity of labour employed by activity (million persons)
pwe_c	export price (foreign currency)
pwm_c	import price (foreign currency)

qg_c	government commodity demand
$qinvbar_c$	based year investment demand
$shryid_{id,f}$	share for domestic institutions except government in income of factor f
$tcap_f$	rate of tax on capital income
te_c	export tax rate
$tent_{ent}$	rate of corporate tax
tic_c	sale tax rate (indirect tax)
tia_c	value added tax rate (indirect tax)
tm_c	import tax rate
$tr_{i,i}$	transfer from institution i to institution i
ty_h	rate of household income tax rate
wfa_{fa}	wage (rent) for factor f in activity a (for calibration only)
α_{fa}	production function share parameter or value-added share for factor f in activity a
β_{ch}	share of household consumption spending on commodity c
δ_c^q	share parameter for composite supply (Armington function)
δ_c^t	share parameter for output transformation (CET) function
θ_{ac}	yield of commodity c per unit of activity A
ρ_c^q	exponent for composite supply (Armington function) $-1 < \rho_c^q < \infty$
ρ_c^t	exponent for output transformation (CET) function $1 < \rho_c^t < \infty$
σ_c^q	elasticity of substitution between domestic goods and imports for commodity c
σ_t^q	elasticity of transformation between domestic sales and exports for commodity

B.3 Variables

EG	government expenditure
EXR	foreign exchange rate (domestic currency per unit of foreign currency
$ENTSAV_{ent}$	enterprise savings
$FSAV$	foreign savings
$IADJ$	investment adjustment factor
MPS_h	marginal propensity to save for household h
PA_a	activity price
PD_c	domestic output price
PE_c	export price (domestic currency)
PM_c	import price (domestic currency)
PQ_c	composite commodity price
PVA_a	value added price
PX_c	producer price
QA_a	activity level
QD_c	quantity of domestic output sold domestically
QE_c	export quantity
QF_{fa}	quantity demand of factor f by activity a
QFS_f	supply of factor f
QH_{ch}	quantity of consumption of commodity c by household h
$QINT_{ca}$	quantity of intermediate use of commodity c by activity a
$QINV_c$	quantity investment demand
QM_c	import quantity
QQ_c	composite supply (quantity supplied to domestic commodity demand)
QX_c	domestic output quantity
$WALRAS$	dummy variable (zero at equilibrium)
WF_f	average wage (rental rate) of factor f
$WFDIST_{fa}$	wage distortion factor for factor f in activity a
$YENT_{ent}$	enterprise income

YF_f	income of factor f
$YFID_{id,f}$	income transfer from factor f to domestic institutions
YG	government revenue
YH_h	household income

Appendix C

Source of data entries in the 2000 macro SAM for Thailand (million baht)

No.	Name	Cell entries in Macro SAM (row, column)	Sources
1.	Intermediate Input	(2,1): 6,471,709	Input-output 2000, (190,190): Total intermediate transaction
2.	Value added (wages and rent)	(3,1): 1,609,453 and (4,1): 2,493,198	Input-output 2000, (201,190): Wages and salaries and (202,190): Operating surplus
3.	Indirect taxes and tariffs	(7,1): 442,847 and (7,2): 62,931	National Income 2000 (Account 5: General Government): Indirect taxes
4.	Domestic sales	(1,2): 11,017,207	Total value of sales: the sum of activity cost
5.	Imports	(9,2): 2,862,305	National Income 2000 (Account 6: External transaction): Imports of goods and services
6.	Labour income	(5,3): 1,609,453	Input-output 2000, (201,190): Wages and salaries
7.	Distributed profits	(5,4): 1,662,712	National Income 2000 (Account 4 Household and private non-profit institutions): Income from property + Income from unincorporated enterprises + Transfer
8.	Non-distributed profits	(6,4): 782,364	Operating surplus (2,493,198) – Distributed profits (1,662,712) – Tax on profit (48,122)
9.	Tax on profits	(7,4): (48,122)	National Income 2000 (Account 5: General government): Income from property and entrepreneurship
10.	Household consumption	(2,5): 2,762,925	National Income 2000 (Account 4: Household and private non-profit institutions): Consumption expenditure
11.	Household Transfers to firms	(6,5): 34,596	National Income 2000 (Account 4: Household and private non-profit institutions): Interest on consumers' debt
12.	Direct taxes	(7,5): 112,109	National Income 2000 (Account 5: General government): Direct taxes on household + Total contributions to social security + Other current transfer from households
13.	Household saving	(8,5): 367,833	National Income 2000 (Account 4: Household and private non-profit institutions): Savings

No.	Name	Cell entries in Macro SAM (row, column)	Sources
14.	Taxes	(7,6): 105,985	National Income 2000 (Account 5: General government): Direct taxes on corporations + Transfer from corporations - Interest on public debt
15.	Firm savings	(8,6): 311,602	National Income 2000 (Account 3: Domestic capital formation): Saving of corporations
16.	Current transfer abroad	(9,6): 246,803	National Income 2000 (Account 6: External transaction) Net income payment from the rest of the world
17.	Government consumption	(2,7): 581,273	National Income 2000 (Account 5: General government): Consumption expenditure + subsidy
18.	Transfer to households	(5,7): 36,715	National Income 2000 (Account 5: General government): Current transfers to households
19.	Transfer to enterprises	(6,7): 16,299	National Income 2000 (Account 5: General government): Social security benefit
20.	Government saving	(7,7): 140,300	National Income 2000 (Account 5: General government): savings
21.	Government transfer to the rest of the world	(8,7): 1,075	National Income 2000 (Account 5: General government): Current transfers to the rest of the world
22.	Investment	(2,8): 1,124,164	National Income 2000 (Account 3: Domestic capital formation)
23.	Exports	(2,9): 3,263,818	National Income 2000 (Account 6: External transaction): Exports of goods and services
24.	Transfers to household from the ROW	(5,9): 34,721	National Income 2000 (Account 4: Household and private non-profit institutions): Transfer from the ROW
25.	Transfers to firms from the ROW	(6,9): 169,929	National Income 2000 (Account 6: External transaction) Net income payment from the rest of the world
26.	Transfers to government from ROW	(7,9): 3,668	National Income 2000 (Account 5: General government): Transfer from ROW
27.	Foreign savings	(8,9)	National Income 2000 (Account 3: Domestic capital formation): Provision for consumption of fixed capital - surplus of the national current account - statistical discrepancy

Appendix D
2000 input-output of Thailand

See CD attached

Source: Office of National Economic and Social Development Board (NESDB) (2000)

Appendix E

Thailand 2000 Input output classification

I/O Code (180x180)	Description
001	Paddy
002	Maize
003	Other Cereals
004	Cassava
005	Other Root Crops
006	Beans and Nuts
007	Vegetables
008	Fruits
009	Sugar Cane
010	Coconut
011	Palm Nut And Oil Palm And Oil Palm
012	Kenaf And Jute
013	Crops for Textile and Matting
014	Tobacco
015	Coffee and Tea
016	Rubber
017	Other Agricultural Products
018	Cattle And Buffalo
019	Swine
020	Other Livestock
021	Poultry
022	Poultry Products
023	Silk Farming
024	Agricultural Services
025	Logging
026	Charcoal and Firewood
027	Other Forestry Products
028	Ocean And Coastal Fishing
029	Inland Water Fishing
030	Coal And Lignite
031	Crude Oil & Natural Gas
032	Iron Ore
033	Tin Ore
034	Tungsten Ore
035	Other Non-Ferrous Metal Ore
036	Fluorite Ore
037	Natural Chemical & Fertilizer
038	Salt
039	Limestone
040	Stone Quarrying
041	Other Mining & Quarrying
042	Slaughtering
043	Canning & Preserving Of Meat
044	Dairy Products

045	Canning & Preserving Of Fruits & Vegetables
046	Canning & Preserving Of Fish & Seafood
047	Coconut and Palm Oil
048	Other Vegetable & Animal Oils
049	Rice Milling
050	Flour & Sagu Mild Products & Tapioca Milling
051	Grinding Corn
052	Flour & Other Grain Milling
053	Bakery And Other
054	Noodle & Similar Products
055	Sugar Refineries
056	Confectionery & Snack
057	Ice
058	Monosodium Glutamate
059	Coffee & Cocoa & Tea Processing
060	Other Food Products
061	Fish Meal & Animal Feed
062	Distilling & Blending Of Spirit
063	Breweries
064	Soft Drinks & Carbonated Water
065	Tobacco Processing
066	Tobacco Products
067	Spinning
068	Weaving
069	Textile Bleaching, Printing & Finishing
070	Made-Up Textile Goods
071	Knitting
072	Wearing Apparels
073	Carpets And Rugs
074	Jute Mill Products
075	Tannery And Leather Finishing
076	Leather Products
077	Foot Wear, Except Of Rubber
078	Saw Mill & Wooden Construction Materials
079	Wood And Cork Products
080	Wooden Furniture & Fixture
081	Paper And Paper Board
082	Paper & Paperboard Products
083	Printing & Publishing
084	Basic Chemicals
085	Fertilizer, Pesticide And Insecticide
086	Petrochemical Products
087	Paint
088	Drug And Medicine
089	Soap & Cleaning Preparations
090	Cosmetic
091	Matches
092	Other Chemical Products
093	Petroleum Refinery & Gas Separated Plant
094	Other Coal & Petroleum Products
095	Rubber Sheet & Block Rubber
096	Types And Tubes

097	Other Rubber Products
098	Plastic Wares
099	Ceramic And Earthen Wares
100	Glass & Glass Products
101	Structural Clay Products
102	Cement
103	Concrete And Cement Products
104	Other Non-Metallic Products
105	Iron And Steel
106	Secondary Steel Products
107	Non-Ferrous Metal
108	Cutlery And Hand Tools
109	Metal Furniture & Fixture
110	Structural Metal Products
111	Other Fabricated Metal Products
112	Engine And Turbine
113	Agricultural Machinery & Equipment
114	Wood & Metal Working Machine
115	Special Industrial Machinery
116	Office Equipment & Machinery
117	Electrical Industrial Machinery & Appliances
118	Radio, Television Set & Communication Equipment
119	Others Electric Appliances
120	Insulated Wire And Cable
121	Electric Accumulator & Battery
122	Other Electrical Aparatuses & Supplies
123	Ship Building
124	Railway Equipment
125	Motor Vehicle
126	Motorcycle & Bicycle & Other Carriages
127	Repairing Of Vehicle
128	Aircraft
129	Scientific Equipments
130	Photographic & Optical Goods
131	Watches And Clocks
132	Jewelry & Related Articles
133	Recreational & Athletic Equipment
134	Other Manufacturing Goods
135	Electricity
136	Pipe Line
137	Water Supply System
138	Residential Building Construction
139	Non-Residential Build Construction
140	Public Works For Agriculture & Forestry
141	Non-Agricultural Public Works
142	Construction Of Electric Plant
143	Construction Of Communication Facilities
144	Other Constructions
145	Wholesale Trade
146	Retail Trade
147	Restaurant & Drinking Place
148	Hotel And Lodging Place

149	Railways
150	Route & Non route of Road Passenger Transport
151	Road Freight Transport
152	Land Transport Supporting Services
153	Ocean Transport
154	Coastal & Inland Water Transport
155	Water Transport Services
156	Air Transport
157	Other Services
158	Silo And Warehouse
159	Post And Telecommunication
160	Banking Service
161	Life Insurance Service
162	Other Insurance Service
163	Real-estate
164	Business Service
165	Public Administration
166	Sanitary & Similar Services
167	Education
168	Research
169	Hospital
170	Business & Labor Associations
171	Other Community Services
172	Motion Picture Production
173	Movie Theater
174	Radio, Television & Related Services
175	Library And Museum
176	Amusement & Recreation
177	Repairing, Not Elsewhere Classified
178	Personal Services
180	Unclassified
190	Total Intermedite Transaction
201	Wages and Salaries
202	Operating Surplus
203	Depreciation
204	Indirect Taxes less Subsidies
209	Total Value Added
210	Control Total
301	Private Consumption Expenditure
302	Government Consumption Expenditure
303	Gross Fixed Capital Formation
304	Increase in Stock
305	Exports (F.O.B.)
306	Special Exports
309	Total Final Demand
310	Total Demand
401	Imports (C.I.F.)
402	Import Tax
403	Import Duty
404	Special Imports
409	Total Imports
501	Wholesale Trade Margin

502	Retail Trade Margin
503	Transportation Cost
509	Total Margin and Transportation Cost
600	Control Total
700	Total Supply

Source: Office of National Economic and Social Development Board (NESDB) (2009b)

Appendix F

The aggregation of 180x180 input-output table into 20x20 sectors

I/O Code (180x180)	Description 180x180 sectors	This study (20x20)	Description (aggregated from 180x180 sectors)
001	Paddy	01	Paddy & Maize (001-002)
002	Maize	02	Cassava & Beans and Nuts (004,006)
003	Other Cereals	03	Vegetables, Fruits and Sugar Cane (007-009)
004	Cassava	04	Rubber (016)
005	Other Root Crops	05	Other Crops (003, 005, 010-015, 017,024)
006	Beans and Nuts	06	Livestock (018-023)
007	Vegetables	07	Forestry (025-027)
008	Fruits	08	Fishery (028-029)
009	Sugar Cane	09	Mining and Quarrying (030-041)
010	Coconut	10	Food Manufacturing (042-066)
011	Palm Nut And Oil Palm And Oil Palm	11	Textile Industry (067-074)
012	Kenaf And Jute	12	Paper Industries and Printing (081-083)
013	Crops for Textile and Matting	13	Rubber Chemical and Petroleum Industries (084-098)
014	Tobacco	14	Non Metallic Products (099-104)
015	Coffee and Tea	15	Metal, Metal Product and Machinery (105-128 except 113)
016	Rubber	16	Agricultural Machinery (113)
017	Other Agricultural Products	17	Other Manufacturing, Saw mills and wood products (075-077,129-134)
018	Cattle And Buffalo	18	Public Utilities (135-137)
019	Swine	19	Construction and Trade (138-146)
020	Other Livestock	20	Transportation, Communication and Services (147-180)
021	Poultry		
022	Poultry Products		
023	Silk Farming		
024	Agricultural Services		
025	Logging		
026	Charcoal and Firewood		
027	Other Forestry Products		
028	Ocean And Coastal Fishing		
029	Inland Water Fishing		
030	Coal And Lignite		
031	Crude Oil &		

	Natural Gas		
032	Iron Ore		
033	Tin Ore		
034	Tungsten Ore		
035	Other Non-Ferrous Metal Ore		
036	Fluorite Ore		
037	Natural Chemical & Fertilizer		
038	Salt		
039	Limestone		
040	Stone Quarrying		
041	Other Mining & Quarrying		
042	Slaughtering		
043	Canning & Preserving Of Meat		
044	Dairy Products		
045	Canning & Preserving Of Fruits & Vegetables		
046	Canning & Preserving Of Fish & Seafood		
047	Coconut and Palm Oil		
048	Other Vegetable & Animal Oils		
049	Rice Milling		
050	Flour & Sagu Mild Products & Tapioca Milling		
051	Grinding Corn		
052	Flour & Other Grain Milling		
053	Bakery And Other		
054	Noodle & Similar Products		
055	Sugar Refineries		
056	Confectionery & Snack		
057	Ice		
058	Monosodium Glutamate		
059	Coffee & Cocoa & Tea Processing		
060	Other Food Products		
061	Fish Meal & Animal Feed		

062	Distilling & Blending Of Spirit		
063	Breweries		
064	Soft Drinks & Carbonated Water		
065	Tobacco Processing		
066	Tobacco Products		
067	Spinning		
068	Weaving		
069	Textile Bleaching, Printing & Finishing		
070	Made-Up Textile Goods		
071	Knitting		
072	Wearing Apparels		
073	Carpets And Rugs		
074	Jute Mill Products		
075	Tannery And Leather Finishing		
076	Leather Products		
077	Foot Wear, Except Of Rubber		
078	Saw Mill & Wooden Construction Materials		
079	Wood And Cork Products		
080	Wooden Furniture & Fixture		
081	Paper And Paper Board		
082	Paper & Paperboard Products		
083	Printing & Publishing		
084	Basic Chemicals		
085	Fertilizer, Pesticide And Insecticide		
086	Petrochemical Products		
087	Paint		
088	Drug And Medicine		
089	Soap & Cleaning Preparations		
090	Cosmetic		
091	Matches		

092	Other Chemical Products		
093	Petroleum Refinery & Gas Separated Plant		
094	Other Coal & Petroleum Products		
095	Rubber Sheet & Block Rubber		
096	Types And Tubes		
097	Other Rubber Products		
098	Plastic Wares		
099	Ceramic And Earthen Wares		
100	Glass & Glass Products		
101	Structural Clay Products		
102	Cement		
103	Concrete And Cement Products		
104	Other Non-Metallic Products		
105	Iron And Steel		
106	Secondary Steel Products		
107	Non-Ferrous Metal		
108	Cutlery And Hand Tools		
109	Metal Furniture & Fixture		
110	Structural Metal Products		
111	Other Fabricated Metal Products		
112	Engine And Turbine		
113	Agricultural Machinery & Equipment		
114	Wood & Metal Working Machine		
115	Special Industrial Machinery		
116	Office Equipment & Machinery		
117	Electrical Industrial Machinery & Appliances		
118	Radio, Television		

	Set & Communication Equipment		
119	Others Electric Appliances		
120	Insulated Wire And Cable		
121	Electric Accumulator & Battery		
122	Other Electrical Aparatuses & Supplies		
123	Ship Building		
124	Railway Equipment		
125	Motor Vehicle		
126	Motorcycle & Bicycle & Other Carriages		
127	Repairing Of Vehicle		
128	Aircraft		
129	Scientific Equipments		
130	Photographic & Optical Goods		
131	Watches And Clocks		
132	Jewelry & Related Articles		
133	Recreational & Athletic Equipment		
134	Other Manufacturing Goods		
135	Electricity		
136	Pipe Line		
137	Water Supply System		
138	Residential Building Construction		
139	Non-Residential Build Construction		
140	Public Works For Agriculture & Forestry		
141	Non-Agricultural Public Works		
142	Construction Of Electric Plant		

143	Construction Of Communication Facilities		
144	Other Constructions		
145	Wholesale Trade		
146	Retail Trade		
147	Restaurant & Drinking Place		
148	Hotel And Lodging Place		
149	Railways		
150	Route & Non route of Road Passenger Transport		
151	Road Freight Transport		
152	Land Transport Supporting Services		
153	Ocean Transport		
154	Coastal & Inland Water Transport		
155	Water Transport Services		
156	Air Transport		
157	Other Services		
158	Silo And Warehouse		
159	Post And Telecommunication		
160	Banking Service		
161	Life Insurance Service		
162	Other Insurance Service		
163	Real-estate		
164	Business Service		
165	Public Administration		
166	Sanitary & Similar Services		
167	Education		
168	Research		
169	Hospital		
170	Business & Labor Associations		
171	Other Community Services		
172	Motion Picture Production		

173	Movie Theater		
174	Radio, Television & Related Services		
175	Library And Museum		
176	Amusement & Recreation		
177	Repairing, Not Elsewhere Classified		
178	Personal Services		
180	Unclassified		

Source: Office of National Economic and Social Development Board (NESDB)(2009a)

Appendix G

Coefficients for disaggregating in the control cells number 2 – 4 and 6 – 11

Control cells	Sectors										
	01	02	03	04	05	06	07	08	09	10	11
Number 2: Value added (Wages)	0.02095	0.00278	0.01348	0.00486	0.00469	0.00558	0.00123	0.01056	0.01641	0.05095	0.04715
Number 3: Value added (Rent)	0.02188	0.00328	0.02642	0.01133	0.01023	0.01500	0.00137	0.01875	0.01958	0.06247	0.04036
Number 4: Indirect Tax	0.00003	0.00001	0.00057	0.00001	0.00001	0.00003	0.00036	0.00006	0.03737	0.17440	0.02114
Number 6: Tariffs	0.00012	0.00049	0.00253	0.00001	0.00551	0.00063	0.00303	0.00025	0.09502	0.09914	0.02688
Number 7: Import	0.00053	0.00424	0.00163	0.00001	0.00917	0.00095	0.00356	0.00050	0.09110	0.04249	0.03375
Number 8: Private Consumption	0.00013	0.00073	0.04811	0.00000	0.00170	0.00577	0.00119	0.01699	0.00003	0.18922	0.08980
Number 9: Government Consumption	0.00056	0.00006	0.00062	0.00011	0.00116	0.00044	0.00000	0.00065	0.00000	0.00345	0.00098
Number 10: Gross fixed capital formation	0.00000	0.00000	0.00000	0.00000	0.00000	0.00067	0.00000	0.00000	0.00002	0.00000	0.00124
Number 11: Export	0.00010	0.00057	0.00395	0.00293	0.00211	0.00072	0.00062	0.00048	0.00597	0.12766	0.08127

Coefficients for disaggregating in the control cells number 2 – 4 and 6 – 11 (cont.)

Control cells	Sectors									
	12	13	14	15	16	17	18	19	20	Total
Number 2: Value added (Wages)	0.00558	0.03784	0.01098	0.08134	0.00028	0.04764	0.04544	0.14936	0.44290	1.0000
Number 3: Value added (Rent)	0.01615	0.04616	0.01363	0.08633	0.00016	0.04981	0.02565	0.34880	0.18267	1.0000
Number 4: Indirect Tax	0.00431	0.17655	0.00273	0.07610	0.00003	0.01894	0.04062	0.23053	0.21620	1.0000
Number 6: Tariffs	0.02409	0.18929	0.00875	0.49293	0.00393	0.04494	0.00160	0.00004	0.00084	1.0000
Number 7: Import	0.01923	0.14836	0.00697	0.50370	0.00206	0.06242	0.00373	0.00006	0.06554	1.0000
Number 8: Private Consumption	0.01027	0.09287	0.00264	0.10069	0.00015	0.07901	0.02936	0.00134	0.33000	1.0000
Number 9: Government Consumption	0.03381	0.03735	0.00042	0.01349	0.00194	0.01683	0.02174	0.00231	0.86407	1.0000
Number 10: Gross fixed capital formation	0.00000	0.00379	0.00396	0.55733	0.00981	0.08912	0.00000	0.33288	0.00119	1.0000
Number 11: Export	0.01297	0.11643	0.01433	0.41034	0.00044	0.09894	0.00348	0.00015	0.11654	1.0000

Source: Author's calculation

Appendix H

Coefficients for disaggregating in the control cells number 1 (intermediate input)

Activities	Activities										
	ACT01	ACT 02	ACT 03	ACT 04	ACT 05	ACT 06	ACT 07	ACT 08	ACT 09	ACT 10	ACT 11
ACT 01	0.13320	0.00000	0.00000	0.00000	0.25839	0.00000	0.00011	0.00000	0.00000	0.00000	0.00371
ACT 02	0.00000	0.27428	0.00000	0.00000	0.37296	0.00000	0.00003	0.00000	0.00000	0.00000	0.00451
ACT 03	0.00603	0.00917	0.03827	0.00000	0.28319	0.00000	0.00148	0.00000	0.00015	0.00038	0.00336
ACT 04	0.00000	0.00000	0.00000	0.00000	0.08685	0.00000	0.00000	0.00000	0.00000	0.00025	0.01200
ACT 05	0.00868	0.00000	0.00014	0.00000	0.13356	0.00000	0.00056	0.00000	0.00073	0.00006	0.00743
ACT 06	0.03833	0.00638	0.01282	0.00000	0.00376	0.05357	0.00150	0.04588	0.00070	0.69491	0.00041
ACT 07	0.00000	0.00000	0.00000	0.00000	0.09523	0.00000	0.17419	0.00000	0.00000	0.00003	0.02550
ACT 08	0.00000	0.00000	0.00000	0.00000	0.00405	0.00000	0.00003	0.05192	0.00021	0.31704	0.00774
ACT 09	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00203	0.00000	0.07183	0.00000	0.00030
ACT 10	0.17189	0.03230	0.07555	0.00000	0.02641	0.12328	0.00131	0.12568	0.00190	0.25742	0.00090
ACT 11	0.00000	0.00000	0.00000	0.00000	0.04234	0.00334	0.00000	0.00000	0.00026	0.00145	0.62980
ACT 12	0.00137	0.00000	0.00000	0.00000	0.00653	0.00000	0.00515	0.00000	0.00509	0.01399	0.00317
ACT 13	0.00018	0.00002	0.00000	0.05477	0.00338	0.00204	0.00163	0.00215	0.38796	0.00686	0.02072
ACT 14	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00569	0.00004	0.21980	0.00473	0.00681
ACT 15	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00004	0.00000	0.00576	0.00002	0.00236
ACT 16	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
ACT 17	0.00100	0.00000	0.00000	0.00000	0.00025	0.00519	0.03212	0.00097	0.00523	0.02251	0.05312
ACT 18	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.35931	0.00000	0.00066
ACT 19	0.00000	0.00000	0.00000	0.00000	0.00027	0.00000	0.00241	0.00000	0.06363	0.00668	0.01532
ACT 20	0.00088	0.00280	0.03566	0.00000	0.00234	0.00207	0.00166	0.02119	0.00090	0.13686	0.01713

Coefficients for disaggregating in the control cells number 1 (intermediate input) (cont.)

Activities	Activities									
	ACT 12	ACT 13	ACT 14	ACT 15	ACT 16	ACT 17	ACT 18	ACT 19	ACT 20	Total
ACT 01	0.00000	0.51929	0.00009	0.02342	0.01428	0.00016	0.00022	0.00032	0.04680	1.0000
ACT 02	0.00000	0.22750	0.00020	0.03863	0.01146	0.00277	0.00021	0.00042	0.06703	1.0000
ACT 03	0.00297	0.42115	0.00031	0.08017	0.02454	0.01136	0.00213	0.00059	0.11475	1.0000
ACT 04	0.00000	0.68025	0.01081	0.10954	0.01194	0.00114	0.00000	0.00018	0.08704	1.0000
ACT 05	0.00312	0.59040	0.00965	0.08928	0.04871	0.01578	0.00910	0.00049	0.08232	1.0000
ACT 06	0.00165	0.08189	0.00028	0.01436	0.00206	0.00310	0.01198	0.00252	0.02390	1.0000
ACT 07	0.00252	0.09828	0.04969	0.33972	0.01004	0.06063	0.00214	0.00302	0.13901	1.0000
ACT 08	0.00055	0.48209	0.00147	0.05738	0.01409	0.00079	0.00613	0.00230	0.05421	1.0000
ACT 09	0.00155	0.31575	0.00022	0.15420	0.00000	0.00760	0.02793	0.00275	0.41585	1.0000
ACT 10	0.01495	0.04781	0.00537	0.05835	0.00000	0.00126	0.01758	0.00046	0.03758	1.0000
ACT 11	0.01270	0.15092	0.00018	0.01383	0.00000	0.02854	0.06444	0.00039	0.05181	1.0000
ACT 12	0.71609	0.16812	0.00018	0.02143	0.00000	0.00244	0.02339	0.00048	0.03258	1.0000
ACT 13	0.00852	0.42144	0.00120	0.01201	0.00000	0.00305	0.04271	0.00036	0.03101	1.0000
ACT 14	0.02846	0.27174	0.16382	0.07656	0.00000	0.00650	0.13922	0.00116	0.07548	1.0000
ACT 15	0.00494	0.07935	0.00863	0.83967	0.00000	0.00733	0.02095	0.00032	0.03062	1.0000
ACT 16	0.00342	0.04539	0.00151	0.47891	0.35236	0.00913	0.04750	0.00036	0.06142	1.0000
ACT 17	0.01639	0.15890	0.01340	0.16607	0.00000	0.44771	0.01760	0.00030	0.05924	1.0000
ACT 18	0.00274	0.14423	0.00021	0.03417	0.00000	0.00163	0.37891	0.00123	0.07691	1.0000
ACT 19	0.01856	0.09377	0.16850	0.18047	0.00000	0.04280	0.05031	0.00167	0.35562	1.0000
ACT 20	0.04368	0.26577	0.00407	0.14368	0.00024	0.01928	0.05590	0.00219	0.24368	1.0000

Source: Author's calculation

Appendix I

Coefficients for disaggregating in the control cell number 5 (domestic sales)

Activities	Activities										
	01	02	03	04	05	06	07	08	09	10	11
01	0.13078	0.00000	0.00000	0.00000	0.25839	0.00000	0.00009	0.00000	0.00000	0.00000	0.00329
02	0.00000	0.25911	0.00000	0.00000	0.37296	0.00000	0.00002	0.00000	0.00000	0.00000	0.00433
03	0.00597	0.00639	0.03093	0.00000	0.26069	0.00000	0.00105	0.00000	0.00014	0.00037	0.00319
04	0.00000	0.00000	0.00000	0.00000	0.08685	0.00000	0.00000	0.00000	0.00000	0.00025	0.01162
05	0.00849	0.00000	0.00014	0.00000	0.12094	0.00000	0.00036	0.00000	0.00059	0.00005	0.00701
06	0.03739	0.00584	0.01010	0.00000	0.00367	0.05026	0.00126	0.03620	0.00067	0.60114	0.00037
07	0.00000	0.00000	0.00000	0.00000	0.09523	0.00000	0.15740	0.00000	0.00000	0.00003	0.02315
08	0.00000	0.00000	0.00000	0.00000	0.00405	0.00000	0.00001	0.04342	0.00005	0.27065	0.00768
09	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00176	0.00000	0.07180	0.00000	0.00029
10	0.16657	0.03015	0.05908	0.00000	0.02360	0.10843	0.00091	0.10334	0.00148	0.24082	0.00076
11	0.00000	0.00000	0.00000	0.00000	0.04029	0.00328	0.00000	0.00000	0.00026	0.00143	0.55980
12	0.00127	0.00000	0.00000	0.00000	0.00644	0.00000	0.00389	0.00000	0.00435	0.01261	0.00261
13	0.00018	0.00002	0.00000	0.05121	0.00314	0.00201	0.00129	0.00208	0.38777	0.00610	0.01829
14	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00477	0.00003	0.18809	0.00433	0.00633
15	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00003	0.00000	0.00564	0.00002	0.00207
16	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
17	0.00096	0.00000	0.00000	0.00000	0.00023	0.00491	0.02897	0.00084	0.00497	0.02242	0.04762
18	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.35522	0.00000	0.00051
19	0.00000	0.00000	0.00000	0.00000	0.00016	0.00000	0.00206	0.00000	0.03823	0.00391	0.01367
20	0.00067	0.00257	0.02674	0.00000	0.00170	0.00191	0.00099	0.01409	0.00085	0.11917	0.01457

Coefficients for disaggregating in the control cell number 5 (domestic sales) (cont.)

Activities	Activities									
	12	13	14	15	16	17	18	19	20	Total
01	0.00000	0.38174	0.00005	0.02153	0.01369	0.00004	0.00022	0.11494	0.07524	1.00
02	0.00000	0.13270	0.00014	0.03325	0.00989	0.00193	0.00021	0.08779	0.09768	1.00
03	0.00283	0.28266	0.00029	0.07577	0.02375	0.00891	0.00213	0.15449	0.14042	1.00
04	0.00000	0.46330	0.00136	0.08785	0.01145	0.00073	0.00000	0.19572	0.14086	1.00
05	0.00311	0.42208	0.00414	0.08244	0.04625	0.01337	0.00910	0.16373	0.11817	1.00
06	0.00145	0.03279	0.00018	0.01327	0.00194	0.00227	0.01198	0.15232	0.03688	1.00
07	0.00238	0.08051	0.02023	0.29630	0.00869	0.04278	0.00214	0.10940	0.16175	1.00
08	0.00049	0.41241	0.00126	0.05687	0.01395	0.00048	0.00603	0.10854	0.07411	1.00
09	0.00147	0.28674	0.00017	0.15061	0.00000	0.00623	0.02793	0.03129	0.42171	1.00
10	0.01305	0.04026	0.00406	0.05274	0.00000	0.00110	0.01753	0.08233	0.05378	1.00
11	0.01060	0.13044	0.00016	0.01337	0.00000	0.02471	0.06442	0.09133	0.05992	1.00
12	0.56119	0.14446	0.00016	0.02004	0.00000	0.00195	0.02337	0.16095	0.05672	1.00
13	0.00592	0.35723	0.00087	0.01164	0.00000	0.00244	0.04254	0.06709	0.04019	1.00
14	0.02503	0.24647	0.14459	0.06723	0.00000	0.00520	0.13892	0.05925	0.10976	1.00
15	0.00439	0.06490	0.00721	0.75739	0.00000	0.00645	0.02091	0.09132	0.03967	1.00
16	0.00297	0.03294	0.00140	0.35985	0.29530	0.00699	0.04609	0.16077	0.09368	1.00
17	0.01215	0.12693	0.01148	0.14001	0.00000	0.35969	0.01748	0.15086	0.07049	1.00
18	0.00257	0.13288	0.00014	0.02933	0.00000	0.00131	0.37891	0.01411	0.08503	1.00
19	0.01580	0.07777	0.13418	0.15734	0.00000	0.02881	0.05031	0.08222	0.39551	1.00
20	0.03469	0.22871	0.00293	0.13662	0.00023	0.01669	0.05501	0.08791	0.25397	1.00

Source: Author’s calculation

Appendix J

The unbalanced 2000 micro SAM for Thailand

	ACT01	ACT 02	ACT 03	ACT 04	ACT 05	ACT 06	ACT 07
ACT01							
ACT 02							
ACT 03							
ACT 04							
ACT 05							
ACT 06							
ACT 07							
ACT 08							
ACT 09							
ACT 10							
ACT 11							
ACT 12							
ACT 13							
ACT 14							
ACT 15							
ACT 16							
ACT 17							
ACT 18							
ACT 19							
ACT 20							
COM01	19,033.96	0.00	616.88	0.00	692.26	4,077.00	0.00
COM02	0.00	8,574.89	937.79	0.00	0.00	678.35	0.00
COM03	0.00	0.00	3,913.37	0.00	11.01	1,363.45	0.00
COM04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COM05	36,922.85	11,659.78	28,960.57	3,702.73	10,653.52	399.93	1,991.37
COM06	0.00	0.00	0.00	0.00	0.00	5,697.81	0.00
COM07	16.19	0.89	151.67	0.00	44.37	159.65	3,642.38
COM08	0.00	0.00	0.00	0.00	0.00	4,880.06	0.00
COM09	0.00	0.00	15.40	0.00	58.44	73.98	0.00
COM10	0.00	0.00	38.36	10.68	4.57	73,916.58	0.66
COM11	530.43	140.99	343.48	511.55	592.39	43.80	533.31
COM12	0.00	0.00	303.61	0.00	248.54	176.00	52.59
COM13	74,203.36	7,112.47	43,068.69	29,002.21	47,094.09	8,710.79	2,055.09
COM14	12.77	6.20	31.80	460.90	769.60	30.16	1,039.00
COM15	3,347.06	1,207.71	8,198.16	4,670.15	7,121.56	1,527.04	7,103.60
COM16	2,040.76	358.38	2,509.10	509.09	3,885.08	219.26	209.94
COM17	22.35	86.59	1,161.61	48.59	1,258.57	330.21	1,267.85
COM18	31.01	6.54	218.14	0.00	726.18	1,274.67	44.71
COM19	46.03	13.03	60.45	7.75	39.46	268.16	63.13
COM20	6,687.99	2,095.48	11,734.75	3,711.07	6,566.12	2,542.03	2,906.78
LAB	33,715.52	4,471.82	21,701.50	7,815.06	7,541.92	8,985.53	1,977.30
CAP	54,541.06	8,178.68	65,873.72	28,240.20	25,506.36	37,393.72	3,416.89
ENT							
HH							
Govt							
YTAX							
ITAX	14.90	2.34	250.58	5.05	3.37	13.34	160.12
TAR							
S-I							
ROW							
Total	231,166.24	43,915.79	190,089.63	78,695.05	112,817.42	152,761.55	26,464.72

	ACT 08	ACT 09	ACT 10	ACT 11	ACT 12	ACT 13	ACT 14
ACT01							
ACT02							
ACT03							
ACT04							
ACT05							
ACT06							
ACT07							
ACT08							
ACT09							
ACT10							
ACT11							
ACT12							
ACT13							
ACT14							
ACT15							
ACT16							
ACT17							
ACT18							
ACT19							
ACT20							
COM01	0.00	0.00	75,444.67	0.00	248.18	213.72	0.08
COM02	0.00	0.00	14,179.10	0.00	0.00	20.13	0.00
COM03	0.00	0.00	33,162.51	0.00	0.00	0.11	0.00
COM04	0.00	0.00	0.00	0.00	0.00	64,275.50	0.00
COM05	523.89	0.00	11,592.04	16,312.70	1,180.44	3,972.13	0.00
COM06	0.00	0.00	54,108.84	1,286.40	0.00	2,399.54	0.00
COM07	4.15	913.86	575.25	0.14	929.70	1,915.99	802.64
COM08	6,714.73	0.00	55,166.06	0.00	0.00	2,518.05	5.30
COM09	27.76	32,312.00	835.46	100.20	919.26	455,311.44	30,992.66
COM10	41,001.79	0.00	112,986.47	558.42	2,527.12	8,049.67	667.13
COM11	1,001.40	134.12	396.09	242,670.99	572.41	24,321.73	960.49
COM12	70.63	696.99	6,559.92	4,894.26	129,355.52	9,998.91	4,012.59
COM13	62,347.85	142,039.31	20,983.23	58,152.44	30,369.81	494,608.18	38,315.91
COM14	189.57	97.78	2,358.41	69.46	31.85	1,405.36	23,099.30
COM15	7,420.81	69,366.80	25,609.62	5,327.04	3,870.43	14,090.47	10,795.44
COM16	1,822.20	0.62	0.85	0.00	0.00	0.00	0.00
COM17	102.77	3,418.34	553.71	10,995.69	440.20	3,579.06	916.01
COM18	792.50	12,564.10	7,715.56	24,831.21	4,225.97	50,120.87	19,630.55
COM19	297.16	1,236.07	203.45	149.30	86.38	424.19	163.71
COM20	7,010.98	187,073.47	16,493.90	19,963.56	5,885.20	36,389.53	10,642.64
LAB	16,994.88	26,409.53	82,002.05	75,887.93	8,983.09	60,900.40	17,674.85
CAP	46,753.73	48,815.71	155,742.17	100,618.03	40,273.38	115,074.00	33,975.60
ENT							
HH							
GOVT							
YTAX							
ITAX	25.88	16,551.23	77,234.32	9,361.12	1,908.30	78,186.25	1,208.02
TAR							
S-I							
ROW							
Total	193,102.70	541,629.93	753,903.69	571,178.87	231,807.24	1,427,775.21	193,862.92

	ACT 15	ACT 16	ACT 17	ACT 18	ACT 19	ACT 20	COM01
ACT01							30,801.69
ACT02							0.00
ACT03							0.00
ACT04							0.00
ACT05							60,859.50
ACT06							0.00
ACT07							20.63
ACT08							0.00
ACT09							0.00
ACT10							0.00
ACT11							775.53
ACT12							0.00
ACT13							89,911.58
ACT14							12.32
ACT15							5,071.12
ACT16							3,224.54
ACT17							10.46
ACT18							51.11
ACT19							27,072.55
ACT20							17,720.71
COM01	0.00	0.00	268.28	0.00	0.00	612.99	
COM02	0.00	0.00	0.00	0.00	0.00	1,950.26	
COM03	0.00	0.00	0.00	0.00	0.00	24,815.15	
COM04	0.00	0.00	0.00	0.00	0.00	0.00	
COM05	0.00	0.00	66.51	0.04	1.60	1,626.20	
COM06	0.00	0.00	1,398.66	0.00	0.00	1,440.50	
COM07	69.64	0.00	8,650.59	0.00	14.06	1,156.26	
COM08	0.00	0.00	261.76	0.00	0.00	14,747.63	
COM09	10,162.61	0.00	1,408.50	110,503.52	370.51	627.97	
COM10	40.40	0.00	6,061.53	0.00	38.88	95,237.09	
COM11	4,157.04	0.00	14,306.54	203.34	89.19	11,920.72	
COM12	8,713.93	16.63	4,412.80	842.91	108.08	30,393.87	
COM13	139,939.12	220.49	42,794.35	44,357.82	546.05	184,938.80	
COM14	15,214.56	7.31	3,608.20	65.57	981.15	2,834.46	
COM15	1,480,794.08	2,326.37	44,724.95	10,509.14	1,050.89	99,979.48	
COM16	2.80	1,711.62	0.00	0.00	0.00	166.98	
COM17	12,935.01	44.36	120,573.16	500.28	249.23	13,414.20	
COM18	36,946.09	230.73	4,739.76	116,529.95	292.94	38,898.04	
COM19	570.48	1.76	80.69	378.70	9.70	1,522.08	
COM20	53,997.52	298.34	15,955.13	23,652.37	2,070.76	169,565.89	
LAB	130,912.88	446.84	76,678.16	73,141.36	240,392.16	712,820.24	
CAP	215,226.52	386.89	124,183.39	63,944.82	869,625.93	455,427.20	
ENT							
HH							
GOVT							
YTAX							
ITAX	33,702.14	12.65	8,388.79	17,986.76	102,088.50	95,743.35	
TAR							7.41
S-I							
ROW							1,516.58
Total	2,143,384.81	5,703.98	478,561.74	462,616.55	1,217,929.61	1,959,839.37	237,055.72

	COM02	COM03	COM04	COM05	COM06	COM07	COM08
ACT01	0.00	800.00	0.00	1,072.36	6,004.61	0.00	0.00
ACT02	12,801.44	856.65	0.00	0.00	937.17	0.00	0.00
ACT03	0.00	4,144.37	0.00	17.43	1,621.86	0.00	0.00
ACT04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACT05	18,426.26	34,924.75	5,894.29	15,271.37	589.90	2,870.36	708.21
ACT06	0.00	0.00	0.00	0.00	8,072.21	0.00	0.00
ACT07	0.77	141.20	0.00	45.78	203.06	4,744.18	2.50
ACT08	0.00	0.00	0.00	0.00	5,813.78	0.00	7,590.36
ACT09	0.00	19.16	0.00	74.28	106.94	0.00	8.67
ACT10	0.00	49.69	16.77	6.83	96,543.33	0.95	47,317.78
ACT11	213.88	427.90	788.83	885.69	60.11	697.73	1,342.09
ACT12	0.00	379.28	0.00	392.74	233.47	71.68	85.59
ACT13	6,556.24	37,867.88	31,443.95	53,295.47	5,266.46	2,426.58	72,101.50
ACT14	6.74	38.87	92.47	523.10	29.22	609.77	219.80
ACT15	1,642.65	10,151.12	5,962.61	10,409.23	2,131.48	8,930.41	9,942.58
ACT16	488.72	3,181.93	777.19	5,839.88	311.12	262.04	2,439.45
ACT17	95.41	1,193.48	49.72	1,688.73	364.99	1,289.40	84.60
ACT18	10.33	285.77	0.00	1,149.53	1,924.54	64.44	1,055.07
ACT19	4,337.41	20,697.51	13,283.62	20,673.56	24,462.58	3,297.41	18,975.23
ACT20	4,825.79	18,811.85	9,559.72	14,921.28	5,922.36	4,875.23	12,957.06
COM01							
COM02							
COM03							
COM04							
COM05							
COM06							
COM07							
COM08							
COM09							
COM10							
COM11							
COM12							
COM13							
COM14							
COM15							
COM16							
COM17							
COM18							
COM19							
COM20							
LAB							
CAP							
ENT							
HH							
GOVT							
YTAX							
ITAX							
TAR	30.66	159.01	0.71	346.54	39.94	190.88	15.82
S-I							
ROW	12,135.49	4,677.26	35.62	26,250.17	2,720.89	10,185.85	1,427.19
Total	61,571.79	138,807.66	67,905.51	152,863.98	163,360.02	40,516.90	176,273.51

	COM09	COM10	COM11	COM12	COM13	COM14	COM15
ACT01	0.00	111,980.29	0.00	311.34	305.51	0.11	0.00
ACT02	0.00	20,265.28	0.00	0.00	28.39	0.00	0.00
ACT03	0.00	39,714.92	0.00	0.00	0.15	0.00	0.00
ACT04	0.00	0.00	0.00	0.00	85,919.47	0.00	0.00
ACT05	0.00	15,868.54	23,446.04	1,583.49	5,264.25	0.00	0.00
ACT06	0.00	72,895.91	1,908.38	0.00	3,375.31	0.00	0.00
ACT07	1,290.50	612.12	0.12	957.53	2,167.68	923.92	88.51
ACT08	0.00	69,471.41	0.00	0.00	3,491.08	6.11	0.00
ACT09	52,638.40	993.63	149.44	1,069.51	650,563.26	36,446.54	15,298.49
ACT10	0.00	161,895.39	830.53	3,103.35	10,228.55	839.02	55.25
ACT11	212.76	511.93	325,741.82	642.50	30,679.97	1,226.19	5,620.26
ACT12	1,079.33	8,770.62	6,165.89	138,059.20	9,937.18	4,849.41	11,916.20
ACT13	210,207.85	27,067.67	75,902.46	35,538.41	599,331.54	47,757.69	176,008.61
ACT14	124.66	2,727.12	93.00	38.28	1,459.73	28,017.47	19,552.73
ACT15	110,414.01	35,457.49	7,779.51	4,930.67	19,527.34	13,027.20	2,054,143.69
ACT16	1.01	1.30	0.00	0.00	0.00	0.00	4.30
ACT17	4,564.16	739.21	14,378.98	479.38	4,090.39	1,007.03	17,488.91
ACT18	20,475.12	11,782.31	37,486.60	5,748.64	71,361.46	26,918.07	56,711.35
ACT19	22,936.27	55,348.19	53,142.97	39,596.49	112,548.95	11,480.26	247,662.83
ACT20	309,160.81	36,153.65	34,866.77	13,953.77	67,422.83	21,267.77	107,586.04
COM01							
COM02							
COM03							
COM04							
COM05							
COM06							
COM07							
COM08							
COM09							
COM10							
COM11							
COM12							
COM13							
COM14							
COM15							
COM16							
COM17							
COM18							
COM19							
COM20							
LAB							
CAP							
ENT							
HH							
GOVT							
YTAX							
ITAX							
TAR	5,979.52	6,238.90	1,691.53	1,516.23	11,911.97	550.86	31,020.32
S-I							
ROW	260,743.74	121,616.82	96,614.42	55,033.39	424,638.03	19,954.52	1,441,755.28
Total	999,828.13	800,112.70	680,198.46	302,562.17	2,114,253.06	214,272.17	4,184,912.77

	COM16	COM17	COM18	COM19	COM20	L	K
ACT01	0.00	352.37	0.00	0.00	898.23		
ACT02	0.00	0.00	0.00	0.00	3,435.30		
ACT03	0.00	0.00	0.00	0.00	35,807.85		
ACT04	0.00	0.00	0.00	0.00	0.00		
ACT05	0.00	83.05	0.06	156.68	2,277.74		
ACT06	0.00	1,809.91	0.00	0.00	2,551.49		
ACT07	0.00	10,670.49	0.00	2,030.91	1,322.10		
ACT08	0.00	309.31	0.00	0.00	18,869.46		
ACT09	0.00	1,830.05	185,153.25	37,663.96	1,137.60		
ACT10	0.00	8,257.03	0.00	3,853.70	159,597.39		
ACT11	0.00	17,539.95	264.22	13,469.86	19,507.37		
ACT12	23.20	4,473.75	1,339.58	15,568.66	46,459.06		
ACT13	256.99	46,754.19	69,262.58	76,608.65	306,298.65		
ACT14	10.93	4,230.55	74.82	132,184.43	3,926.86		
ACT15	2,807.30	51,573.57	15,286.12	154,999.22	182,966.72		
ACT16	2,303.73	0.00	0.00	0.00	303.24		
ACT17	54.56	132,495.17	684.85	28,381.25	22,350.17		
ACT18	359.60	6,440.54	197,499.18	49,557.35	73,674.34		
ACT19	1,254.26	55,571.79	7,352.96	80,999.25	117,725.54		
ACT20	730.82	25,966.50	44,318.44	389,618.99	340,120.29		
COM01							
COM02							
COM03							
COM04							
COM05							
COM06							
COM07							
COM08							
COM09							
COM10							
COM11							
COM12							
COM13							
COM14							
COM15							
COM16							
COM17							
COM18							
COM19							
COM20							
LAB							
CAP							
ENT							782,364.00
HH						1,609,453.00	1,662,712.00
GOVT							48,122.00
YTAX							
ITAX							
TAR	247.10	2,827.88	100.59	2.33	52.80		
S-I							
ROW	5,888.63	178,653.83	10,682.24	182.30	187,592.76		
Total	13,937.12	549,839.93	532,018.88	985,277.55	1,526,874.96	1,609,453.00	2,493,198.00

	ENT	HH	GOVT	YTAX	ITAX	TAR
ACT01						
ACT02						
ACT03						
ACT04						
ACT05						
ACT06						
ACT07						
ACT08						
ACT09						
ACT10						
ACT11						
ACT12						
ACT13						
ACT14						
ACT15						
ACT16						
ACT17						
ACT18						
ACT19						
ACT20						
COM01		358.58	324.16			
COM02		2,029.83	33.62			
COM03		132,930.14	358.06			
COM04		0.00	64.83			
COM05		4,687.20	675.76			
COM06		15,946.36	254.66			
COM07		3,282.31	0.00			
COM08		46,940.36	380.46			
COM09		91.30	0.00			
COM10		522,798.97	2,006.75			
COM11		248,114.04	571.86			
COM12		28,371.62	19,654.35			
COM13		256,582.56	21,712.21			
COM14		7,302.83	245.83			
COM15		278,187.93	7,843.01			
COM16		405.74	1,126.99			
COM17		218,296.54	9,781.30			
COM18		81,130.45	12,639.11			
COM19		3,705.48	1,342.32			
COM20		911,762.76	502,257.70			
LAB						
CAP						
ENT		34,596.00	16,299.00			
HH			36,715.00			
GOVT				218,094.00	442,847.00	62,931.00
YTAX	105,985.00	112,109.00				
ITAX						
TAR						
S-I	311,602.00	367,833.00	140,300.00			
ROW	246,803.00		1,075.00			
Total	664,390.00	3,277,463.00	775,662.00	218,094.00	442,847.00	62,931.00

	S-I	ROW	Total
ACT01			152,526.51
ACT02			38,324.23
ACT03			81,306.59
ACT04			85,919.47
ACT05			188,224.49
ACT06			90,613.21
ACT07			25,222.00
ACT08			105,551.51
ACT09			983,153.18
ACT10			492,595.57
ACT11			420,608.57
ACT12			249,804.84
ACT13			1,969,864.96
ACT14			193,972.84
ACT15			2,707,154.04
ACT16			19,138.46
ACT17			231,490.85
ACT18			562,555.36
ACT19			938,419.64
ACT20			1,480,760.67
COM01	0.00	339.90	101,617.67
COM02	0.00	1,858.53	28,312.24
COM03	0.00	12,901.32	184,639.97
COM04	0.00	9,573.27	73,913.61
COM05	0.00	6,881.98	140,185.11
COM06	748.78	2,350.05	84,191.11
COM07	0.00	2,011.27	23,184.73
COM08	0.00	1,566.95	118,433.74
COM09	18.37	19,478.80	912,705.62
COM10	0.00	416,675.31	1,187,383.29
COM11	1,393.43	265,240.64	807,289.34
COM12	0.00	42,340.19	262,737.23
COM13	4,265.10	379,999.07	2,048,844.26
COM14	4,450.17	46,764.02	108,390.15
COM15	626,529.39	1,339,260.13	3,984,659.77
COM16	11,027.64	1,431.07	27,261.13
COM17	100,182.27	322,919.55	810,795.18
COM18	0.00	11,349.30	649,701.14
COM19	374,210.39	500.04	384,714.68
COM20	1,338.46	380,376.63	2,264,929.03
LAB			1,609,453.00
CAP			2,493,198.00
ENT		169,929.00	1,003,188.00
HH		34,721.00	3,343,601.00
GOVT		3,668.00	775,662.00
YTAX			218,094.00
ITAX			442,847.00
TAR			62,931.00
S-I		304,429.00	1,124,164.00
ROW			3,110,183.00
Total	1,124,164.00	3,776,565.00	

Appendix K

The core GAMS code for cross entropy SAM estimation

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$TITLE   BALANCING 2000 MICRO SAM FOR THAILAND

SETS
i   sam accounts
        / ACT01     Paddy and Maize Activities
          ACT02     Cassava Beans and Nuts Activities
          ACT03     Vegetables Sugarcane and Fruits
          ACT04     Rubber and Latex
          ACT05     Other Crops
          ACT06     Livestock
          ACT07     Forestry
          ACT08     Fishery
          ACT09     Mining and Quarrying
          ACT10     Food Manufacturing
          ACT11     Textile Industry
          ACT12     Paper Industries and Printing
          ACT13     Rubber' Chemical and Petroleum Industries
          ACT14     Non Metallic Products
          ACT15     Metal Product and Machinery
          ACT16     Agricultural Machinery
          ACT17     Other Manufacturing
          ACT18     Electricity Water Work (Public Utilities)
          ACT19     Construction and Trade
          ACT20     Service Transportation and Communication
          COM01     Paddy and Maize Commodity
          COM02     Cassava Beans and Nuts Commodity
          COM03     Vegetables Sugarcane and Fruits Commodity
          COM04     Rubber and Latex Commodity
          COM05     Other Crops Commodity
          COM06     Livestock Commodity
          COM07     Forestry Commodity
          COM08     Fishery Commodity
          COM09     Mining and Quarrying Commodity
          COM10     Food Manufacturing Commodity
          COM11     Textile Industry Commodity
          COM12     Paper Industries and Printing Commodity
          COM13     Rubber Chemical and Petroleum Industries Commodity
          COM14     Non Metallic Products Commodity
          COM15     Metal Product and Machinery Commodity
          COM16     Agricultural Machinery Commodity
          COM17     Other Manufacturing Commodity
          COM18     Electricity Water Work Public Utilities Commodity
          COM19     Construction and Trade Commodity
          COM20     Service Transportation and Communication Commodity
          FACL      Labour
          FACK      Capital
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ENT Enterprises
HOU Households
GOVT Government
YTAX Income tax
ITAX indirect tax less subsidy
TAR import tariff
CAP Capital account
ROW Rest of the world
TOTAL /

ii(i) all account in i except Total
/ ACT01 Paddy and Maize Activities
ACT02 Cassava Beans and Nuts Activities
ACT03 Vegetables Sugarcane and Fruits
ACT04 Rubber and Latex
ACT05 Other Crops
ACT06 Livestock
ACT07 Forestry
ACT08 Fishery
ACT09 Mining and Quarrying
ACT10 Food Manufacturing
ACT11 Textile Industry
ACT12 Paper Industries and Printing
ACT13 Rubber' Chemical and Petroleum Industries
ACT14 Non Metallic Products
ACT15 Metal Product and Machinery
ACT16 Agricultural Machinery
ACT17 Other Manufacturing
ACT18 Electricity Water Work (Public Utilities)
ACT19 Construction and Trade
ACT20 Service Transportation and Communication
COM01 Paddy and Maize Commodity
COM02 Cassava Beans and Nuts Commodity
COM03 Vegetables Sugarcane and Fruits Commodity
COM04 Rubber and Latex Commodity
COM05 Other Crops Commodity
COM06 Livestock Commodity
COM07 Forestry Commodity
COM08 Fishery Commodity
COM09 Mining and Quarrying Commodity
COM10 Food Manufacturing Commodity
COM11 Textile Industry Commodity
COM12 Paper Industries and Printing Commodity
COM13 Rubber Chemical and Petroleum Industries Commodity
COM14 Non Metallic Products Commodity
COM15 Metal Product and Machinery Commodity
COM16 Agricultural Machinery Commodity
COM17 Other Manufacturing Commodity
COM18 Electricity Water Work Public Utilities Commodity
COM19 Construction and Trade Commodity
COM20 Service Transportation and Communication Commodity
FACL Labour

```
           FACK       Capital
           ENT        Enterprises
           HOU        Households
           GOVT       Government
           YTAX       Income tax
           ITAX       Indirect tax less subsidy
           TAR        Import tariff
           CAP        Capital account
           ROW        Rest of the world /

macro macro controls  /gdpfc2, gdp2 /

jwt   set of weights for errors in variables     / 1*5 /

* ii(i)    = YES;
* ii("Total") = NO;

ALIAS (i,j), (ii,jj);

*----------------------------------SAM DATABASE----------------------------------------

TABLE SAM(i,j)         social accounting matrix (see Appendix J)

PARAMETER

SAM0 (i,j)            Base SAM transactions matrix
T0(i,j)               Matrix of SAM transactions (flow matrix)
T1(i,j)               SAM transactions adjusted to eliminate negative entries
Abar0(i,j)            Prior SAM coefficient matrix
Abar1(i,j)            Prior SAM adjusted to eliminate negative coefficients
Target0(i)            Targets for macro SAM colum totals
vbar1(i,jwt)          Error support set 1
vbar2(macro,jwt)      Error support set 2
wbar1(i,jwt)          Weights on error support set 1
wbar2(macro,jwt)      Weights on error support set 2
sigmay1(i)            Prior standard error of column sums
sigmay2(macro)        Prior standard error of macro aggregates
epsilon               Tolerance to allow zero entries in SAM
;

SCALARS

gdp0                  base GDP
gdp00                 GDP from final SAM
gdpfc0                GDP at factor cost ;
*Initializing Parameters
SAM("TOTAL",jj)        = sum(ii, SAM(ii,jj));
SAM(ii,"TOTAL")        = sum(jj, SAM(ii,jj));

Scalar scalesam Scaling value /1000/ ;
sam(i,j)              = sam(i,j)/scalesam ;
Abar0(ii,jj)$SAM(ii,jj) = SAM(ii,jj)/SAM("TOTAL",jj) ;
```

```
T0(ii,jj)              = SAM(ii,jj) ;
T0("TOTAL",jj)         = sum(ii, SAM(ii,jj)) ;
T0(ii,"TOTAL")         = sum(jj, SAM(ii,jj)) ;

epsilon                = 0.0001 ;
Display T0, Abar0 ;

*-------------------------------RED ALERT-----------------------------------------

SET
red(i,j)                    Set of negative SAM flows ;

Parameter
redsam(i,j)                   Negative SAM value only
rtot(i)                     Row total
ctot(i)                     Column total ;

rtot(ii)                    = sum(jj, T0(ii,jj));
ctot(jj)                    = sum(ii, T0(ii,jj));

red(ii,jj)$(T0(ii,jj) LT 0)     = yes ;
redsam(ii,jj)                 = 0;
redsam(ii,jj)$red(ii,jj)        = T0(ii,jj);
redsam(jj,ii)$red(ii,jj)        = T0(ii,jj);

T1(ii,jj)                    = T0(ii,jj) - redsam(ii,jj);
T1("Total",jj)                 = sum(ii, T1(ii,jj));
T1(ii,"Total")                 = sum(jj, T1(ii,jj));

redsam("Total",jj)             = sum(ii, redsam(ii,jj));
redsam(ii,"Total")             = sum(jj, redsam(ii,jj));

sam(ii,"Total")                = sum(jj, T1(ii,jj));
sam("Total",jj)                = sum(ii, T1(ii,jj));

rtot(ii)                    = sum(jj, T1(ii,jj));
ctot(jj)                    = sum(ii, T1(ii,jj));

Abar1(ii,jj)                  = T1(ii,jj)/SAM("TOTAL",jj);

display "NON-NEGATIVE SAM" ;
display redsam, T1, Abar0, Abar1, rtot, ctot ;

SET
NONZERO(i,j)                SAM elements that can be nonzero ;
NONZERO(ii,jj)$(Abar1(ii,jj))     = yes ;

target0(ii)               = (sam(ii,"Total")+ sam("Total",ii))/2 ;
gdpfc0                    = T1("FACL","ACT01") + T1("FACL","ACT02") +
T1("FACL","ACT03")
                        + T1("FACL","ACT04") + T1("FACL","ACT05") + T1("FACL","ACT06")
```

```
                  + T1("FACL","ACT07") + T1("FACL","ACT08") + T1("FACL","ACT09")
                  + T1("FACL","ACT10") + T1("FACL","ACT11") + T1("FACL","ACT12")
                  + T1("FACL","ACT13") + T1("FACL","ACT14") + T1("FACL","ACT15")
                  + T1("FACL","ACT16") + T1("FACL","ACT17") + T1("FACL","ACT18")
                  + T1("FACL","ACT19") + T1("FACL","ACT20")
                  + T1("FACK","ACT01") + T1("FACK","ACT02") +
T1("FACK","ACT03")
                  + T1("FACK","ACT04") + T1("FACK","ACT05") +
T1("FACK","ACT06")
                  + T1("FACK","ACT07") + T1("FACK","ACT08") +
T1("FACK","ACT09")
                  + T1("FACK","ACT10") + T1("FACK","ACT11") +
T1("FACK","ACT12")
                  + T1("FACK","ACT13") + T1("FACK","ACT14") +
T1("FACK","ACT15")
                  + T1("FACK","ACT16") + T1("FACK","ACT17") +
T1("FACK","ACT18")
                  + T1("FACK","ACT19") + T1("FACK","ACT20")

;
gdp0               = T1("FACL","ACT01") + T1("FACL","ACT02") +
T1("FACL","ACT03")
                  + T1("FACL","ACT04") + T1("FACL","ACT05") + T1("FACL","ACT06")
                  + T1("FACL","ACT07") + T1("FACL","ACT08") + T1("FACL","ACT09")
                  + T1("FACL","ACT10") + T1("FACL","ACT11") + T1("FACL","ACT12")
                  + T1("FACL","ACT13") + T1("FACL","ACT14") + T1("FACL","ACT15")
                  + T1("FACL","ACT16") + T1("FACL","ACT17") + T1("FACL","ACT18")
                  + T1("FACL","ACT19") + T1("FACL","ACT20")
                  + T1("FACK","ACT01") + T1("FACK","ACT02") +
T1("FACK","ACT03")
                  + T1("FACK","ACT04") + T1("FACK","ACT05") +
T1("FACK","ACT06")
                  + T1("FACK","ACT07") + T1("FACK","ACT08") +
T1("FACK","ACT09")
                  + T1("FACK","ACT10") + T1("FACK","ACT11") +
T1("FACK","ACT12")
                  + T1("FACK","ACT13") + T1("FACK","ACT14") +
T1("FACK","ACT15")
                  + T1("FACK","ACT16") + T1("FACK","ACT17") +
T1("FACK","ACT18")
                  + T1("FACK","ACT19") + T1("FACK","ACT20")
                 + T1("ITAX","ACT01") + T1("ITAX","ACT02") + T1("ITAX","ACT03")
                 + T1("ITAX","ACT04") + T1("ITAX","ACT05") + T1("ITAX","ACT06")
                 + T1("ITAX","ACT07") + T1("ITAX","ACT08") + T1("ITAX","ACT09")
                 + T1("ITAX","ACT10") + T1("ITAX","ACT11") + T1("ITAX","ACT12")
                 + T1("ITAX","ACT13") + T1("ITAX","ACT14") + T1("ITAX","ACT15")
                 + T1("ITAX","ACT16") + T1("ITAX","ACT17") + T1("ITAX","ACT18")
                 + T1("ITAX","ACT19") + T1("ITAX","ACT20")
                 + T1("TAR","COM01")  + T1("TAR","COM02")  + T1("TAR","COM03")
                 + T1("TAR","COM04")  + T1("TAR","COM05")  + T1("TAR","COM06")
                 + T1("TAR","COM07")  + T1("TAR","COM08")  + T1("TAR","COM09")
                 + T1("TAR","COM10")  + T1("TAR","COM11")  + T1("TAR","COM12")
```

```
                + T1("TAR","COM13")  + T1("TAR","COM14")  + T1("TAR","COM15")
                + T1("TAR","COM16")  + T1("TAR","COM17")  + T1("TAR","COM18")
                + T1("TAR","COM19")  + T1("TAR","COM20")
                ;

display gdpfc0, gdp0 ;

*-------------------Define variable bounds on errors-----------------------------------
*1. define standard error for errors on column sum

sigmay1(ii)              = 0.05 * target0(ii) ;

*-------------------Set constants for 5-weight error distribution-----------------------

vbar1(ii,"1")            = -3 * sigmay1(ii) ;
vbar1(ii,"2")            = -1 * sigmay1(ii) ;
vbar1(ii,"3")            = 0 ;
vbar1(ii,"4")            = +1 * sigmay1(ii) ;
vbar1(ii,"5")            = +3 * sigmay1(ii) ;

wbar1(ii,"1")            = 1/72 ;
wbar1(ii,"2")            = 27/72 ;
wbar1(ii,"3")            = 16/72 ;
wbar1(ii,"4")            = 27/72 ;
wbar1(ii,"5")            = 1/72 ;

*2. define standard errors for errors on macro aggregates

sigmay2("gdpfc2")        = 0.05 * gdpfc0 ;
sigmay2("gdp2")          = 0.05 * gdp0 ;

*-------------------Set constants for 5-weight error distribution-----------------------

vbar2(macro,"1")         = -3 * sigmay2(macro) ;
vbar2(macro,"2")         = -1 * sigmay2(macro) ;
vbar2(macro,"3")         = 0 * sigmay2(macro) ;
vbar2(macro,"4")         = +1 * sigmay2(macro) ;
vbar2(macro,"5")         = +3 * sigmay2(macro) ;

wbar2(macro,"1")         = 1/72  ;
wbar2(macro,"2")         = 27/72  ;
wbar2(macro,"3")         = 16/72  ;
wbar2(macro,"4")         = 27/72  ;
wbar2(macro,"5")         = 1/72  ;

display vbar1, vbar2, sigmay1, sigmay2  ;

VARIABLES

A(ii,jj)            Post SAM coefficient matrix
TSAM(ii,jj)             Post matrix of SAM transaction
Y(ii)               Row sum of SAM
```

```
X(ii)                     Column sum of SAM
ERR1(ii)                  Error value on column sums
ERR2(macro)               Error value for macro aggregates
W1(ii,jwt)                Error weights
W2(macro,jwt)             Error weights
DENTROPY                  Entropy difference (objective)
GDPFC                     GDP at factor cost
GDP                       GDP at market prices
;

*----------------------Initialize Variables-------------------------------------------

A.L(ii,jj)                = Abar1(ii,jj) ;
TSAM.L(ii,jj)             = T1(ii,jj)    ;
Y.L(ii)                   = target0(ii)  ;
X.L(ii)                   = target0(ii)  ;
ERR1.L(ii)                = 0.0          ;
ERR2.L(macro)             = 0.0          ;
W1.L(ii,jwt)              = wbar1(ii,jwt)  ;
W2.L(macro,jwt)           = wbar2(macro,jwt)  ;
DENTROPY.L                = 0  ;
GDPFC.L                   = gdpfc0  ;
GDP.L                     = gdp0 ;

EQUATIONS

SAMEQ(i)                  row and column sum constraint
SAMMAKE(i,j)              make SAM flow
ERROR1EQ(i)               definition of error term 1
ERROR2EQ(macro)           definition of error term 2
SUMW1(i)                  Sum of weights 1
SUMW2(macro)              Sum of weights 2
ENTROPY                   Entropy difference definition
ROWSUM(i)                 row target
COLSUM(j)                 column target
GDPFCDEF                  define GDP at factor cost
GDPDEF                    define GDP
;

SAMEQ(ii)..                    Y(ii) =E= X(ii) +ERR1(ii) ;
SAMMAKE(ii,jj)$nonzero(ii,jj)..   TSAM(ii,jj) =E= A(ii,jj) * (X(jj)+ERR1(jj)) ;
ERROR1EQ(ii)..                 ERR1(ii) =E= SUM(jwt, W1(ii,jwt)*vbar1(ii,jwt))  ;
SUMW1(ii)..                    SUM(jwt, W1(ii,jwt)) =E= 1  ;
ENTROPY..                      DENTROPY =E= SUM((ii,jj)$nonzero(ii,jj),
                                A(ii,jj)*(LOG(A(ii,jj) + epsilon)
                                - LOG(Abar1(ii,jj) + epsilon)))
                                + SUM((ii,jwt), W1(ii,jwt)
                                * (LOG(W1(ii,jwt) + epsilon)
                                - LOG(wbar1(ii,jwt) + epsilon)))
                                + SUM((macro,jwt), W2(macro,jwt)
                                * (LOG(W2(macro,jwt) + epsilon)
                                - LOG(wbar2(macro,jwt) + epsilon)))  ;
```

```
ROWSUM(ii)$(NOT SAMEAS(ii,"ROW")).. SUM(jj, TSAM(ii,jj))   =E= Y(ii)   ;
COLSUM(jj)..                    SUM(ii, TSAM(ii,jj))   =E= (X(jj) + ERR1(jj))  ;

GDPFCDEF..    GDPFC =E= TSAM("FACL","ACT01") + TSAM("FACL","ACT02") +
TSAM("FACL","ACT03")
              + TSAM("FACL","ACT04") + TSAM("FACL","ACT05") +
TSAM("FACL","ACT06")
              + TSAM("FACL","ACT07") + TSAM("FACL","ACT08") +
TSAM("FACL","ACT09")
              + TSAM("FACL","ACT10") + TSAM("FACL","ACT11") +
TSAM("FACL","ACT12")
              + TSAM("FACL","ACT13") + TSAM("FACL","ACT14") +
TSAM("FACL","ACT15")
              + TSAM("FACL","ACT16") + TSAM("FACL","ACT17") +
TSAM("FACL","ACT18")
              + TSAM("FACL","ACT19") + TSAM("FACL","ACT20")
              + TSAM("FACK","ACT01") + TSAM("FACK","ACT02") +
TSAM("FACK","ACT03")
              + TSAM("FACK","ACT04") + TSAM("FACK","ACT05") +
TSAM("FACK","ACT06")
              + TSAM("FACK","ACT07") + TSAM("FACK","ACT08") +
TSAM("FACK","ACT09")
              + TSAM("FACK","ACT10") + TSAM("FACK","ACT11") +
TSAM("FACK","ACT12")
              + TSAM("FACK","ACT13") + TSAM("FACK","ACT14") +
TSAM("FACK","ACT15")
              + TSAM("FACK","ACT16") + TSAM("FACK","ACT17") +
TSAM("FACK","ACT18")
              + TSAM("FACK","ACT19") + TSAM("FACK","ACT20")
              + ERR2("gdpfc2")  ;

GDPDEF..      GDP   =E= TSAM("FACL","ACT01") + TSAM("FACL","ACT02") +
TSAM("FACL","ACT03")
              + TSAM("FACL","ACT04") + TSAM("FACL","ACT05") +
TSAM("FACL","ACT06")
              + TSAM("FACL","ACT07") + TSAM("FACL","ACT08") +
TSAM("FACL","ACT09")
              + TSAM("FACL","ACT10") + TSAM("FACL","ACT11") +
TSAM("FACL","ACT12")
              + TSAM("FACL","ACT13") + TSAM("FACL","ACT14") +
TSAM("FACL","ACT15")
              + TSAM("FACL","ACT16") + TSAM("FACL","ACT17") +
TSAM("FACL","ACT18")
              + TSAM("FACL","ACT19") + TSAM("FACL","ACT20")
              + TSAM("FACK","ACT01") + TSAM("FACK","ACT02") +
TSAM("FACK","ACT03")
              + TSAM("FACK","ACT04") + TSAM("FACK","ACT05") +
TSAM("FACK","ACT06")
              + TSAM("FACK","ACT07") + TSAM("FACK","ACT08") +
TSAM("FACK","ACT09")
```

```
            + TSAM("FACK","ACT10") + TSAM("FACK","ACT11") +
TSAM("FACK","ACT12")
            + TSAM("FACK","ACT13") + TSAM("FACK","ACT14") +
TSAM("FACK","ACT15")
            + TSAM("FACK","ACT16") + TSAM("FACK","ACT17") +
TSAM("FACK","ACT18")
            + TSAM("FACK","ACT19") + TSAM("FACK","ACT20")
            + TSAM("ITAX","ACT01") + TSAM("ITAX","ACT02") +
TSAM("ITAX","ACT03")
            + TSAM("ITAX","ACT04") + TSAM("ITAX","ACT05") +
TSAM("ITAX","ACT06")
            + TSAM("ITAX","ACT07") + TSAM("ITAX","ACT08") +
TSAM("ITAX","ACT09")
            + TSAM("ITAX","ACT10") + TSAM("ITAX","ACT11") +
TSAM("ITAX","ACT12")
            + TSAM("ITAX","ACT13") + TSAM("ITAX","ACT14") +
TSAM("ITAX","ACT15")
            + TSAM("ITAX","ACT16") + TSAM("ITAX","ACT17") +
TSAM("ITAX","ACT18")
            + TSAM("ITAX","ACT19") + TSAM("ITAX","ACT20")
            - TSAM("ACT01","GOVT") - TSAM("ACT02","GOVT") -
TSAM("ACT03","GOVT")
            - TSAM("ACT04","GOVT") - TSAM("ACT05","GOVT") -
TSAM("ACT06","GOVT")
            - TSAM("ACT07","GOVT") - TSAM("ACT08","GOVT") -
TSAM("ACT09","GOVT")
            - TSAM("ACT10","GOVT") - TSAM("ACT11","GOVT") -
TSAM("ACT12","GOVT")
            - TSAM("ACT13","GOVT") - TSAM("ACT14","GOVT") -
TSAM("ACT15","GOVT")
            - TSAM("ACT16","GOVT") - TSAM("ACT17","GOVT") -
TSAM("ACT18","GOVT")
            - TSAM("ACT19","GOVT") - TSAM("ACT20","GOVT")
            + TSAM("TAR","COM01")  + TSAM("TAR","COM02")  +
TSAM("TAR","COM03")
            + TSAM("TAR","COM04")  + TSAM("TAR","COM05")  +
TSAM("TAR","COM06")
            + TSAM("TAR","COM07")  + TSAM("TAR","COM08")  +
TSAM("TAR","COM09")
            + TSAM("TAR","COM10")  + TSAM("TAR","COM11")  +
TSAM("TAR","COM12")
            + TSAM("TAR","COM13")  + TSAM("TAR","COM14")  +
TSAM("TAR","COM15")
            + TSAM("TAR","COM16")  + TSAM("TAR","COM17")  +
TSAM("TAR","COM18")
            + TSAM("TAR","COM19")  + TSAM("TAR","COM20")
            + ERR2("gdp2")  ;


ERROR2EQ(macro)..          ERR2(macro) =E= SUM(jwt,
W2(macro,jwt)*vbar2(macro,jwt))  ;
SUMW2(macro)..                SUM(jwt, W2(macro,jwt)) =E= 1  ;
```

```
*----------------------Define bounds for cell values------------------------------------

A.LO(ii,jj)$nonzero(ii,jj)              = 0 ;
A.UP(ii,jj)$nonzero(ii,jj)              = 1 ;
A.FX(ii,jj)$(NOT nonzero(ii,jj))    = 0 ;

TSAM.LO(ii,jj)                    = 0.0 ;
TSAM.UP(ii,jj)                    = +inf ;
TSAM.FX(ii,jj)$(NOT nonzero(ii,jj))  = 0 ;

W1.LO(ii,jwt)                   = 0 ;
W1.UP(ii,jwt)                   = 1 ;
W2.LO(macro,jwt)              = 0 ;
W2.UP(macro,jwt)               = 1 ;

X.FX(ii)                          = TARGET0(ii)  ;

GDP.FX                           = GDP0 ;
GDPFC.FX                        = GDPFC0  ;

*------------------Define Model-----------------------------------------------------
MODEL SAMENTROP  / ALL /

*------------------Solve Model------------------------------------------------------

OPTION ITERLIM                     = 5000  ;
OPTION LIMROW = 0,   LIMCOL          = 0  ;
OPTION SOLPRINT                    = ON  ;

*SAMENTROP.optfile  = 1 ;
SAMENTROP.HOLDFIXED = 1 ;
*OPTION NLP          = MINOS5 ;
OPTION NLP         = CONOPT3 ;
*SAMENTROP.WORKSPACE = 25.0  ;

*------------------Solve statement------------------------------------------------
SOLVE SAMENTROP using NLP mininmizing dentropy ;

*--------------------------------Parameters for reporting results----------------------

Parameters

Macsam1(i,j)                Assigned new balanced SAM flows from CE
Macsam2(i,j)                Balanced SAM flows from entropy diff x scalesam
SEM                         Squared Error Measure
percent1(i,j)               Percent change of new SAM from original SAM
PosUnbal(i,j)               Positive unbalanced SAM
PosBalan(i,j)               Positive balanced SAM
Diffrnce(i,j)               Difference btw original SAM and Final SAM in values ;
macsam1(ii,jj)               = TSAM.l(ii,jj) ;
macsam1("total",jj)            = SUM(ii, macsam1(ii,jj))  ;
```

```
macsam1(ii,"total")              = SUM(jj, macsam1(ii,jj))  ;
macsam2(i,j)                    = macsam1(i,j) * scalesam  ;
SEM                            = SUM((ii,jj), SQR(A.L(ii,jj)
                              - Abar1(ii,jj)))/SQR(card(ii)) ;
percent1(i,j)$(T1(i,j))          = 100*(macsam1(i,j) - T1(i,j)) / T1(i,j)  ;
PosUnbal(i,j)                   = T1(i,j) * scalesam  ;
PosBalan(i,j)                   = macsam2(i,j)  ;
Diffrnce(i,j)                   = PosBalan(i,j) - PosUnbal(i,j)  ;

DISPLAY
macsam1, macsam2, percent1, sem, dentropy.l, PosUnbal, PosBalan, Diffrnce  ;

*---------------------Return negative flows to inintial cell position-------------------

macsam1(ii,jj)                  = macsam1(ii,jj) + redsam(ii,jj)  ;
macsam1("total",jj)              = SUM(ii, macsam1(ii,jj))  ;
macsam1(ii,"total")              = SUM(jj, macsam1(ii,jj))  ;
macsam2(i,j)                    = macsam1(i,j) * scalesam  ;

gdp00       = macsam1("FACL","ACT01") + macsam1("FACL","ACT02") +
macsam1("FACL","ACT03")
          + macsam1("FACL","ACT04") + macsam1("FACL","ACT05") +
macsam1("FACL","ACT06")
          + macsam1("FACL","ACT07") + macsam1("FACL","ACT08") +
macsam1("FACL","ACT09")
          + macsam1("FACL","ACT10") + macsam1("FACL","ACT11") +
macsam1("FACL","ACT12")
          + macsam1("FACL","ACT13") + macsam1("FACL","ACT14") +
macsam1("FACL","ACT15")
          + macsam1("FACL","ACT16") + macsam1("FACL","ACT17") +
macsam1("FACL","ACT18")
          + macsam1("FACL","ACT19") + macsam1("FACL","ACT20")
          + macsam1("FACK","ACT01") + macsam1("FACK","ACT02") +
macsam1("FACK","ACT03")
          + macsam1("FACK","ACT04") + macsam1("FACK","ACT05") +
macsam1("FACK","ACT06")
          + macsam1("FACK","ACT07") + macsam1("FACK","ACT08") +
macsam1("FACK","ACT09")
          + macsam1("FACK","ACT10") + macsam1("FACK","ACT11") +
macsam1("FACK","ACT12")
          + macsam1("FACK","ACT13") + macsam1("FACK","ACT14") +
macsam1("FACK","ACT15")
          + macsam1("FACK","ACT16") + macsam1("FACK","ACT17") +
macsam1("FACK","ACT18")
          + macsam1("FACK","ACT19") + macsam1("FACK","ACT20")
          + macsam1("ITAX","ACT01") + macsam1("ITAX","ACT02") +
macsam1("ITAX","ACT03")
          + macsam1("ITAX","ACT04") + macsam1("ITAX","ACT05") +
macsam1("ITAX","ACT06")
          + macsam1("ITAX","ACT07") + macsam1("ITAX","ACT08") +
macsam1("ITAX","ACT09")
```

```
        + macsam1("ITAX","ACT10") + macsam1("ITAX","ACT11") +
macsam1("ITAX","ACT12")
        + macsam1("ITAX","ACT13") + macsam1("ITAX","ACT14") +
macsam1("ITAX","ACT15")
        + macsam1("ITAX","ACT16") + macsam1("ITAX","ACT17") +
macsam1("ITAX","ACT18")
        + macsam1("ITAX","ACT19") + macsam1("ITAX","ACT20")
        + macsam1("TAR","COM01")  + macsam1("TAR","COM02")  +
macsam1("TAR","COM03")
        + macsam1("TAR","COM04")  + macsam1("TAR","COM05")  +
macsam1("TAR","COM06")
        + macsam1("TAR","COM07")  + macsam1("TAR","COM08")  +
macsam1("TAR","COM09")
        + macsam1("TAR","COM10")  + macsam1("TAR","COM11")  +
macsam1("TAR","COM12")
        + macsam1("TAR","COM13")  + macsam1("TAR","COM14")  +
macsam1("TAR","COM15")
        + macsam1("TAR","COM16")  + macsam1("TAR","COM17")  +
macsam1("TAR","COM18")
        + macsam1("TAR","COM19")  + macsam1("TAR","COM20")
        ;

DISPLAY
macsam1, macsam2  ;
DISPLAY
gdp0, gdp00, gdp.l, gdpfc0, gdpfc.l

PARAMETER
ANEW(i,j)  ;
ANEW("TOTAL",jj)             = SUM(ii, A.L(ii,jj))   ;
ANEW(ii,"TOTAL")             = SUM(jj, A.L(ii,jj))   ;

Abar1("TOTAL",jj)            = SUM(ii, Abar1(ii,jj))  ;
Abar1(ii,"TOTAL")            = SUM(jj, Abar1(ii,jj))  ;

DISPLAY
ANEW, Abar1  ;

SCALAR
meanerr1, meanerr2  ;
meanerr1                     = SUM(ii, abs(err1.l(ii))) / card(ii)   ;
meanerr2                     = SUM(macro, abs(err2.l(macro))) / card(macro)  ;

DISPLAY
meanerr1, meanerr2  ;
```

Appendix L

The balanced 2000 micro SAM for Thailand

	ACT01	ACT 02	ACT 03	ACT 04	ACT 05	ACT 06	ACT 07
ACT01							
ACT 02							
ACT 03							
ACT 04							
ACT 05							
ACT 06							
ACT 07							
ACT 08							
ACT 09							
ACT 10							
ACT 11							
ACT 12							
ACT 13							
ACT 14							
ACT 15							
ACT 16							
ACT 17							
ACT 18							
ACT 19							
ACT 20							
COM01	18,394.35		509.55		1,075.46	3,633.47	
COM02		8,098.89	710.63			575.11	
COM03			2,735.04		26.70	1,077.79	
COM04							
COM05	30,887.30	10,926.08	20,984.34	3,922.18	14,565.18	336.33	1,951.59
COM06						4,683.79	
COM07	29.38	4.06	122.55		74.54	140.91	3,565.35
COM08						3,919.25	
COM09			22.25		92.55	70.47	
COM10			38.29	17.97	17.73	57,816.55	2.67
COM11	440.40	134.71	253.26	537.63	793.43	45.23	521.12
COM12			226.80		343.70	150.76	53.72
COM13	59,376.78	6,603.78	30,241.79	30,089.40	62,144.21	6,877.57	2,002.03
COM14	26.16	9.33	34.79	493.26	1,057.83	35.15	1,018.08
COM15	2,714.04	1,126.33	5,794.80	4,866.06	9,459.78	1,220.73	6,920.11
COM16	1,526.46	330.99	1,678.69	518.40	4,833.77	175.51	204.64
COM17	32.94	84.18	823.76	57.86	1,664.52	270.64	1,234.74
COM18	41.07	9.61	167.37		982.02	1,024.41	46.08
COM19	61.80	16.29	60.59	15.98	73.76	244.52	65.20
COM20	5,247.70	1,939.00	8,117.86	3,819.82	8,523.73	1,986.66	2,821.99
LAB	27,846.19	4,181.44	15,585.83	8,223.58	10,212.19	7,236.23	1,934.47
CAP	45,154.59	7,648.56	47,371.30	29,728.75	34,572.92	30,125.95	3,342.20
ENT							
HH							
GOVT							
YTAX							
ITAX	27.70	5.51	191.96	12.07	16.62	20.91	158.84
TAR							
S-I							
ROW							
Total	191,806.85	41,118.76	135,671.45	82,302.97	150,530.64	121,667.90	25,842.84

	ACT 08	ACT 09	ACT 10	ACT 11	ACT 12	ACT 13	ACT 14
ACT01							
ACT02							
ACT03							
ACT04							
ACT05							
ACT06							
ACT07							
ACT08							
ACT09							
ACT10							
ACT11							
ACT12							
ACT13							
ACT14							
ACT15							
ACT16							
ACT17							
ACT18							
ACT19							
ACT20							
COM01			99,586.54		350.81	1,977.10	18.92
COM02			13,253.80			323.80	
COM03			22,843.66			89.53	
COM04						62,753.66	
COM05	430.78		9,647.16	15,479.57	1,301.77	6,417.81	
COM06			47,501.02	1,330.09		4,648.55	
COM07	15.41	1,583.20	527.11	42.27	1,024.75	3,083.99	839.29
COM08	5,263.29		42,887.39			3,492.61	20.83
COM09	34.66	49,321.88	697.58	134.24	990.78	582,290.83	31,098.57
COM10	31,151.03		77,830.63	500.92	2,569.94	7,755.95	664.95
COM11	779.69	250.38	328.16	202,416.90	605.64	24,818.15	956.80
COM12	67.94	1,067.46	4,825.62	4,227.61	133,182.74	11,155.12	3,974.34
COM13	47,817.70	198,724.77	15,088.63	49,115.38	31,106.05	522,494.69	37,612.07
COM14	163.82	234.48	1,945.63	109.60	55.47	2,200.20	23,472.36
COM15	5,734.31	99,713.84	18,809.30	4,622.24	4,018.62	15,950.66	10,683.04
COM16	1,328.31	35.10	24.52				
COM17	92.01	4,701.12	435.24	9,131.53	468.85	3,653.37	910.02
COM18	628.11	18,510.83	5,804.34	21,662.77	4,414.93	59,041.96	19,515.00
COM19	271.10	3,200.27	314.34	248.97	132.64	2,140.11	207.04
COM20	5,295.58	239,089.86	11,026.37	15,928.36	5,876.71	31,546.32	10,223.07
LAB	13,366.40	41,906.73	65,095.74	69,472.50	9,586.54	85,013.55	17,917.87
CAP	36,821.26	78,210.96	124,652.05	92,730.49	43,036.50	164,283.81	34,517.39
ENT							
HH							
GOVT							
YTAX							
ITAX	33.20	25,504.33	59,802.26	8,445.93	2,036.04	101,912.73	1,233.15
TAR							
S-I							
ROW							
Total	149,294.59	762,055.20	622,927.07	495,599.33	240,758.76	1,697,044.47	193,864.71

	ACT 15	ACT 16	ACT 17	ACT 18	ACT 19	ACT 20	COM01
ACT01							23,398.36
ACT02							
ACT03							
ACT04							
ACT05							40,865.39
ACT06							
ACT07							29.63
ACT08							
ACT09							
ACT10							
ACT11							597.68
ACT12							
ACT13							64,884.13
ACT14							24.47
ACT15							3,732.10
ACT16							1,262.62
ACT17							23.24
ACT18							52.62
ACT19							20,153.57
ACT20							13,414.01
COM01			321.17			3,152.86	
COM02						3,193.46	
COM03						16,200.62	
COM04							
COM05			84.78	43.20	91.91	1,958.05	
COM06			1,170.29			2,066.72	
COM07	418.69		6,754.09		101.45	1,392.19	
COM08			231.59			13,543.15	
COM09	13,324.16		1,093.11	123,418.01	398.50	710.68	
COM10	152.03		4,308.64		85.20	62,094.21	
COM11	4,029.74		10,270.59	255.81	130.34	8,451.22	
COM12	9,250.47	37.45	3,245.94	947.33	154.28	23,161.49	
COM13	137,048.92	481.38	30,912.47	46,793.18	482.42	134,513.19	
COM14	23,129.17	17.16	2,808.33	122.13	976.93	2,976.81	
COM15	1,576,263.29	5,069.38	32,709.30	11,324.56	890.93	77,293.09	
COM16		3,709.62				84.19	
COM17	11,599.02	97.78	85,730.82	561.46	246.08	9,191.48	
COM18	42,291.35	504.07	3,532.01	126,859.60	314.01	31,632.34	
COM19	4,733.38	5.01	117.31	656.62	200.90	4,538.11	
COM20	39,782.43	649.95	11,070.91	23,501.07	1,416.87	100,619.89	
LAB	190,249.02	976.26	58,658.03	83,845.00	211,065.88	685,376.04	
CAP	323,253.50	845.60	95,445.19	73,832.40	774,752.51	448,519.58	
ENT							
HH							
GOVT							
YTAX							
ITAX	44,657.95	28.81	6,358.73	20,238.85	85,904.87	86,086.79	
TAR							19.41
S-I							
ROW							1,135.33
Total	2,420,183.13	12,422.47	354,823.32	512,399.22	1,077,213.06	1,716,756.17	169,592.54

	COM02	COM03	COM04	COM05	COM06	COM07	COM08
ACT01		1,086.89		1,103.21	4,616.90		
ACT02	9,633.93	1,134.88			718.57		
ACT03		5,621.03		31.41	1,266.98		
ACT04							
ACT05	13,496.26	41,127.01	5,967.15	13,935.07	424.55	2,260.08	586.69
ACT06					6,184.28		
ACT07	4.17	198.37		58.51	163.09	3,794.10	14.16
ACT08					4,475.10		6,890.88
ACT09		38.89		84.90	89.46		19.47
ACT10		83.03	24.28	19.58	73,761.68	3.34	42,617.85
ACT11	165.85	581.05	841.83	902.35	56.94	563.35	1,213.70
ACT12		503.42		399.33	185.56	60.41	88.89
ACT13	4,899.84	48,022.57	32,777.47	51,742.64	3,902.54	1,937.71	62,283.55
ACT14	9.09	69.26	105.72	548.85	33.55	494.69	215.47
ACT15	1,236.17	13,089.42	6,260.99	10,252.76	1,604.47	7,143.39	8,722.30
ACT16	312.51	2,146.88	630.86	3,320.91	153.18	188.45	1,206.90
ACT17	77.10	1,639.98	60.21	1,753.41	295.72	1,044.50	92.82
ACT18	11.76	383.49		1,140.51	1,444.50	54.62	934.93
ACT19	3,270.02	27,090.69	14,028.75	20,619.22	18,492.59	2,647.33	16,865.27
ACT20	3,653.71	25,038.13	10,166.74	15,097.71	4,540.15	3,924.69	11,693.16
COM01							
COM02							
COM03							
COM04							
COM05							
COM06							
COM07							
COM08							
COM09							
COM10							
COM11							
COM12							
COM13							
COM14							
COM15							
COM16							
COM17							
COM18							
COM19							
COM20							
LAB							
CAP							
ENT							
HH							
GOVT							
YTAX							
ITAX							
TAR	27.30	222.23	6.28	355.87	40.72	155.85	26.80
S-I							
ROW	9,118.65	6,079.99	44.13	25,974.64	2,054.28	8,156.98	1,272.46
Total	45,916.35	174,157.21	70,914.41	147,340.86	124,504.81	32,429.47	154,745.30

	COM09	COM10	COM11	COM12	COM13	COM14	COM15
ACT01		158,087.83		354.83	878.98	13.09	
ACT02		24,846.00			269.81		
ACT03		60,338.38			392.63		
ACT04					82,302.97		
ACT05		10,558.71	16,749.09	1,355.39	2,023.41		
ACT06		100,462.09	2,382.26		5,926.61		
ACT07	1,091.15	763.63	52.12	961.42	2,536.58	713.14	317.52
ACT08		98,954.98			6,544.01	18.30	
ACT09	36,643.95	1,016.94	191.44	1,024.02	506,507.24	26,856.64	6,926.33
ACT10		221,336.13	1,075.43	3,235.62	17,000.88	670.28	817.08
ACT11	267.89	757.55	374,960.13	682.78	44,732.15	963.33	8,911.35
ACT12	916.24	9,731.65	6,395.37	134,036.56	10,607.04	3,668.89	9,657.48
ACT13	155,911.78	28,018.89	74,471.26	33,907.50	550,748.81	35,635.35	107,510.78
ACT14	209.41	4,110.40	193.47	68.10	3,129.13	22,086.05	48,840.24
ACT15	88,292.54	40,282.89	8,228.91	4,857.08	21,953.35	9,875.47	1,816,445.21
ACT16							
ACT17	4,809.88	1,275.13	19,071.82	545.84	9,191.49	818.05	56,412.48
ACT18	16,035.03	13,034.30	38,510.35	5,608.09	74,713.20	20,289.75	44,642.32
ACT19	19,833.33	69,004.29	59,690.94	39,847.44	151,850.91	8,832.92	318,196.90
ACT20	288,339.25	49,844.03	42,106.40	14,467.32	111,656.83	16,606.01	205,894.12
COM01							
COM02							
COM03							
COM04							
COM05							
COM06							
COM07							
COM08							
COM09							
COM10							
COM11							
COM12							
COM13							
COM14							
COM15							
COM16							
COM17							
COM18							
COM19							
COM20							
LAB							
CAP							
ENT							
HH							
GOVT							
YTAX							
ITAX							
TAR	4,879.28	7,204.32	1,851.53	1,516.40	13,645.71	433.23	28,450.20
S-I							
ROW	214,944.72	143,403.30	104,253.30	54,510.70	511,450.66	15,209.96	1,487,254.69
Total	832,174.45	1,043,031.44	750,183.82	296,979.08	2,128,062.39	162,690.45	4,140,276.69

	COM16	COM17	COM18	COM19	COM20	LAB	CAP
ACT01		540.48			1,726.29		
ACT02					4,515.56		
ACT03					68,021.02		
ACT04							
ACT05		99.75	25.84	103.05	953.21		
ACT06		2,450.71			4,261.95		
ACT07		12,249.87		1,348.17	1,547.21		
ACT08		485.33			31,925.98		
ACT09		1,941.81	158,103.90	21,608.38	1,001.84		
ACT10		10,873.73		2,867.54	248,540.62		
ACT11		22,161.19	308.50	9,481.58	27,450.12		
ACT12	36.81	5,133.96	1,269.67	9,857.98	48,209.50		
ACT13	386.80	50,900.00	61,419.72	46,298.89	281,384.26		
ACT14	18.48	5,868.41	127.22	100,483.81	7,228.90		
ACT15	4,212.52	59,717.08	14,189.37	99,559.23	200,527.90		
ACT16	3,200.17						
ACT17	84.43	189,310.83	789.42	22,559.12	44,967.85		
ACT18	541.09	7,360.52	180,154.48	31,230.34	76,257.35		
ACT19	1,886.75	68,440.30	7,151.96	55,363.51	153,946.40		
ACT20	1,102.41	34,191.77	44,858.28	284,080.45	536,081.00		
COM01							
COM02							
COM03							
COM04							
COM05							
COM06							
COM07							
COM08							
COM09							
COM10							
COM11							
COM12							
COM13							
COM14							
COM15							
COM16							
COM17							
COM18							
COM19							
COM20							
LAB							
CAP							
ENT							764,906.66
HH						1,607,749.51	1,672,729.88
GOVT							51,208.94
YTAX							
ITAX							
TAR	372.73	3,346.80	136.95	48.32	184.73		
S-I							
ROW	8,840.73	212,056.63	10,108.92	176.16	221,137.00		
Total	20,682.91	687,129.17	478,644.23	685,066.54	1,959,868.70	1,607,749.51	2,488,845.48

	ENT	HH	GOVT	YTAX	ITAX	TAR
ACT01						
ACT02						
ACT03						
ACT04						
ACT05						
ACT06						
ACT07						
ACT08						
ACT09						
ACT10						
ACT11						
ACT12						
ACT13						
ACT14						
ACT15						
ACT16						
ACT17						
ACT18						
ACT19						
ACT20						
COM01		20,041.66	922.82			
COM02		10,689.11	154.14			
COM03		120,716.89	440.24			
COM04			135.34			
COM05		12,166.75	967.74			
COM06		53,940.85	454.98			
COM07		8,107.11				
COM08		81,989.71	540.88			
COM09		638.02				
COM10		477,990.26	2,135.82			
COM11		259,761.14	683.38			
COM12		35,156.92	21,667.32			
COM13		290,586.30	23,484.80			
COM14		15,507.34	393.69			
COM15		353,855.37	8,771.54			
COM16		116.30	942.73			
COM17		214,743.59	10,280.87			
COM18		113,459.18	14,389.19			
COM19		55,438.06	2,742.51			
COM20		695,835.21	493,805.05			
LAB						
CAP						
ENT		11,479.46	13,223.57			
HH			29,976.71			
GOVT				218,059.65	442,677.25	62,924.67
YTAX	110,880.49	107,179.16				
ITAX						
TAR						
S-I	332,604.02	380,735.55	148,163.10			
ROW	391,286.14		1,755.55			
Total	834,770.65	3,320,133.93	776,031.94	218,059.65	442,677.25	62,924.67

	S-I	ROW	Total
ACT01			191,806.85
ACT02			41,118.76
ACT03			135,671.45
ACT04			82,302.97
ACT05			150,530.64
ACT06			121,667.90
ACT07			25,842.84
ACT08			149,294.59
ACT09			762,055.20
ACT10			622,927.07
ACT11			495,599.33
ACT12			240,758.76
ACT13			1,697,044.47
ACT14			193,864.71
ACT15			2,420,183.13
ACT16			12,422.47
ACT17			354,823.32
ACT18			512,399.22
ACT19			1,077,213.06
ACT20			1,716,756.17
COM01		19,607.85	169,592.54
COM02		8,917.41	45,916.35
COM03		10,026.75	174,157.21
COM04		8,025.40	70,914.41
COM05		15,178.36	147,340.86
COM06	843.90	7,864.62	124,504.81
COM07		4,603.11	32,429.47
COM08		2,856.62	154,745.30
COM09	73.73	27,764.45	832,174.45
COM10		317,898.66	1,043,031.44
COM11	999.96	232,720.13	750,183.82
COM12		44,082.07	296,979.08
COM13	2,999.85	361,465.05	2,128,062.39
COM14	3,815.03	82,087.73	162,690.45
COM15	446,988.15	1,435,477.23	4,140,276.69
COM16	4,822.64	351.05	20,682.91
COM17	65,564.47	265,552.80	687,129.17
COM18		13,813.98	478,644.23
COM19	598,576.06	11,006.01	685,066.54
COM20	864.35	240,879.92	1,959,868.70
LAB			1,607,749.51
CAP			2,488,845.48
ENT		45,160.96	834,770.65
HH		9,677.83	3,320,133.93
GOVT		1,161.44	776,031.94
YTAX			218,059.65
ITAX			442,677.25
TAR			62,924.67
S-I		264,045.48	1,125,548.14
ROW			3,430,224.91
Total	1,125,548.14	3,430,224.91	

Appendix M

Labour and capital stock by activities in Thailand, 2000

M.1 Quantity of labour employed by activity in Thailand, 2000

Sector	Description	Number of workers
ACT01	Paddy and Maize	4,301,954
ACT02	Cassava, Beans and Nuts	570,585
ACT03	Vegetables, Sugarcane and Fruits	2,769,017
ACT04	Rubber and Latex	997,168
ACT05	Other Crops	962,316
ACT06	Livestock	1,146,515
ACT07	Forestry	252,294
ACT08	Fishery	442,050
ACT09	Mining and Quarrying	68,730
ACT010	Food Manufacturing	929,460
ACT011	Textile Industry	860,159
ACT012	Paper Industries and Printing	101,820
ACT013	Rubber Chemical and Petroleum Industries	690,281
ACT014	Non Metallic Products	200,337
ACT015	Metal Product and Machinery	1,483,844
ACT016	Agricultural Machinery	5,065
ACT017	Other Manufacturing	869,115
ACT018	Electricity, Water Work, Public Utilities	101,630
ACT019	Construction and Trade	6,588,070
ACT020	Service Transportation and Communication	7,104,260

Source: National Statistical Office (2001)

M.2 The quantity of net capital stock of Thailand in each sector, 2000

Sector	Description	Net Capital Stock
ACT01	Paddy and Maize	211,526
ACT02	Cassava, Beans and Nuts	31,719
ACT03	Vegetables, Sugarcane and Fruits	255,477
ACT04	Rubber and Latex	109,524
ACT05	Other Crops	98,921
ACT06	Livestock	145,024
ACT07	Forestry	13,252
ACT08	Fishery	181,324
ACT09	Mining and Quarrying	229,649
ACT010	Food Manufacturing	589,372
ACT011	Textile Industry	380,767
ACT012	Paper Industries and Printing	152,406
ACT013	Rubber Chemical and Petroleum Industries	435,473
ACT014	Non Metallic Products	128,573
ACT015	Metal Product and Machinery	814,478
ACT016	Agricultural Machinery	1,464
ACT017	Other Manufacturing	469,945
ACT018	Electricity, Water Work, Public Utilities	1,253,577
ACT019	Construction and Trade	1,912,144
ACT020	Service Transportation and Communication	9,247,325

Source: Office of National Economic and Social Development Board (2006)

Appendix N

CES and CET

N.1 Constant elasticity of substitution (CES) between domestically produced and import commodities (Armington elasticities)

Sector	Description	CES
COM01	Paddy and Maize	1.0694
COM02	Cassava, Beans and Nuts	1.9097
COM03	Vegetables, Sugarcane and Fruits	1.6296
COM04	Rubber and Latex	0.11
COM05	Other Crops	0.6954
COM06	Livestock	0.7587
COM07	Forestry	0.3646
COM08	Fishery	1.6722
COM09	Mining and Quarrying	0.1151
COM010	Food Manufacturing	1.6171
COM011	Textile Industry	1.463
COM012	Paper Industries and Printing	0.9807
COM013	Rubber Chemical and Petroleum Industries	0.8326
COM014	Non Metallic Products	0.5172
COM015	Metal Product and Machinery	0.9735
COM016	Agricultural Machinery	0.7359
COM017	Other Manufacturing	0.9692
COM018	Electricity, Water Work, Public Utilities	0.953
COM019	Construction and Trade	0.12
COM020	Service Transportation and Communication	0.8486

Source: Warr & Lapiz (1994)

N.2 Elasticity of transformation (CET) between domestically sold and exported commodities

Sector	Description	CET
COM01	Paddy and Maize	0.9777[1/]
COM02	Cassava, Beans and Nuts	0.9546[1/]
COM03	Vegetables, Sugarcane and Fruits	0.1
COM04	Rubber and Latex	0.1
COM05	Other Crops	0.1
COM06	Livestock	0.1
COM07	Forestry	0.1
COM08	Fishery	0.1
COM09	Mining and Quarrying	0.1
COM010	Food Manufacturing	0.1
COM011	Textile Industry	0.1
COM012	Paper Industries and Printing	0.1
COM013	Rubber Chemical and Petroleum Industries	0.1
COM014	Non Metallic Products	0.1
COM015	Metal Product and Machinery	0.1
COM016	Agricultural Machinery	0.1
COM017	Other Manufacturing	0.1
COM018	Electricity, Water Work, Public Utilities	0.1
COM019	Construction and Trade	0.12
COM020	Service Transportation and Communication	0.1

Sources: [1/] Warr & Lapiz (1994)

Wattanakuljarus & Coxhead (2006)

Appendix O

The core GAMS code for CGE model

$title Anuwat's 2000CGE Model of Thailand:20x20 production sectors C-D Production Function

SCALAR SCL /100/ ;

SETS AC global set (SAM accounts and other items)

/ACT01 Paddy and Maize Activity

ACT02 Cassava Beans and Nuts Activity

ACT03 Vegetables Sugarcane and Fruits Activity

ACT04 Rubber and Latex Activity

ACT05 Other Crops Activity

ACT06 Livestock Activity

ACT07 Forestry Activity

ACT08 Fishery Activity

ACT09 Mining and Quarrying Activity

ACT10 Food Manufacturing Activity

ACT11 Textile Industry Activity

ACT12 Paper Industries and Printing Activity

ACT13 Rubber Chemical and Petroleum Industries Activity

ACT14 Non Metallic Products Activity

ACT15 Metal Product and Machinery Activity

ACT16 Agricultural Machinery Activity

ACT17 Other Manufacturing Activity

ACT18 Electricity Water Work Public Utilities Activity

ACT19 Construction and Trade Activity

ACT20 Service Transportation and Communication Activity

COM01 Paddy and Maize Commodity

COM02 Cassava Beans and Nuts Commodity

COM03 Vegetables Sugarcane and Fruits Commodity

COM04 Rubber and Latex Commodity

COM05 Other Crops Commodity

COM06 Livestock Commodity

COM07 Forestry Commodity

COM08 Fishery Commodity

COM09 Mining and Quarrying Commodity

COM10 Food Manufacturing Commodity

COM11 Textile Industry Commodity

COM12 Paper Industries and Printing Commodity

COM13 Rubber Chemical and Petroleum Industries Commodity

COM14 Non Metallic Products Commodity

COM15 Metal Product and Machinery Commodity

COM16 Agricultural Machinery Commodity

COM17 Other Manufacturing Commodity

COM18 Electricity Water Work Public Utilities Commodity

COM19 Construction and Trade Commodity

COM20 Service Transportation and Communication Commodity

LAB labor

CAP capital

HHD household

ENT private enterprise

GOV government

YTAX income tax

ITAX indirect tax less subsidy

TAR import tariff

S-I saving-investment

ROW rest of world

TOTAL total account in SAM /

ACNT(AC) all elements in AC except total

A(AC) activities

/ACT01, ACT02, ACT03, ACT04, ACT05, ACT06, ACT07, ACT08, ACT09, ACT10, ACT11, ACT12, ACT13, ACT14, ACT15, ACT16, ACT17, ACT18, ACT19, ACT20/

C(AC) commodities

/COM01, COM02, COM03, COM04, COM05, COM06, COM07, COM08, COM09, COM10, COM11, COM12, COM13, COM14, COM15, COM16, COM17, COM18, COM19, COM20/

CE(C) exported commodities

/COM01, COM02, COM03, COM04, COM05, COM06, COM07, COM08, COM09, COM10, COM11, COM12, COM13, COM14, COM15, COM16, COM17, COM18, COM19, COM20/

CM(C) imported commodities

/COM01, COM02, COM03, COM04, COM05, COM06, COM07, COM08, COM09, COM10, COM11, COM12, COM13, COM14, COM15, COM16, COM17, COM18, COM19, COM20/

F(AC) factors

/LAB, CAP/

I(AC) institutions

/HHD, ENT, GOV, ROW/

ID(I) domestic institutions no govt

/HHD, ENT/

H(ID) households

/HHD/

ENT(ID) enterprises

/ENT/

;

ALIAS(AC,ACP); ALIAS(C,CP); ALIAS(F,FP); ALIAS(I,IP); ALIAS(H,HH);

ALIAS(ENT,ENTT);

ACNT(AC) = YES; ACNT('TOTAL') = NO; ALIAS(ACNT,ACNTP);

PARAMETERS

ad(A) efficiency parameter in the production fn for activity A alpha(F,A) share of value-added to factor f in activity A

alphaK(A) Cobb-Douglas power of K in the production function of activity a

alphaL(A) Cobb-Douglas power of L in the production function of activity a

aq(C) Armington function shift parameter for commodity C

at(C) CET function shift parameter for commodity C

beta(C,H) share of household consumption spending on commodity C

cpi consumer price index

cwts(C) weight of commodity c in the CPI

deltaq(C) Armington function share parameter for commodity C

deltat(C) CET function share parameter for commodity C

finv foreign investment (Thailand invests abroad)

gsav government saving

ica(C,A) qnty of c as intermediate input per unit of activity A

int(ENT,H) rate of interest payment from HH to firm

pwe(C) export price for C (foreign currency)

pwm(C) import price for C (foreign currency)

qg(C) government demand for commodity C

qinvbar(C) base-year qnty of investment demand for commodity C

rhoq(C) Armington function exponent for commodity C

rhot(C) CET function exponent for commodity C

shryid(ID,F) share for household in the income of factor F

tcap(F) rate of profit tax (tax on CAP)

te(C) rate of export subsidy for commodity C

tent(ENT) rate of income tax for (private) enterprise

theta(A,C) yield of output c per unit of activity A

tia(A) rate of indirect tax less subsidy for activity A

tic(C) rate of indirect tax (sales tax) less subsidy for commodity C

tm(C) rate of import tariff for commodity C

tr(I,IP) transfer from institution ip to institution I

ty(H) rate of income tax for household H

;

TABLE SAM(AC,ACP) social accounting matrix 2000

SAM(AC,ACP) = SAM(AC,ACP)/SCL ;

PARAMETER

tdiff(AC) column minus row total for account AC;

SAM('TOTAL',ACNTP) = SUM(ACNT, SAM(ACNT,ACNTP));

SAM(ACNT,'TOTAL') = SUM(ACNTP, SAM(ACNT,ACNTP));

tdiff(ACNT) = SAM('TOTAL',ACNT)-SAM(ACNT,'TOTAL');

VARIABLES

EG government expenditures

ENTSAV(ENT) saving of enterprise

EXR exchange rate (dom. currency per unit of for. currency)

FSAV foreign savings (foreign currency)

IADJ investment adjustment factor

MPS(H) marginal (and average) propensity to save for household h

PA(A) price of activity a

PD(C) domestic price of domestic output c

PE(C) export price for c (domestic currency)

PM(C) import price for c (domestic currency)

PQ(C) composite commodity price for c

PVA(A) value-added price for activity a

PX(C) producer price for commodity c

QA(A) level of activity a

QD(C) quantity sold domestically of domestic output c

QE(C) quantity of exports for commodity c

QF(F,A) quantity demanded of factor f from activity a

QFS(F) supply of factor f

QH(C,H) quantity consumed of commodity c by household h

QINT(C,A) qnty of commodity c as intermediate input to activity a

QINV(C) quantity of investment demand for commodity c

QM(C) quantity of imports of commodity c

QQ(C) quantity of goods supplied domestically (composite supply)

QX(C) quantity of domestic output of commodity c

WALRAS dummy variable (zero at equilibrium)

WF(F) average price of factor f

WFDIST(F,A) wage distortion factor for factor f in activity a

YENT(ENT) income of enterprises

YF(F) income of factor f

YFID(ID,F) transfer of income to institution no govt from factor f

YG government revenue

YH(H) income of household h

;

EQUATIONS

*=======================PRICE BLOCK=========================

PMDEF(C) import price for commodity c (domestic currency)

PEDEF(C) export price for commodity c (domestic currency)

ABSORB(C) absorption for commodity c

OUTVAL(C) output value for commodity c

PADEF(A) price for activity a

PVADEF(A) value-added price for activity a

*=============PRODUCTION AND COMMODITY BLOCK=============

PRODFN(A) Cobb-Douglas production function for activity a

FACDEM(F,A) demand for factor f from activity a

INTDEM(C,A) intermediate demand for commodity c from activity a

OUTPUTFN(C) output of commodity c

ARMING(C) composite supply (Armington) function for commodity c

IMPDOMRAT(C) import-domestic demand ratio for commodity c

CET(C) output transformation (CET) function for commodity c

EXPDOMRAT(C) export-domestic supply ratio for commodity c

*=====================INSTITUTION BLOCK======================

FACTINC(F) factor income of institutions no govt

```
FACTTRNS(ID,F) transfer of income from factor f to institutions no govt
HHDINC(H) income of household h
HHDEM(C,H) consumption demand for household h & commodity c
ENTINC(ENT) income of enterprise
ENTEXP(ENT) expenditure of enterprise
INVDEM(C) investment demand for commodity c
GOVREV government revenue
GOVEXP government expenditures

*=====================SYSTEM CONSTRAINT BLOCK================
FACTEQ(F) market equilibrium condition for factor f
COMEQ(C) market equilibrium condition for composite commodity c
CURACC current account balance for ROW
SAVINV savings-investment balance
PNORM price normalization
;
*=========================PRICE BLOCK=========================
PMDEF(C)$CM(C).. PM(C) =E= (1 + tm(C))*EXR*pwm(C);
PEDEF(C)$CE(C).. PE(C) =E= (1 - te(C))*EXR*pwe(C);
ABSORB(C).. PQ(C)*QQ(C) =E= (PD(C)*QD(C) + (PM(C)*QM(C))$CM(C))*(1 + tic(C));
OUTVAL(C).. PX(C)*QX(C) =E= PD(C)*QD(C) + (PE(C)*QE(C))$CE(C);
PADEF(A).. PA(A) =E= SUM(C, PX(C)*theta(A,C));
PVADEF(A).. PVA(A) =E= PA(A)*(1-tia(A))- SUM(C, PQ(C)*ica(C,A));

*==================PRODUCTION AND COMMODITY BLOCK=========
PRODFN(A).. QA(A) =E= ad(A)*(QF('LAB',A)**alphaL(A))*QF('CAP',A)**alphaK(A) ;
FACDEM(F,A).. WF(F)*WFDIST(F,A) =E= alpha(F,A)*PVA(A)*QA(A)/QF(F,A);
INTDEM(C,A).. QINT(C,A) =E= ica(C,A)*QA(A);

OUTPUTFN(C).. QX(C) =E= SUM(A, theta(A,C)*QA(A));
ARMING(C).. QQ(C) =E= aq(C)*(deltaq(C)*QM(C)**(-rhoq(C))
 + (1-deltaq(C))*QD(C)**(-rhoq(C)))**(-1/rhoq(C));
```

```
IMPDOMRAT(C).. QM(C)/QD(C) =E= ( (PD(C)/PM(C))*(deltaq(C)/
 (1-deltaq(C))) )**(1/(1 + rhoq(C)));
CET(C).. QX(C) =E= at(C)*(deltat(C)*QE(C)**rhot(C)
 + (1-deltat(C))*QD(C)**rhot(C) )**(1/rhot(C));
EXPDOMRAT(C)$CE(C).. QE(C)/QD(C) =E= ( PE(C)/PD(C)
 *(1-deltat(C))/deltat(C) )**(1/(rhot(C)-1) );

*====================INSTITUTION BLOCK=======================
FACTINC(F).. YF(F) =E= SUM(A, WF(F)*WFDIST(F,A)*QF(F,A));
FACTTRNS(ID,F).. YFID(ID,F) =E= shryid(ID,F)*((1-tcap(F))*YF(F));
HHDINC(H).. YH(H) =E= SUM(F, YFID(H,F)) + tr('HHD','ENT')+ tr(H,'GOV') +
EXR*tr(H,'ROW');
HHDEM(C,H)..QH(C,H) =E= beta(C,H)*(1-MPS(H))*(1-ty(H))*(1-int('ENT',H))
 *YH(H)/PQ(C);
ENTINC(ENT).. YENT(ENT) =E= SUM(F, YFID(ENT,F)) + SUM(H, int(ENT,H)*YH(H))
 + tr(ENT,'GOV') + EXR*tr(ENT,'ROW');
ENTEXP(ENT).. YENT(ENT) - tent(ENT)*YENT(ENT) - EXR*tr('ROW',ENT) =E=
ENTSAV(ENT);

INVDEM(C).. QINV(C) =E= qinvbar(C)*IADJ;
GOVREV.. YG =E= SUM(F, tcap(F)*YF(F)) + EXR*tr('GOV','ROW')
 + SUM(H, ty(H)*(1-int('ENT',H))*YH(H)) + SUM(ENT, tent(ENT)*YENT(ENT))
 + SUM(C, tic(C)*(PD(C)*QD(C) + (PM(C)*QM(C))$CM(C)))
 + SUM(A, tia(A)*(PA(A)*QA(A)))
 + SUM(C$CM(C), tm(C)*EXR*pwm(C)*QM(C))
 + SUM(C$CE(C), te(C)*EXR*pwe(C)*QE(C));

GOVEXP.. EG =E= SUM(C, PQ(C)*qg(C)) + SUM(H, tr(H,'GOV'))
 + SUM(ENT, tr(ENT,'GOV')) + EXR*tr('ROW','GOV');

*====================SYSTEM CONSTRAINT BLOCK================

FACTEQ(F).. SUM(A, QF(F,A)) =E= QFS(F);
```

```
COMEQ(C).. QQ(C) =E= SUM(A, QINT(C,A)) + SUM(H, QH(C,H)) + qg(C) + QINV(C) ;

CURACC.. SUM(C$CE(C), pwe(C)*QE(C)) + SUM(I, tr(I,'ROW')) + FSAV =E=
 SUM(C$CM(C), pwm(C)*QM(C))+ SUM(I, tr('ROW',I)) + finv;


SAVINV.. SUM(H, MPS(H)*(1-ty(H))*(1-int('ENT',H))*YH(H)) + (YG-EG)
 + SUM(ENT, YENT(ENT) - tent(ENT)*YENT(ENT) - tr('ROW',ENT)*EXR)  +
EXR*FSAV  =E= SUM(C, PQ(C)*QINV(C)) + EXR*finv  + WALRAS;


PNORM.. SUM(C, PQ(C)*cwts(C)) =E= cpi;


*==========================MODEL===============================


MODELS CGE1 /ALL/;
DISPLAY SAM, tdiff ;
*=======ASSIGNMENTS FOR PARAMETERS AND VARIABLES============


PARAMETERS
*The following parameters are used to define initial values of model variables.
EG0, ENTSAV0(ENT), EXR0, FSAV0, IADJ0, MPS0(H), PA0(A), PD0(C), PE0(C),
PM0(C),
PQ0(C), PVA0(A), PX0(C), QA0(A), QD0(C), QE0(C), QF0(F,A), QFS0(F),
QH0(C,H), QINT0(C,A), QINV0(C), QM0(C), QQ0(C), QX0(C), WF0(F),
WFDIST0(F,A), YENT0(ENT), YF0(F), YFID0(ID,F), YG0, YH0(H)
;
*===========FACTOR EMPLOYMENT AND PRICES===================


PARAMETERS
*quantity of labour from Table 5, Labour Force Survey Q1 Year 2000 (see Appendix M)
*quantity of capital is from net capital stock of Thailand 2000 (see Appendix M)
;
labor(A) = labor(A)/SCL;
capital(A) = capital(A)/SCL;
PARAMETERS
```

```
wfa(F,A) wage for factor f in activity a (only for calibration)
costgap(F,A) gap calibrated factor cost-SAM value (should be zero)
;
*Defining factor employment and supply
QF0('LAB',A) = labor(A);
QF0('CAP',A) = capital(A);
QFS0(F) = SUM(A, QF0(F,A));
*Computing activity-specific wage, rent
wfa(F,A) = SAM(F,A)/QF0(F,A);

*Computing average wage, rent
WF0(F) = SUM(A, SAM(F,A))/SUM(A, QF0(F,A));

*Computing wage distortion factors
WFDIST0(F,A) = wfa(F,A) / WF0(F);

*Checking calibration
costgap(F,A) = WF0(F)*WFDIST0(F,A)*QF0(F,A)-SAM(F,A);

DISPLAY wfa, costgap;
*===============================PRICE BLOCK====================

PARAMETERS
sigmaq(C) elasticity of substitution bt. dom goods and imports for c
sigmat(C) elasticity of transformation bt. dom sales and exports for c
;
EXR0 = 1;
PA0(A) = 1;
PD0(C) = 1;
PE0(C) = 1;
PM0(C) = 1;
PX0(C) = 1;
```

```
PVA0(A) = SUM(F, SAM(F,A))/SAM(A,'TOTAL')/PA0(A);
tia(A) =  SAM('ITAX',A)/ SAM('TOTAL',A);
tic(C) = SAM('ITAX',C)
 /(SAM('TAR',C) + SAM('ROW',C) + SUM(A, SAM(A,C)) - SAM(C,'ROW') );
PQ0(C) = 1 + tic(C);
QA0(A) = SAM('TOTAL',A)/PA0(A);
QD0(C) = (SUM(A, SAM(A,C))-SAM(C,'ROW'))/PD0(C);
QE0(C) = SAM(C,'ROW')/PE0(C);
QM0(C) = (SAM('ROW',C) + SAM('TAR',C))/PM0(C);
QQ0(C) = (SAM('TOTAL',C)-SAM(C,'ROW'))/PQ0(C);
QX0(C) = SUM(A, SAM(A,C))/PX0(C);
ica(C,A) = SAM(C,A) / QA0(A);
theta(A,C) = (SAM(A,C)/PX0(C)) / QA0(A);
te(C) = 0;
pwe(C) = PE0(C)/((1 + te(C))*EXR0);
tm(C)$CM(C) = SAM('TAR',C)/SAM('ROW',C);
pwm(C)$CM(C) = PM0(C) / ( EXR0*(1 + tm(C)) );

*================PRODUCTION AND COMMODITY BLOCK==========
QINT0(C,A) = SAM(C,A)/PQ0(C);
ica(C,A) = QINT0(C,A) / QA0(A);
alphaK(A) = SAM("CAP",A) / SUM(FP, SAM(FP,A));
alphaL(A) = 1 - alphaK(A) ;
alpha(F,A) = SAM(F,A) / SUM(FP, SAM(FP,A));
ad(A) = QA0(A) / ((QF0('LAB',A)**alphaL(A))*QF0('CAP',A)**alphaK(A)) ;
*share and shift parameters
*CET (see Appendix N)
*CES (see Appendix N)

rhot(C) = 1/sigmat(C) + 1;
rhoq(C) = 1/sigmaq(C) - 1;
```

```
deltat(C)$CE(C) = 1/(1 + (PD0(C)/PE0(C))*(QE0(C)/QD0(C))**(rhot(C)- 1));
at(C)$CE(C) = QX0(C) / ( deltat(C)*QE0(C)**rhot(C)
 + (1-deltat(C))*QD0(C)**rhot(C) )**(1/rhot(C));
deltaq(C)$CM(C) = 1/(1 + (PD0(C)/PM0(C))*(QD0(C)/QM0(C))**(1+rhoq(C)));
aq(C)$CM(C) = QQ0(C) / (deltaq(C)*QM0(C)**(-rhoq(C))
 + (1-deltaq(C))*QD0(C)**(-rhoq(C)))**(-1/rhoq(C));

*========================INSTITUTION BLOCK====================
EG0 = SAM('TOTAL','GOV')-SAM('S-I','GOV');
ENTSAV0(ENT) = SAM('S-I',ENT);
FSAV0 = SAM('S-I','ROW')/EXR0;
IADJ0 = 1;
MPS0(H) = SAM('S-I',H) / (SAM('TOTAL',H) - SAM('YTAX',H) - SAM('ENT',H) );
QH0(C,H) = SAM(C,H)/PQ0(C);
QINV0(C) = SAM(C,'S-I')/PQ0(C);
YENT0(ENT) = SAM('TOTAL',ENT);
YF0(F) = SAM('TOTAL',F);
YFID0(ID,F) = SAM(ID,F);
YG0 = SAM('GOV','TOTAL');
YH0(H) = SAM('TOTAL',H);

beta(C,H) = SAM(C,H)/SUM(CP,SAM(CP,H));
int(ENT,H) = SAM(ENT,H)/SAM('TOTAL',H);
finv = SAM('ROW','S-I')/EXR0;
qg(C) = SAM(C,'GOV')/PQ0(C);
qinvbar(C) = SAM(C,'S-I')/PQ0(C);
shryid(ID,F) = SAM(ID,F)/(SAM('TOTAL',F)-SAM('GOV',F));
tcap(F) = SAM('GOV',F)/SAM('TOTAL',F);
tent(ENT) = SAM('YTAX',ENT)/SAM('TOTAL',ENT);
tr('HHD','GOV') = SAM('HHD','GOV');
tr(I,'ROW') = SAM(I,'ROW')/EXR0;
tr('GOV','ROW') = SAM('GOV','ROW');
```

```
tr('ENT','GOV') = SAM('ENT','GOV');
tr('ENT','ROW') = SAM('ENT','ROW');
tr('ROW',ENT) = SAM('ROW',ENT);
tr('ROW',I) = SAM('ROW',I);
ty(H) = SAM('YTAX',H)/(SAM('TOTAL',H) - SAM('ENT',H)) ;

*=====================SYSTEM CONSTRAINT BLOCK===============
cwts(C) = SUM(H, SAM(C,H)) / SUM((CP,H), SAM(CP,H));
cpi = SUM(C, cwts(C)*PQ0(C));
*=========================INITIALIZATION======================
EG.L = EG0;
ENTSAV.L(ENT) = ENTSAV0(ENT);
EXR.L = EXR0;
FSAV.L = FSAV0;
IADJ.L = IADJ0;
MPS.L(H) = MPS0(H);
PA.L(A) = PA0(A);
PD.L(C) = PD0(C);
PE.L(C) = PE0(C);
PM.L(C) = PM0(C);
PQ.L(C) = PQ0(C);
PVA.L(A) = PVA0(A);
PX.L(C) = PX0(C);
QA.L(A) = QA0(A);
QD.L(C) = QD0(C);
QE.L(C) = QE0(C);
QF.L(F,A) = QF0(F,A);
QFS.L(F) = QFS0(F);
QH.L(C,H) = QH0(C,H);
QINT.L(C,A) = QINT0(C,A);
QINV.L(C) = QINV0(C);
QM.L(C) = QM0(C);
```

```
QQ.L(C) = QQ0(C);

QX.L(C) = QX0(C);

WF.L(F) = WF0(F);

WFDIST.L(F,A) = WFDIST0(F,A);

YENT.L(ENT) = YENT0(ENT);

YF.L(F) = YF0(F);

YFID.L(ID,F) = YFID0(ID,F);

YG.L = YG0;

YH.L(H) = YH0(H);


DISPLAY

ad, alpha, aq, at, beta, deltaq, deltat, cpi, cwts, ica, int, pwe, pwm, shryid, theta, qg, qinvbar,
rhoq, rhot, sigmaq, sigmat, tcap, te, tent, tia, tic, tm, tr, ty, finv,

EG.L, ENTSAV.L, EXR.L, FSAV.L, IADJ.L, MPS.L, PA.L, PD.L, PE.L, PM.L,

PQ.L, PVA.L, PX.L, QA.L, QD.L, QE.L, QF.L, QFS.L, QH.L, QINT.L, QINV.L, QM.L,
QQ.L, QX.L, WF.L, WFDIST.L, YENT.L, YF.L, YFID.L, YG.L, YH.L,

alphaK, alphaL

;


*====================SELECTING CLOSURES=====================

*=================A.SAVINGS-INVESTMENT BALANCE=============

SCALAR

SICLOS savings-investment closure /2/

*Select 1 or 2

*if SICLOS = 1, savings is investment-driven

*if SICLOS = 2, investment is savings-driven

IF(SICLOS EQ 1,

*Investment-driven savings-MPS('N-HHD', 'G-HHD') is flexible, permitting

*the savings value to adjust.

IADJ.FX = IADJ0;

MPS.FX('HHD') = MPS0('HHD');

MPS.FX('HHD') = MPS0('HHD');

MPS.LO('HHD') = -INF;
```

```
MPS.UP('HHD') = +INF;
MPS.L('HHD') = MPS0('HHD');
);
IF(SICLOS EQ 2,
*Savings-driven investment-IADJ is flexible, permitting
*investment quantities and the investment value to adjust.
MPS.FX(H) = MPS0(H);
IADJ.LO = -INF;
IADJ.UP = +INF;
IADJ.L = IADJ0;
);
*===========================B.*FACTOR MARKETS===============
SCALARS
CAPCLOS closure for capital market /2/
*Select 1 or 2
*if CAPCLOS = 1, capital is mobile and fully employed
*if CAPCLOS = 2, capital is activity-specific and fully employed

IF(CAPCLOS EQ 1,
*Capital is fully employed and mobile. WF('CAP') is the market-clearing
*variable for the unified capital market.
WFDIST.FX('CAP',A) = WFDIST0('CAP',A);
WF.LO('CAP') = -INF;
WF.UP('CAP') = +INF;
WF.L('CAP') = WF0('CAP');
QF.LO('CAP',A) = -INF;
QF.UP('CAP',A) = +INF;
QF.L('CAP',A) = QF0('CAP',A);
QFS.FX('CAP') = QFS0('CAP');
);
IF(CAPCLOS EQ 2,
*Capital is unemployed and activity-specific.
```

```
*WFDIST('CAP',A) is the market-clearing variable, one for
*each segment of the capital market.
WFDIST.LO('CAP',A) = -INF;
WFDIST.UP('CAP',A) = +INF;
WFDIST.L('CAP',A) = WFDIST0('CAP',A);
WF.FX('CAP') = WF0('CAP');
QF.FX('CAP',A) = QF0('CAP',A);
*QFS.LO('CAP') = -INF;
*QFS.UP('CAP') = +INF;
QFS.L('CAP') = QFS0('CAP');
);
IF(CAPCLOS EQ 3,
*Capital is underutilized and mobile. For each activity
*WFDIST('CAP',A)*WF('CAP'), is fixed. QFS('CAP') is the market-clearing
*variable for the unified labor market.
WFDIST.LO('CAP',A) = -INF;
WFDIST.UP('CAP',A) = +INF;
WFDIST.FX('CAP',A) = WFDIST0('CAP',A);
WF.FX('CAP') = WF0('CAP');
QF.LO('CAP',A) = -INF;
QF.UP('CAP',A) = +INF;
QF.L('CAP',A) = QF0('CAP',A);
QFS.LO('CAP') = -INF;
QFS.UP('CAP') = +INF;
QFS.L('CAP') = QFS0('CAP');
);

SCALAR
LABCLOS closure for labor market /1/
*Select 1 or 2 or 3
*if LABCLOS = 1, labor is mobile and fully employed
*if LABCLOS = 2, labor is mobile and unemployed (fixed wages)
```

```
*if LABCLOS = 3, use to sim labor movement from one sector to another

IF(LABCLOS EQ 1,
*Labor is fully employed and mobile. WF('LAB') is the market-clearing
*variable for the unified capital market.
WFDIST.FX('LAB',A) = WFDIST0('LAB',A);
WF.LO('LAB') = -INF;
WF.UP('LAB') = +INF;
WF.L('LAB') = WF0('LAB');
QF.LO('LAB',A) = -INF;
QF.UP('LAB',A) = +INF;
QF.L('LAB',A) = QF0('LAB',A);
QFS.FX('LAB') = QFS0('LAB');
);
IF(LABCLOS EQ 2,
*Labor is unemployed and mobile. For each activity, the wage,
*WFDIST('LAB',A)*WF('LAB'), is fixed. QFS('LAB') is the market-clearing
*variable for the unified labor market.
WFDIST.FX('LAB',A) = WFDIST0('LAB',A);
WF.FX('LAB') = WF0('LAB');
QF.LO('LAB',A) = -INF;
QF.UP('LAB',A) = +INF;
QF.L('LAB',A) = QF0('LAB',A);
QFS.LO('LAB') = -INF;
QFS.UP('LAB') = +INF;
QFS.L('LAB') = QFS0('LAB');
);
IF(LABCLOS EQ 3,
*Labor is fully employed and activity-specific.
*WFDIST('lAB',A) is the market-clearing variable, one for
*each segment of the labor market.
*WF('LAB') AND QF('LAB') are fixed
```

```
WFDIST.L('LAB',A) = WFDIST0('LAB',A);
WFDIST.LO('LAB',A) = -INF;
WFDIST.UP('LAB',A) = +INF;
WF.LO('LAB') = -INF;
WF.UP('LAB') = +INF;
WF.FX('LAB') = WF0('LAB');
QF.LO('LAB',A) = -INF;
QF.UP('LAB',A) = +INF;
QF.FX('LAB',A) = QF0('LAB',A);
QFS.L('LAB') = QFS0('LAB');
QFS.LO('LAB') = -INF;
QFS.UP('LAB') = +INF;
);
*==============C.*THE FOREIGN EXCHANGE MARKET================
SCALAR
ROWCLOS rest-of-world closure /1/
*Select 1 or 2
*if ROWCLOS = 1, exchange rate is flexible
*if ROWCLOS = 2, foreign savings is flexible
;
IF(ROWCLOS EQ 1,
*Foreign savings is fixed. A flexible exchange rate clears
*the current account of the balance of payments.
FSAV.FX = FSAV0;
EXR.LO = -INF;
EXR.UP = +INF;
EXR.L = EXR0;
);
IF(ROWCLOS EQ 2,
*The exchange rate is fixed. Flexible foreign savings clears
*the current account of the balance of payments.
EXR.FX = EXR0;
```

```
FSAV.LO = -INF;
FSAV.UP = +INF;
FSAV.L = FSAV0;
);

DISPLAY SICLOS, CAPCLOS, LABCLOS, ROWCLOS ;
*=================SOLVE STATEMENT FOR BASE=================

CGE1.HOLDFIXED = 1;
OPTION NLP = CONOPT3 ;
OPTION Iterlim = 5000 ;
*OPTION DECIMALS = 4 ;
SOLVE CGE1 USING CNS ;
*===========================================================
*$INCLUDE REP.INC
*=========================SIMULATIONS=======================

PARAMETERS

EGREP government expenditures
ENTSAVREP(ENT) enterprise's saving
EXRREP exchange rate (dom. cur. per unit of for. cur.)
FSAVREP foreign savings (foreign currency)
IADJREP investment adjustment factor
MPSREP(H) marginal (and avg) propensity to save for household h
PAREP(A) price of activity a
PDREP(C) domestic price of domestic output c
PEREP(C) export price for c (domestic currency)
PMREP(C) import price for c (domestic currency)
PQREP(C) composite commodity price for c
PVAREP(A) value-added price for activity a
PXREP(C) producer price for commodity c
```

QAREP(A) level of activity a

QDREP(C) quantity sold domestically of domestic output c

QEREP(C) quantity of exports for commodity c

QFREP(F,A) demand for factor f from activity a

QFSREP(F) supply of factor f for sim

QHREP(C,H) consumption of commodity c by household h

QINTREP(C,A) qnty of commodity c as intermed. input for activity a

QINVREP(C) quantity of investment by commodity of origin c

QMREP(C) quantity of imports for commodity c

QQREP(C) quantity of goods supplied domestically ("composite supply")

QXREP(C) quantity of domestic output of commodity c

WFREP(F) average price of factor f

WFAREP(F,A) price of factor f for activity a

WFDISTREP(F,A) wage distortion factor for factor f in activity a

YENTREP(ENT) enterprise's income

YFREP(F) income of institutions from factor f

YFIDREP(ID,F) income of household h from factor f

YGREP government revenue

YHREP(H) income of household h

WALRASREP dummy variable (zero at equilibrium)

;

EGREP = EG.L;

ENTSAVREP(ENT) = ENTSAV.L(ENT);

EXRREP = EXR.L;

FSAVREP = FSAV.L;

IADJREP = IADJ.L;

MPSREP(H) = MPS.L(H);

PAREP(A) = PA.L(A);

PDREP(C) = PD.L(C);

PEREP(CE) = PE.L(CE);

PMREP(CM) = PM.L(CM);

PQREP(C) = PQ.L(C);

```
PVAREP(A) = PVA.L(A);
PXREP(C) = PX.L(C);
QAREP(A) = QA.L(A);
QDREP(C) = QD.L(C);
QEREP(CE) = QE.L(CE);
QFREP(F,A) = QF.L(F,A);
QFSREP(F) = QFS.L(F);
QHREP(C,H) = QH.L(C,H);
QINTREP(C,A) = QINT.L(C,A);
QINVREP(C) = QINV.L(C);
QMREP(CM) = QM.L(CM);
QQREP(C) = QQ.L(C);
QXREP(C) = QX.L(C);
WFREP(F) = WF.L(F);
WFAREP(F,A) = WF.L(F)*WFDIST.L(F,A);
WFDISTREP(F,A) = WFDIST.L(F,A);
YENTREP(ENT) = YENT.L(ENT);
YFREP(F) = YF.L(F);
YFIDREP(ID,F) = YFID.L(ID,F);
YGREP = YG.L;
YHREP(H) = YH.L(H);
WALRASREP = WALRAS.L;

SETS
ACGDP GDP items
/
GDPMP1 GDP at market prices (from spending side)
PRVCON private consumption
GOVCON government consumption
INVEST investment
EXP exports of goods and services
IMP imports of goods and services
```

```
NITAX net indirect taxes
GDPFC GDP at factor prices
GDPMP2 GDP at market prices (from income side)
GDPGAP gap bt alternative calculations for GDP at market prices
/
ACGDP1(ACGDP) components of GDP at market prices
/
PRVCON private consumption
GOVCON government consumption
INVEST investment
EXP exports of goods and services
IMP imports of goods and services
/
;
PARAMETER
GDPREP(*) nominal GDP data;
*GDP data
GDPREP('PRVCON') = SUM((C,H), PQ.L(C)*QH.L(C,H));
GDPREP('GOVCON') = SUM(C, PQ.L(C)*qg(C));
GDPREP('INVEST') = SUM(C, PQ.L(C)*QINV.L(C));
GDPREP('EXP') = SUM(C, EXR.L*pwe(C)*QE.L(C));
GDPREP('IMP') = - SUM(C, EXR.L*pwm(C)*QM.L(C));
GDPREP('GDPFC') = SUM((F,A), WF.L(F)*WFDIST.L(F,A)*QF.L(F,A));
GDPREP('NITAX')
= SUM(C, tic(C)*(PD.L(C)*QD.L(C) + (PM.L(C)*QM.L(C))$CM(C)))
+ SUM(A, tia(A)*(PA.L(A)*QA.L(A)))
+ SUM(C$CM(C), tm(C)*EXR.L*pwm(C)*QM.L(C))
+ SUM(C$CE(C), te(C)*EXR.L*pwe(C)*QE.L(C));

*Processing GDP data
GDPREP('GDPMP1') = SUM(ACGDP1, GDPREP(ACGDP1)) ;
GDPREP('GDPMP2') = GDPREP('GDPFC') + GDPREP('NITAX') ;
```

```
GDPREP('GDPGAP') = GDPREP('GDPMP1')-GDPREP('GDPMP2') ;

*==========================Simulations===========================
*1.==SIM1==increase alphaK by 5% in each agricultural sector==> Closures 2,2,1,1===
*alphaL decrease =1-alphaK ==> Closure 2,2,1,1
*1.1 increase alphaK by 5% in ACT01
*alphaK('ACT01') = alphaK('ACT01')*1.05 ;
*alphaL('ACT01') = 1-alphaK('ACT01') ;
*1.2 increase alphaK by 5% in ACT02
*alphaK('ACT02') = alphaK('ACT02')*1.05 ;
*alphaL('ACT02') = 1-alphaK('ACT02') ;
*1.3 increase alphaK by 5% in ACT03
*alphaK('ACT03') = alphaK('ACT03')*1.05 ;
*alphaL('ACT03') = 1-alphaK('ACT03') ;
*1.4 increase alphaK by 5% in ACT04
*alphaK('ACT04') = alphaK('ACT04')*1.05 ;
*alphaL('ACT04') = 1-alphaK('ACT04') ;
*1.5 increase alphaK by 5% in ACT05
*alphaK('ACT05') = alphaK('ACT05')*1.05 ;
*alphaL('ACT05') = 1-alphaK('ACT05') ;
*1.6 increase alphaK by 5% in ACT06
*alphaK('ACT06') = alphaK('ACT06')*1.05 ;
*alphaL('ACT06') = 1-alphaK('ACT06') ;
*1.7 increase alphaK by 5% in ACT07
*alphaK('ACT07') = alphaK('ACT07')*1.05 ;
*alphaL('ACT07') = 1-alphaK('ACT07') ;
*1.8 increase alphaK by 5% in ACT08
*alphaK('ACT08') = alphaK('ACT08')*1.05 ;
*alphaL('ACT08') = 1-alphaK('ACT08') ;

*2==SIM2=Capital stock increase in each agricultural sector=> Closures 2,2,1,1==
*2.1 Capital stock increase in ACT01 by 5%
```

```
*QF.FX('CAP','ACT01') = QF0('CAP','ACT01')*1.05 ;
*2.2 Capital stock increase in ACT02 by 5%
*QF.FX('CAP','ACT02') = QF0('CAP','ACT02')*1.05 ;
*2.3 Capital stock increase in ACT03 by 5%
*QF.FX('CAP','ACT03') = QF0('CAP','ACT03')*1.05 ;
*2.4 Capital stock increase in ACT04 by 5%
*QF.FX('CAP','ACT04') = QF0('CAP','ACT04')*1.05 ;
*2.5 Capital stock increase in ACT05 by 5%
*QF.FX('CAP','ACT05') = QF0('CAP','ACT05')*1.05 ;
*2.6 Capital stock increase in ACT06 by 5%
*QF.FX('CAP','ACT06') = QF0('CAP','ACT06')*1.05 ;
*2.7 Capital stock increase in ACT07 by 5%
*QF.FX('CAP','ACT07') = QF0('CAP','ACT07')*1.05 ;
*2.8 Capital stock increase in ACT08 by 5%
*QF.FX('CAP','ACT08') = QF0('CAP','ACT08')*1.05 ;

*3==SIM3= import tariff for sector COM16 is equal to zero=> Closures 2,2,1,1======
*tm('COM16') = tm('COM16')*0 ;

*4. SIM 1➔ SIM 1 + SIM 2 + SIM 3 ====================================
SOLVE CGE1 USING CNS;
*$INCLUDE CRT.INC
DISPLAY
EGREP, ENTSAVREP, EXRREP, FSAVREP, IADJREP, MPSREP, PAREP, PDREP,
PEREP, PMREP, PQREP, PVAREP, PXREP, QAREP, QDREP, QEREP, QFREP, QFSREP,
QHREP, QINTREP, QINVREP, QMREP, QQREP, QXREP, WFREP, WFAREP,
WFDISTREP, YENTREP, YFREP, YFIDREP, YGREP, YHREP, GDPREP, WALRASREP
;

PARAMETERS

EGCRT government expenditures
ENTSAVCRT(ENT) enterprise's saving
```

EXRCRT exchange rate (dom. cur. per unit of for. cur.)

FSAVCRT foreign savings (foreign currency)

IADJCRT investment adjustment factor

MPSCRT(H) marginal (and avg) propensity to save for household h

PACRT(A) price of activity a

PDCRT(C) domestic price of domestic output c

PECRT(C) export price for c (domestic currency)

PMCRT(C) import price for c (domestic currency)

PQCRT(C) composite commodity price for c

PVACRT(A) value-added price for activity a

PXCRT(C) producer price for commodity c

QACRT(A) level of activity a

QDCRT(C) quantity sold domestically of domestic output c

QECRT(C) quantity of exports for commodity c

QFCRT(F,A) demand for factor f from activity a

QFSCRT(F) supply of factor f for sim

QHCRT(C,H) consumption of commodity c by household h

QINTCRT(C,A) qnty of commodity c as intermed. input for activity a

QINVCRT(C) quantity of investment by commodity of origin c

QMCRT(C) quantity of imports for commodity c

QQCRT(C) quantity of goods supplied domestically ("composite supply")

QXCRT(C) quantity of domestic output of commodity c

WFCRT(F) average price of factor f

WFACRT(F,A) price of factor f for activity a

WFDISTCRT(F,A) wage distortion factor for factor f in activity a

YENTCRT(ENT) enterprise's income

YFCRT(F) income of institutions from factor f

YFIDCRT(ID,F) income of household h from factor f

YGCRT government revenue

YHCRT(H) income of household h

WALRASCRT dummy variable (zero at equilibrium)

GDPCRT(*) nominal GDP data

```
;
EGCRT = EG.L;
ENTSAVCRT(ENT) = ENTSAV.L(ENT);
EXRCRT = EXR.L;
FSAVCRT = FSAV.L;
IADJCRT = IADJ.L;
MPSCRT(H) = MPS.L(H);
PACRT(A) = PA.L(A);
PDCRT(C) = PD.L(C);
PECRT(CE) = PE.L(CE);
PMCRT(CM) = PM.L(CM);
PQCRT(C) = PQ.L(C);
PVACRT(A) = PVA.L(A);
PXCRT(C) = PX.L(C);
QACRT(A) = QA.L(A);
QDCRT(C) = QD.L(C);
QECRT(CE) = QE.L(CE);
QFCRT(F,A) = QF.L(F,A);
QFSCRT(F) = QFS.L(F);
QHCRT(C,H) = QH.L(C,H);
QINTCRT(C,A) = QINT.L(C,A);
QINVCRT(C) = QINV.L(C);
QMCRT(CM) = QM.L(CM);
QQCRT(C) = QQ.L(C);
QXCRT(C) = QX.L(C);
WFCRT(F) = WF.L(F);
WFACRT(F,A) = WF.L(F)*WFDIST.L(F,A);
WFDISTCRT(F,A) = WFDIST.L(F,A);
YENTCRT(ENT) = YENT.L(ENT);
YFCRT(F) = YF.L(F);
YFIDCRT(ID,F) = YFID.L(ID,F);
YGCRT = YG.L;
```

```
YHCRT(H) = YH.L(H);
WALRASCRT = WALRAS.L;


*GDP data
GDPCRT('PRVCON') = SUM((C,H), PQ.L(C)*QH.L(C,H));
GDPCRT('GOVCON') = SUM(C, PQ.L(C)*qg(C));
GDPCRT('INVEST') = SUM(C, PQ.L(C)*QINV.L(C));
GDPCRT('EXP') = SUM(C, EXR.L*pwe(C)*QE.L(C));
GDPCRT('IMP') = - SUM(C, EXR.L*pwm(C)*QM.L(C));
GDPCRT('GDPFC') = SUM((F,A), WF.L(F)*WFDIST.L(F,A)*QF.L(F,A));
GDPCRT('NITAX')
= SUM(C, tic(C)*(PD.L(C)*QD.L(C) + (PM.L(C)*QM.L(C))$CM(C)))
+ SUM(A, tia(A)*(PA.L(A)*QA.L(A)))
+ SUM(C$CM(C), tm(C)*EXR.L*pwm(C)*QM.L(C))
+ SUM(C$CE(C), te(C)*EXR.L*pwe(C)*QE.L(C));


*Processing GDP data
GDPCRT('GDPMP1') = SUM(ACGDP1, GDPCRT(ACGDP1));
GDPCRT('GDPMP2') = GDPCRT('GDPFC') + GDPCRT('NITAX') ;
GDPCRT('GDPGAP') = GDPCRT('GDPMP1')-GDPCRT('GDPMP2');


DISPLAY
EGCRT, ENTSAVCRT, EXRCRT, FSAVCRT, IADJCRT, MPSCRT, PACRT, PDCRT,
PECRT, PMCRT, PQCRT, PVACRT, PXCRT, QACRT, QDCRT, QECRT, QFCRT,
QFSCRT, QHCRT, QINTCRT, QINVCRT, QMCRT, QQCRT, QXCRT, WFCRT,
WFACRT, WFDISTCRT, YENTCRT, YFCRT, YFIDCRT, YGCRT, YHCRT, GDPCRT,
WALRASCRT;


DISPLAY
EGREP, EGCRT, ENTSAVREP, ENTSAVCRT, EXRREP, EXRCRT, FSAVREP,
FSAVCRT, IADJREP, IADJCRT, MPSREP, MPSCRT, PAREP, PACRT, PDREP, PDCRT,
PEREP, PECRT, PMREP, PMCRT, PQREP, PQCRT, PVAREP, PVACRT, PXREP,
PXCRT, QAREP, QACRT, QDREP, QDCRT, QEREP, QECRT, QFREP, QFCRT,
QFSREP, QFSCRT, QHREP, QHCRT, QINTREP, QINTCRT, QINVREP, QINVCRT,
QMREP, QMCRT, QQREP, QQCRT, QXREP, QXCRT, WFREP, WFCRT, WFAREP,
WFACRT, WFDISTREP, WFDISTCRT, YENTREP, YENTCRT,
```

```
YFREP, YFCRT, YFIDREP, YFIDCRT, YGREP, YGCRT, YHREP, YHCRT, GDPREP,
GDPCRT, WALRASREP, WALRASCRT, alphaL, alphaK, ad, tm, MPS.L ;


FILE results /results.cvs/;

results.nd = 5;

results.pc = 5;

put results;

put 0,0, "GDPREP", "GDPCRT"/;

loop(ACGDP,

 put ACGDP.tl, 0, GDPREP(ACGDP), GDPCRT(ACGDP)/);


put 0,0, "YGREP", "YGCRT"/;

loop(AC,

 put AC.tl, 0, YGREP, YGCRT/);


put 0,0, "EGREP", "EGCRT" /;

loop(AC,

 put AC.tl, 0, EGREP, EGCRT/);


put 0,0, "IADJREP", "IADJCRT"/;

loop(AC,

 put AC.tl, 0, IADJREP, IADJCRT/);


put 0,0, "FSAVREP", "FSAVCRT"/;

loop(AC,

 put AC.tl, 0, FSAVREP, FSAVCRT/);


put 0,0, "EXRREP", "EXRCRT"/;

loop(AC,

 put AC.tl, 0, EXRREP, EXRCRT/);


put 0,0, "YFREP", "YFCRT"/;
```

```
loop(F,
 put F.tl, 0, YFREP(F), YFCRT(F)/);

put 0,0, "QFREP", "QFCRT"/;
loop((F,A),
 put F.tl, A.tl, QFREP(F,A), QFCRT(F,A)/);

put 0,0, "WFREP",  "WFCRT"/;
loop(F,
 put F.tl, 0, WFREP(F), WFCRT(F)/);

put 0,0,"WFDISTREP", "WFDISTCRT"/;
loop((F,A),
 put F.tl, A.tl, WFDISTREP(F,A), WFDISTCRT(F,A)/);

put 0,0, "QFSREP", "QFSCRT"/;
loop(F,
 put F.tl, 0, QFSREP(F), QFSCRT(F)/);

put 0, 0 "WFAREP", "WFACRT"/;
loop((F,A),
 put F.tl, A.tl, WFAREP(F,A), WFACRT(F,A)/);

put 0,0, "YFIDREP", "YFIDCRT"/;
loop((ID,F),
 put ID.tl, F.tl, YFIDREP(ID,F), YFIDCRT(ID,F)/);

put 0,0, "QINVREP", "QINVCRT"/;
loop(C,
 put C.tl, 0, QINVREP(C), QINVCRT(C)/);

put 0,0, "YHREP", "YHCRT"/;
```

```
loop(H,
 put H.tl, 0, YHREP(H), YHCRT(H)/);

put 0,0,"QHREP", "QHCRT"/;
loop((C,H),
 put C.tl, H.tl, QHREP(C,H), QHCRT(C,H)/);

put 0,0, "MPSREP", "MPSCRT"/;
loop(H,
 put H.tl,  0, MPSREP(H), MPSCRT(H)/);

put 0,0, "YENTREP", "YENTCRT"/;
loop(ENT,
 put ENT.tl, 0, YENTREP(ENT), YENTCRT(ENT)/);

put 0,0, "ENTSAVREP", "ENTSAVCRT"/;
loop(ENT,
 put ENT.tl, 0, ENTSAVREP(ENT), ENTSAVCRT(ENT)/);

put 0,0, "QEREP", "QECRT"/;
loop(CE,
 put CE.tl, 0, QEREP(CE), QECRT(CE)/);

put 0,0, "PEREP", "PECRT"/;
loop(CE,
 put CE.tl, 0, PEREP(CE), PECRT(CE)/);

put 0,0, "QMREP", "QMCRT"/;
loop(CM,
 put CM.tl, 0, QMREP(CM), QMCRT(CM)/);

put 0,0, "PMREP", "PMCRT"/;
```

```
loop(CM,
 put CM.tl, 0, PMREP(CM), PMCRT(CM)/);

put 0,0, "QXREP", "QXCRT"/;
loop(C,
 put C.tl, 0, QXREP(C), QXCRT(C)/);

put 0,0, "PXREP", "PXCRT"/;
loop(C,
 put C.tl, 0, PXREP(C), PXCRT(C)/);

put 0,0, "QQREP", "QQCRT"/;
loop(C,
 put C.tl, 0, QQREP(C), QQCRT(C)/);

put 0,0, "PQREP", "PQCRT"/;
loop(C,
 put C.tl, 0, PQREP(C), PQCRT(C)/);

put 0,0, "QDREP", "QDCRT"/;
loop(C,
 put C.tl, 0, QDREP(C), QDCRT(C)/);

put 0,0, "PDREP", "PDCRT" /;
loop(C,
 put C.tl, 0, PDREP(C), PDCRT(C)/);

put 0,0, "QAREP", "QACRT"/;
loop(A,
 put A.tl, 0, QAREP(A), QACRT(A)/);

put 0,0, "PAREP", "PACRT" /;
```

```
loop(A,
 put A.tl, 0, PAREP(A), PACRT(A)/);

put 0,0, "PVAREP", "PVACRT"/;
loop(A,
 put A.tl, 0, PVAREP(A), PVACRT(A)/);

put 0,0,"QINTREP", "QINTCRT"/;
loop((C,A),
 put C.tl, A.tl, QINTREP(C,A), QINTCRT(C,A)/);
```

Appendix P Results of Simulations 1 and 1.1 – 1.8

P.1 Percentage change of level of activity (QA), quantity of domestic output (QX), quantity of export (QE), output c sold domestically (QD), quantity of import (QM) and composite commodity (QQ) from results of Simulations 1.1 – 1.8 compared with base year

Sector	Simulation 1.1 (%Δ)						Simulation 1.2 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	-10.87	-1.51	-2.45	-1.39	-0.20	-1.38	0.61	-0.01	-0.22	0.02	0.28	0.02
2. Cassava, Beans and Nuts	4.20	1.18	1.34	1.13	0.69	1.02	-	-3.19	-3.61	-3.06	-1.95	-2.79
3. Vegetables, Sugarcane and Fruits	1.00	-0.04	-0.04	-0.04	-0.01	-0.04	0.25	-0.19	-0.21	-0.19	0.08	-0.18
4. Rubber and Latex	0.01	-0.09	0.08	-0.11	-0.40	-0.11	0.02	-0.14	-0.08	-0.15	-0.20	-0.15
5. Other Crops	0.48	-0.36	0.24	-0.45	-5.08	-1.39	0.05	-0.20	0.03	-0.24	-2.09	-0.61
6. Livestock	0.26	-0.25	-0.30	-0.24	0.21	-0.24	-0.02	-0.08	-0.09	-0.08	-0.03	-0.08
7. Forestry	1.25	0.20	0.21	0.19	0.13	0.17	0.36	-0.05	-0.05	-0.05	-0.03	-0.04
8. Fishery	0.72	-0.04	7.30	-0.14	0.35	-0.14	0.03	-0.12	7.21	-0.22	0.27	-0.22
9. Mining and Quarrying	-0.19	-0.03	-0.01	-0.03	-0.06	-0.04	-0.12	-0.15	-0.16	-0.15	-0.14	-0.15
10. Food Manufacturing	0.16	-1.58	-1.69	-1.52	1.37	-0.92	-0.02	-0.24	-0.25	-0.23	0.08	-0.16
11. Textile Industry	0.43	0.27	0.28	0.26	-0.05	0.20	0.03	-0.03	-0.03	-0.03	-0.05	-0.03
12. Paper Industries and Printing	0.09	0.04	0.03	0.04	0.06	0.04	-	-0.04	-0.05	-0.04	-0.04	-0.04
13. Rubber Chemical and Petroleum Industries	-0.11	-0.07	-0.02	-0.08	-0.65	-0.25	-0.15	-0.11	-0.11	-0.11	-0.12	-0.11
14. Non Metallic Products	0.24	0.02	0.01	0.04	0.17	0.06	-0.14	-0.13	-0.13	-0.12	-0.07	-0.11
15. Metal Product and Machinery	0.10	0.07	0.08	0.07	-	0.03	-0.08	-0.09	-0.09	-0.09	-0.11	-0.10
16. Agricultural Machinery	-10.23	-2.81	-3.90	-2.77	-1.83	-2.35	-4.00	-1.18	-2.25	-1.15	-0.55	-0.88
17. Other Manufacturing	0.06	0.08	0.08	0.07	-0.04	0.02	-0.10	-0.08	-0.08	-0.08	-0.09	-0.08
18. Electricity, Water Work and Public Utilities	0.26	0.02	-0.07	0.03	0.15	0.03	-0.14	-0.14	-0.22	-0.13	-0.04	-0.13
19. Construction and Trade	0.02	0.05	-0.01	0.05	0.04	0.05	-0.04	-0.13	-0.20	-0.13	-0.13	-0.13
20. Service Transportation and Communication	-0.04	0.08	0.11	0.08	-0.20	0.04	-0.18	-0.13	-0.13	-0.12	-0.03	-0.11

Sector	Simulation 1.3 (%Δ)						Simulation 1.4 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	1.27	0.21	-0.21	0.27	0.81	0.27	0.10	0.06	0.02	0.07	0.12	0.07
2. Cassava, Beans and Nuts	2.10	0.61	0.77	0.56	0.14	0.46	0.37	0.12	0.11	0.12	0.13	0.12
3. Vegetables, Sugarcane and Fruits	-10.28	-0.31	-0.34	-0.30	0.25	-0.28	0.07	0.06	0.06	0.06	-0.04	0.05
4. Rubber and Latex	0.07	-	-0.16	0.02	0.20	0.02	-9.78	0.08	-0.05	0.10	0.20	0.10
5. Other Crops	0.26	-0.10	0.27	-0.15	-3.06	-0.74	-0.03	0.05	0.14	0.04	-0.68	-0.10
6. Livestock	0.05	0.15	0.15	0.15	0.19	0.15	0.05	0.08	0.09	0.08	-	0.08
7. Forestry	0.62	0.11	0.12	0.11	0.06	0.09	0.32	0.11	0.12	0.11	0.11	0.11
8. Fishery	0.26	0.07	7.41	-0.03	0.55	-0.03	-0.06	0.08	7.45	-0.02	0.12	-0.02
9. Mining and Quarrying	-0.36	0.05	0.08	0.05	0.03	0.04	0.49	0.15	0.18	0.15	0.11	0.14
10. Food Manufacturing	0.30	-0.28	-0.31	-0.27	0.47	-0.11	0.09	0.08	0.09	0.08	-0.05	0.05
11. Textile Industry	0.22	0.17	0.18	0.17	0.10	0.16	0.26	0.20	0.21	0.19	-0.03	0.15
12. Paper Industries and Printing	0.10	0.09	0.09	0.09	0.06	0.08	-	0.05	0.05	0.05	-0.01	0.04
13. Rubber Chemical and Petroleum Industries	0.02	-0.07	-0.06	-0.07	-0.14	-0.09	0.10	-0.27	-0.32	-0.26	0.23	-0.12
14. Non Metallic Products	-0.16	-0.01	-0.01	-0.01	0.02	-	0.09	0.19	0.21	0.16	-0.15	0.10
15. Metal Product and Machinery	0.04	0.04	0.05	0.04	-0.01	0.01	0.06	0.08	0.08	0.08	0.05	0.07
16. Agricultural Machinery	-6.28	-1.71	-2.68	-1.68	-1.88	-1.77	-1.21	-0.27	-1.22	-0.24	-0.64	-0.42
17. Other Manufacturing	0.03	0.07	0.07	0.07	0.04	0.05	0.09	0.11	0.11	0.10	0.02	0.06
18. Electricity, Water Work and Public Utilities	0.37	0.03	-0.08	0.04	0.35	0.05	0.23	0.28	0.27	0.28	-0.32	0.27
19. Construction and Trade	0.02	0.04	-	0.04	-	0.04	0.08	0.14	0.09	0.14	0.09	0.14
20. Service Transportation and Communication	0.11	-0.28	-0.33	-0.27	0.17	-0.22	0.17	0.11	0.12	0.11	0.01	0.10

Sector	Simulation 1.5 (%Δ)						Simulation 1.6 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	0.31	-2.09	-5.90	-1.60	3.33	-1.56	0.30	0.08	0.52	0.03	-0.50	0.02
2. Cassava, Beans and Nuts	0.48	-2.86	-4.72	-2.27	2.82	-1.02	0.19	0.07	0.15	0.05	-0.16	-
3. Vegetables, Sugarcane and Fruits	0.15	-2.03	-2.24	-2.02	1.65	-1.88	0.06	0.06	0.07	0.06	-0.20	0.05
4. Rubber and Latex	-0.15	-0.89	-3.29	-0.62	2.38	-0.62	0.06	0.07	0.05	0.08	0.20	0.08
5. Other Crops	-8.12	-0.88	-0.88	-0.89	-0.95	-0.90	-0.03	0.07	0.05	0.07	0.19	0.10
6. Livestock	-0.16	-0.84	-0.88	-0.84	-0.53	-0.84	-9.30	-0.30	-0.29	-0.30	-0.31	-0.30
7. Forestry	-0.06	-0.76	-0.89	-0.73	-0.15	-0.56	0.08	0.08	0.10	0.08	-	0.05
8. Fishery	0.16	-0.57	6.72	-0.68	-0.12	-0.67	0.13	0.12	7.55	0.02	-0.63	0.02
9. Mining and Quarrying	-0.62	-0.32	-0.17	-0.33	-0.51	-0.38	0.10	0.11	0.14	0.11	0.08	0.10
10. Food Manufacturing	-1.38	-0.38	-0.39	-0.38	-0.16	-0.33	0.22	-0.89	-0.90	-0.88	-0.62	-0.83
11. Textile Industry	0.03	-0.24	-0.25	-0.23	0.06	-0.17	0.18	0.11	0.12	0.11	-0.02	0.08
12. Paper Industries and Printing	0.02	-0.14	-0.14	-0.13	-0.03	-0.11	0.03	0.06	0.06	0.05	-0.02	0.04
13. Rubber Chemical and Petroleum Industries	-0.62	-0.42	-0.40	-0.43	-0.71	-0.51	0.08	0.06	0.07	0.06	0.01	0.05
14. Non Metallic Products	0.09	-0.19	-0.19	-0.18	-0.15	-0.18	0.10	0.11	0.12	0.11	0.02	0.09
15. Metal Product and Machinery	0.02	-0.02	-0.01	-0.02	-0.11	-0.07	0.10	0.10	0.10	0.10	0.07	0.08
16. Agricultural Machinery	12.18	3.40	3.25	3.40	-3.23	0.33	-0.10	0.05	-0.94	0.08	-0.17	-0.04
17. Other Manufacturing	-0.12	-0.15	-0.15	-0.15	-0.15	-0.15	0.13	0.06	0.07	0.06	-	0.03
18. Electricity, Water Work and Public	0.72	-0.04	-0.14	-0.04	0.21	-0.03	0.24	0.15	0.10	0.15	-0.13	0.15
19. Construction and Trade	0.08	-0.15	-0.19	-0.15	-0.18	-0.15	0.06	0.12	0.08	0.12	0.09	0.12
20. Service Transportation and Communication	-0.32	-0.35	-0.38	-0.35	-0.06	-0.31	0.14	0.10	0.12	0.10	-0.09	0.08

Sector	Simulation 1.7 (%Δ)						Simulation 1.8 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	0.10	0.02	-0.01	0.02	0.04	0.02	0.19	0.03	-0.02	0.03	0.10	0.04
2. Cassava, Beans and Nuts	0.21	0.06	0.06	0.06	0.06	0.06	0.10	0.04	0.05	0.03	-	0.03
3. Vegetables, Sugarcane and Fruits	0.04	-0.01	-0.01	-0.01	0.06	-0.01	0.05	-	0.01	-	-0.07	-
4. Rubber and Latex	0.03	-	0.03	-	-	-	-0.06	-0.01	-0.01	-0.01	-	-0.01
5. Other Crops	0.02	-0.02	0.03	-0.02	-0.37	-0.09	0.05	-0.01	-0.03	-	0.14	0.02
6. Livestock	-	-0.01	-0.01	-0.01	0.03	-0.01	0.01	-0.12	-0.14	-0.12	0.06	-0.12
7. Forestry	-12.77	-2.00	-2.09	-1.98	-1.56	-1.85	-0.06	-0.02	-0.02	-0.02	-0.05	-0.03
8. Fishery	0.01	-	7.35	-0.10	0.27	-0.10	-4.07	-0.18	7.16	-0.28	0.10	-0.28
9. Mining and Quarrying	0.04	-	-0.01	-	0.01	-	-0.17	-0.04	-0.04	-0.04	-0.03	-0.03
10. Food Manufacturing	0.01	0.02	0.02	0.02	0.02	0.02	0.04	-0.41	-0.42	-0.40	-0.03	-0.32
11. Textile Industry	0.04	0.03	0.03	0.03	0.01	0.02	-0.06	-0.05	-0.05	-0.05	-0.07	-0.05
12. Paper Industries and Printing	-	-0.05	-0.06	-0.04	0.11	-0.01	0.01	-	-	-0.01	-0.03	-0.01
13. Rubber Chemical and Petroleum Industries	-	-	-0.01	-	0.02	-	-0.01	-0.09	-0.07	-0.09	-0.21	-0.12
14. Non Metallic Products	0.06	-0.04	-0.03	-0.06	-0.20	-0.09	-0.10	-0.06	-0.07	-0.06	-0.04	-0.06
15. Metal Product and Machinery	0.02	0.02	0.02	0.01	-0.03	-0.01	-0.01	-0.01	-0.01	-0.02	-0.05	-0.03
16. Agricultural Machinery	-0.74	-0.20	-1.17	-0.16	-0.33	-0.24	-	-0.01	-0.94	0.02	-0.56	-0.25
17. Other Manufacturing	0.04	-0.31	-0.32	-0.28	0.07	-0.10	-0.03	-0.03	-0.03	-0.03	-0.04	-0.04
18. Electricity, Water Work and Public	-0.02	0.01	-0.07	0.01	-	0.01	-0.07	-0.09	-0.18	-0.08	0.03	-0.08
19. Construction and Trade	-	-	-0.07	-	-	-	-0.01	-0.04	-0.10	-0.04	-0.04	-0.04
20. Service Transportation and Communication	0.04	0.01	0.01	0.01	-0.01	-	-0.04	-0.09	-0.09	-0.09	-0.03	-0.08

Source: Model Simulation 1 and 1.1 – 1.8

P.2 Percentage change of price of activity (PA), producer price (PX) ,export price (PE), domestic price (PD), import price (PM), composite commodity price (PQ), value added price (PVA) from results of Simulations 1 and 1.1 – 1.8 compared with base year

Sector	Simulation 1.1 (%Δ)							Simulation 1.2 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*	*PA*	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	0.90	0.90	-0.10	1.00	-0.10	1.00	4.99	0.10	0.20	-0.10	0.20	-0.10	0.20	1.05
2. Cassava, Beans and Nuts	0.50	-0.30	-0.10	-0.30	-0.10	-0.30	7.29	0.10	0.40	-0.10	0.50	-0.10	0.40	2.08
3. Vegetables, Sugarcane and Fruits	0.30	-0.10	-0.10	-0.10	-0.10	-0.10	2.80	-	0.10	-0.10	0.10	-0.10	0.10	0.86
4. Rubber and Latex	-0.60	-1.80	-0.10	-2.10	-0.10	-2.10	-0.22	-0.10	-0.60	-0.10	-0.70	-0.10	-0.70	0.22
5. Other Crops	-0.40	-5.90	-0.10	-6.70	-0.10	-5.40	1.01	-0.10	-2.40	-0.10	-2.70	-0.10	-2.20	-
6. Livestock	0.80	0.50	-0.10	0.50	-0.10	0.50	0.65	-	-	-0.10	-	-0.10	-	-
7. Forestry	-0.20	-0.30	-0.10	-0.30	-0.10	-0.20	1.96	-	-	-0.10	-	-0.10	-	0.98
8. Fishery	0.60	0.20	-0.10	0.20	-0.10	0.20	1.79	0.10	0.30	-0.10	0.20	-0.10	0.20	0.30
9. Mining and Quarrying	-0.40	-0.30	-0.10	-0.30	-0.10	-0.30	-0.63	-	-	-0.10	-	-0.10	-	-0.63
10. Food Manufacturing	0.30	1.10	-0.10	1.70	-0.10	1.30	-0.33	-	0.10	-0.10	0.10	-0.10	0.10	-
11. Textile Industry	-0.30	-0.20	-0.10	-0.30	-0.10	-0.30	0.31	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	0.31
12. Paper Industries and Printing	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-	-	-0.10	-0.10	-0.10	-0.10	-0.10	-
13. Rubber Chemical and Petroleum Industries	-0.50	-0.60	-0.10	-0.80	-0.10	-0.60	-0.68	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-
14. Non Metallic Products	-0.10	-	-0.10	0.10	-0.10	0.10	0.37	-0.10	-	-0.10	-	-0.10	-	-
15. Metal Product and Machinery	-0.20	-0.10	-0.10	-0.20	-0.10	-0.10	-	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-
16. Agricultural Machinery	-1.30	1.20	-0.10	1.20	-0.10	0.60	-9.52	-0.40	0.70	-0.10	0.80	-0.10	0.40	-3.40
17. Other Manufacturing	-0.20	-0.20	-0.10	-0.20	-0.10	-0.20	-0.23	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-
18. Electricity, Water Work and Public Utilities	-0.20	-	-0.10	-	-0.10	-	-0.32	-	-	-0.10	-	-0.10	-	-
19. Construction and Trade	-0.30	-0.20	-0.10	-0.20	-0.10	-0.20	-0.22	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.11
20. Service Transportation and Communication	-0.30	-0.40	-0.10	-0.40	-0.10	-0.40	-0.30	-	-	-0.10	-	-0.10	-	-

Sector	Simulation 1.3 (%Δ)							Simulation 1.4 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*	*PA*	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	0.10	0.30	-0.20	0.30	-0.20	0.30	1.84	-	0.10	-	0.10	-	0.10	-0.26
2. Cassava, Beans and Nuts	-	-0.30	-0.20	-0.40	-0.20	-0.30	3.47	-	0.10	-	0.10	-	0.10	0.35
3. Vegetables, Sugarcane and Fruits	0.20	0.10	-0.20	0.20	-0.20	0.10	1.72	-	-	-	-	-	-	-
4. Rubber and Latex	-0.20	1.40	-0.20	1.60	-0.20	1.60	-	0.50	1.40	-	1.60	-	1.60	0.87
5. Other Crops	-0.20	-3.80	-0.20	-4.30	-0.20	-3.50	0.67	-	-0.90	-	-1.00	-	-0.80	-0.34
6. Livestock	0.10	-0.10	-0.20	-0.10	-0.20	-0.10	-	-	-	-	-0.10	-	-0.10	-
7. Forestry	-0.20	-0.30	-0.20	-0.30	-0.20	-0.30	0.98	-	-	-	-	-	-	0.49
8. Fishery	0.10	0.20	-0.20	0.20	-0.20	0.20	0.60	-	0.20	-	0.10	-	0.10	-0.30
9. Mining and Quarrying	-0.20	-0.40	-0.20	-0.40	-0.20	-0.40	-1.27	0.20	-0.30	-	-0.30	-	-0.20	0.63
10. Food Manufacturing	0.10	0.10	-0.20	0.30	-0.20	0.20	0.33	-	-	-	-	-	-	-0.33
11. Textile Industry	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	0.31	-	-	-	-0.10	-	-0.10	0.31
12. Paper Industries and Printing	-0.10	-0.20	-0.20	-0.20	-0.20	-0.20	-	-	-	-	-	-	-	-0.46
13. Rubber Chemical and Petroleum Industries	-0.20	-0.20	-0.20	-0.30	-0.20	-0.20	-	0.10	0.50	-	0.60	-	0.50	-
14. Non Metallic Products	-0.30	-0.20	-0.20	-0.10	-0.20	-0.10	-0.37	-0.10	-0.20	-	-0.50	-	-0.40	-
15. Metal Product and Machinery	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-	-	-	-	-	-	-	-
16. Agricultural Machinery	-1.00	-0.50	-0.20	-0.50	-0.20	-0.30	-6.12	-0.30	-0.50	-	-0.50	-	-0.30	-1.36
17. Other Manufacturing	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	-	0.10	-0.20	0.10	-0.20	0.10	-	-0.20	-0.60	-	-0.60	-	-0.60	-
19. Construction and Trade	-0.20	-0.30	-0.20	-0.30	-0.20	-0.30	-0.11	0.10	-0.10	-	-0.10	-	-0.10	0.11
20. Service Transportation and Communication	-0.10	0.30	-0.20	0.30	-0.20	0.30	-	-0.10	-0.10	-	-0.10	-	-0.10	-

Sector	Simulation 1.5 (%Δ)							Simulation 1.6 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*	*PA*	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	0.40	3.90	-0.20	4.40	-0.20	4.40	0.26	0.10	-0.40	0.10	-0.40	0.10	-0.40	0.26
2. Cassava, Beans and Nuts	0.40	1.80	-0.20	2.40	-0.20	1.80	0.69	0.10	-	0.10	-	0.10	-	-
3. Vegetables, Sugarcane and Fruits	-	1.90	-0.20	2.00	-0.20	2.00	0.43	-	-0.10	0.10	-0.10	0.10	-0.10	-
4. Rubber and Latex	-0.50	27.40	-0.20	30.90	-0.20	30.90	-0.65	-	0.30	0.10	0.30	0.10	0.30	-
5. Other Crops	2.80	-0.30	-0.20	-0.30	-0.20	-0.30	10.40	-0.10	0.20	0.10	0.30	0.10	0.20	-0.34
6. Livestock	-0.10	0.10	-0.20	0.20	-0.20	0.20	-0.65	0.20	0.10	0.10	0.10	0.10	0.10	0.33
7. Forestry	-0.10	1.10	-0.20	1.40	-0.20	0.90	-	-	-0.10	0.10	-0.20	0.10	-0.10	-
8. Fishery	-0.10	0.10	-0.20	0.10	-0.20	0.10	0.30	0.10	-0.30	0.10	-0.30	0.10	-0.30	0.30
9. Mining and Quarrying	-0.40	-1.70	-0.20	-1.80	-0.20	-1.40	-1.27	-	-0.20	0.10	-0.20	0.10	-0.10	-
10. Food Manufacturing	-	-0.20	-0.20	-0.10	-0.20	-0.10	-2.95	-	0.20	0.10	0.20	0.10	0.20	-
11. Textile Industry	-0.10	-0.10	-0.20	-	-0.20	-0.10	-	-	-	0.10	-	0.10	-	-
12. Paper Industries and Printing	-0.10	-0.10	-0.20	-0.10	-0.20	-0.20	-	-	-	0.10	-	0.10	-	-0.46
13. Rubber Chemical and Petroleum Industries	0.40	-0.50	-0.20	-0.60	-0.20	-0.50	-1.36	-	-	0.10	-	0.10	-	-
14. Non Metallic Products	-0.30	-0.20	-0.20	-0.20	-0.20	-0.20	0.37	-	-	0.10	-0.10	0.10	-	-
15. Metal Product and Machinery	-0.20	-0.30	-0.20	-0.30	-0.20	-0.30	-	-	0.10	0.10	-	0.10	0.10	-
16. Agricultural Machinery	-0.10	-8.60	-0.20	-8.80	-0.20	-5.00	10.20	-0.10	-0.20	0.10	-0.30	0.10	-0.10	-0.68
17. Other Manufacturing	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.23	-	0.10	0.10	-	0.10	0.10	-
18. Electricity, Water Work and Public Utilities	-0.20	-	-0.20	-	-0.20	-	0.65	-0.10	-0.20	0.10	-0.20	0.10	-0.20	-
19. Construction and Trade	0.20	-0.40	-0.20	-0.40	-0.20	-0.40	0.22	-	-0.10	0.10	-0.10	0.10	-0.10	-
20. Service Transportation and Communication	-0.20	0.10	-0.20	0.10	-0.20	0.10	-0.15	-0.10	-0.10	0.10	-0.10	0.10	-0.10	-

Sector	Simulation 1.7 (%Δ)							Simulation 1.8 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*	*PA*	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	-	-	-	-	-	-	-	0.10	-	-	-	-	-	0.26
2. Cassava, Beans and Nuts	-	-	-	-	-	-	0.35	-	-0.10	-	-0.10	-	-0.10	-
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-0.10	-	-0.10	-	-0.10	0.22
4. Rubber and Latex	-	-0.30	-	-0.30	-	-0.30	-	-0.20	-0.10	-	-0.10	-	-0.10	-0.22
5. Other Crops	-	-0.50	-	-0.50	-	-0.40	-	-	0.10	-	0.20	-	0.10	-
6. Livestock	-	-	-	-	-	-	-	0.10	0.20	-	0.20	-	0.20	-
7. Forestry	0.20	0.90	-	1.20	-	0.80	0.98	-0.10	-0.10	-	-0.10	-	-0.10	-
8. Fishery	-	0.20	-	0.20	-	0.20	-	0.10	0.20	-	0.20	-	0.20	0.30
9. Mining and Quarrying	-	-	-	-	-	-	-	-0.10	-	-	-	-	-	-0.63
10. Food Manufacturing	-	-	-	-	-	-	-	0.10	0.10	-	0.20	-	0.10	-
11. Textile Industry	-	-	-	-	-	-	-	-0.10	-0.10	-	-0.10	-	-0.10	-
12. Paper Industries and Printing	0.10	0.10	-	0.10	-	0.10	-	-	-0.10	-	-0.10	-	-0.10	-
13. Rubber Chemical and Petroleum Industries	-	-	-	-	-	-	-	-	-0.20	-	-0.20	-	-0.10	-
14. Non Metallic Products	-	-0.10	-	-0.30	-	-0.20	0.37	-0.10	-	-	-	-	-	-
15. Metal Product and Machinery	-	-	-	-0.10	-	-	-	-	-0.10	-	-0.10	-	-0.10	-
16. Agricultural Machinery	-0.20	-0.20	-	-0.20	-	-0.10	-0.68	-0.20	-0.80	-	-0.80	-	-0.50	-
17. Other Manufacturing	0.10	0.10	-	0.30	-	0.20	-	-	-0.10	-	-0.10	-	-0.10	-
18. Electricity, Water Work and Public Utilities	-	-	-	-	-	-	-	-	0.10	-	0.10	-	0.10	-
19. Construction and Trade	-	-	-	-	-	-	-	-	-0.10	-	-0.10	-	-0.10	-
20. Service Transportation and Communication	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Source: Model Simulation 1 and 1.1 – 1.8

P.3 Percentage change of wage distortion for factors (labour and capital) in activities ($WFDIST_{fa}$) from results of Simulations 1 and 1.1 – 1.8 compared with base year

Sectors	Labour									
	Base year	SIM 1 (%Δ)	SIM 1.1 (%Δ)	SIM 1.2 (%Δ)	SIM 1.3 (%Δ)	SIM 1.4 (%Δ)	SIM 1.5 (%Δ)	SIM 1.6 (%Δ)	SIM 1.7 (%Δ)	SIM 1.8 (%Δ)
1. Paddy and Maize	0.123	-	-	-	-	-	-	-	-	-
2. Cassava, Beans and Nuts	0.139	-	-	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	0.107	-	-	-	-	-	-	-	-	-
4. Rubber and Latex	0.156	-	-	-	-	-	-	-	-	-
5. Other Crops	0.201	-	-	-	-	-	-	-	-	-
6. Livestock	0.120	-	-	-	-	-	-	-	-	-
7. Forestry	0.145	-	-	-	-	-	-	-	-	-
8. Fishery	0.573	-	-	-	-	-	-	-	-	-
9. Mining and Quarrying	11.546	-	-	-	-	-	-	-	-	-
10. Food Manufacturing	1.326	-	-	-	-	-	-	-	-	-
11. Textile Industry	1.529	-	-	-	-	-	-	-	-	-
12. Paper Industries and Printing	1.783	-	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum Industries	2.332	-	-	-	-	-	-	-	-	-
14. Non Metallic Products	1.694	-	-	-	-	-	-	-	-	-
15. Metal Product and Machinery	2.428	-	-	-	-	-	-	-	-	-
16. Agricultural Machinery	3.650	-	-	-	-	-	-	-	-	-
17. Other Manufacturing	1.278	-	-	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	15.622	-	-	-	-	-	-	-	-	-
19. Construction and Trade	0.607	-	-	-	-	-	-	-	-	-
20. Service Transportation and Communication	1.827	-	-	-	-	-	-	-	-	-

Sectors	Capital									
	Base year	SIM 1 (%Δ)	SIM 1.1 (%Δ)	SIM 1.2 (%Δ)	SIM 1.3 (%Δ)	SIM 1.4 (%Δ)	SIM 1.5 (%Δ)	SIM 1.6 (%Δ)	SIM 1.7 (%Δ)	SIM 1.8 (%Δ)
1. Paddy and Maize	1.429	0.420	-6.368	1.679	3.149	0.070	0.770	0.630	0.280	0.490
2. Cassava, Beans and Nuts	1.614	8.922	11.958	-9.975	5.824	0.867	1.363	0.372	0.558	0.310
3. Vegetables, Sugarcane and Fruits	1.241	-3.465	3.787	1.128	-8.783	0.081	0.645	0.081	0.161	0.242
4. Rubber and Latex	1.817	-9.851	-0.275	0.165	0.110	-9.026	-0.715	0.110	0.110	-0.275
5. Other Crops	2.340	4.487	1.752	0.299	0.940	-0.342	1.624	-0.385	0.043	0.214
6. Livestock	1.391	-8.627	0.935	-0.072	0.072	-	-0.863	-9.058	-0.072	0.072
7. Forestry	1.688	-7.109	3.140	1.066	1.481	0.652	-0.178	0.059	-12.145	-0.118
8. Fishery	1.359	-0.147	2.428	0.221	0.809	-0.368	0.589	0.294	-	-3.753
9. Mining and Quarrying	2.280	-3.465	-0.877	-0.263	-1.228	1.184	-1.798	0.088	0.088	-0.482
10. Food Manufacturing	1.416	-2.825	0.071	-	0.636	-	-4.025	0.424	-	0.141
11. Textile Industry	1.630	1.840	0.675	0.184	0.307	0.429	0.061	0.245	0.061	-0.123
12. Paper Industries and Printing	1.890	0.370	0.159	0.053	0.370	-0.212	0.053	-0.053	-	0.053
13. Rubber Chemical and Petroleum Industries	2.526	-3.127	-0.713	-0.396	-0.158	0.040	-1.861	-	-0.040	-0.040
14. Non Metallic Products	1.797	-0.556	0.390	-0.334	-0.668	0.056	0.223	0.111	0.167	-0.278
15. Metal Product and Machinery	2.657	-0.301	-0.075	-0.151	-0.113	-0.038	0.038	0.038	0.038	-
16. Agricultural Machinery	3.867	-21.438	-18.516	-7.267	-11.611	-2.483	23.869	-0.414	-1.422	-
17. Other Manufacturing	1.336	1.123	1.572	1.572	1.647	1.796	1.422	1.871	1.871	1.722
18. Electricity, Water Work and Public Utilities	0.394	2.284	0.254	-	0.508	0.254	1.269	0.254	-	-
19. Construction and Trade	2.713	-0.037	-0.258	-0.147	-0.147	0.111	0.295	0.037	-0.037	-0.074
20. Service Transportation and Communication	0.325	-1.231	-0.615	-0.308	-	-	-0.615	-	-	-

Source: Model Simulation 1 and 1.1 – 1.8

P.4 Percentage change of quantity of consumption of commodity c by household h (QH_{ch}) from results of Simulations 1 and 1.1 – 1.8 compared with base year

Sectors	Base[1/] year	SIM 1 (%Δ)	SIM 1.1 (%Δ)	SIM 1.2 (%Δ)	SIM 1.3 (%Δ)	SIM 1.4 (%Δ)	SIM 1.5 (%Δ)	SIM 1.6 (%Δ)	SIM 1.7 (%Δ)	SIM 1.8 (%Δ)
1. Paddy and Maize	20,041.70	-6.389	-1.189	-0.303	-0.387	-0.080	-4.543	0.431	0.002	-0.104
2. Cassava, Beans and Nuts	10,689.10	-2.440	0.080	-0.513	0.265	-0.034	-2.082	0.014	0.026	-0.031
3. Vegetables, Sugarcane and Fruits	120,716.90	-2.790	-0.108	-0.222	-0.224	0.029	-2.255	0.085	-0.014	-0.003
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	12,166.80	13.325	5.529	2.109	3.553	0.801	-0.039	-0.206	0.432	-0.212
6. Livestock	53,940.80	-1.618	-0.672	-0.130	0.051	0.071	-0.506	-0.052	-0.020	-0.281
7. Forestry	8,107.10	-1.879	0.037	-0.091	0.195	-0.020	-1.230	0.099	-0.793	0.004
8. Fishery	81,989.70	-0.413	-0.381	-0.358	-0.242	-0.116	-0.444	0.321	-0.193	-0.272
9. Mining and Quarrying	638.00	1.599	0.078	-0.125	0.266	0.204	1.019	0.141	-0.016	-0.094
10. Food Manufacturing	477,990.30	-2.736	-1.496	-0.218	-0.260	0.035	-0.215	-0.198	0.027	-0.225
11. Textile Industry	259,761.10	-0.013	0.077	-0.056	0.136	0.089	-0.270	0.005	0.035	-0.034
12. Paper Industries and Printing	35,156.90	-0.420	-0.108	-0.071	0.121	0.015	-0.195	-0.009	-0.097	-0.028
13. Rubber Chemical and Petroleum Industries	290,586.30	0.235	0.392	-0.064	0.158	-0.442	0.130	-0.020	0.008	0.058
14. Non Metallic Products	15,507.30	0.165	-0.294	-0.144	0.061	0.446	-0.159	0.061	0.251	-0.073
15. Metal Product and Machinery	353,855.40	-0.175	-0.062	-0.056	0.124	-0.019	-0.069	-0.052	0.048	-0.031
16. Agricultural Machinery	116.30	4.729	-0.774	-0.516	0.258	0.258	4.901	0.086	0.172	0.430
17. Other Manufacturing	214,743.60	-0.353	-0.037	-0.061	0.112	0.010	-0.107	-0.038	-0.154	-0.036
18. Electricity, Water Work and Public Utilities	113,459.20	-0.295	-0.216	-0.158	-0.222	0.591	-0.366	0.226	0.032	-0.166
19. Construction and Trade	55,438.10	0.617	-0.033	-0.058	0.255	0.128	0.072	0.147	-0.027	0.019
20. Service Transportation and Communication	695,835.20	-0.565	0.20	-0.162	-0.352	0.077	-0.402	0.128	0.041	-0.100

Source: Model simulation 1 and 1.1 – 1.8,
Note: 1/ Million baht

P.5 Percentage change of quantity of intermediate use of commodity c by activity a ($QINT_{ca}$) from results of Simulations 1 and 1.1 – 1.8 compared with base year

Commodity C	Intermediate input to activity A (Base year[1/])									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	18,394.30	-	509.50	-	1,075.50	3,633.50	-	-	-	99,586.50
2. Cassava, Beans and Nuts	-	8,098.90	710.60	-	-	575.10	-	-	-	13,253.80
3. Vegetables, Sugarcane and	-	-	2,735.00	-	26.70	1,077.80	-	-	-	22,843.70
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	30,887.30	10,926.10	20,984.30	3,922.20	14,565.20	336.30	1,951.60	430.80	-	9,647.20
6. Livestock	-	-	-	-	-	4,683.80	-	-	-	47,501.00
7. Forestry	29.40	4.10	122.50	-	74.50	140.90	3,565.30	15.40	1,583.20	527.10
8. Fishery	-	-	-	-	-	3,919.20	-	5,263.30	-	42,887.40
9. Mining and Quarrying	-	-	22.20	-	92.50	70.50	-	34.70	49,321.90	697.60
10. Food Manufacturing	-	-	38.30	18.00	17.70	57,816.60	2.70	31,151.00	-	77,830.60
11. Textile Industry	440.40	134.70	253.30	537.60	793.40	45.20	521.10	779.70	250.40	328.20
12. Paper Industries and Printing	-	-	226.80	-	343.70	150.80	53.70	67.90	1,067.50	4,825.60
13. Rubber Chemical and Petroleum Industries	59,376.80	6,603.80	30,241.80	30,089.40	62,144.20	6,877.60	2,002.00	47,817.70	198,724.80	15,088.60
14. Non Metallic Products	26.20	9.30	34.80	493.30	1,057.80	35.10	1,018.10	163.80	234.50	1,945.60
15. Metal Product and Machinery	2,714.00	1,126.30	5,794.80	4,866.10	9,459.80	1,220.70	6,920.10	5,734.30	99,713.80	18,809.30
16. Agricultural Machinery	1,526.50	331.00	1,678.70	518.40	4,833.80	175.50	204.60	1,328.30	35.10	24.50
17. Other Manufacturing	32.90	84.20	823.80	57.90	1,664.50	270.60	1,234.70	92.00	4,701.10	435.20
18. Electricity, Water Work and Public Utilities	41.10	9.60	167.40	-	982.00	1,024.40	46.10	628.10	18,510.80	5,804.30
19. Construction and Trade	61.80	16.30	60.60	16.00	73.80	244.50	65.20	271.10	3,200.30	314.30
20. Service Transportation and Communication	5,247.70	1,939.00	8,117.90	3,819.80	8,523.70	1,986.70	2,822.00	5,295.60	239,089.90	11,026.40

Commodity C	Intermediate input to activity A (Base year[1/])									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	350.80	1,977.10	18.90	-	-	321.20	-	-	3,152.90
2. Cassava, Beans and Nuts	-	-	323.80	-	-	-	-	-	-	3,193.50
3. Vegetables, Sugarcane and	-	-	89.50	-	-	-	-	-	-	16,200.60
4. Rubber and Latex	-	-	62,753.70	-	-	-	-	-	-	-
5. Other Crops	15,479.60	1,301.80	6,417.80	-	-	-	84.80	43.20	91.90	1,958.10
6. Livestock	1,330.10	-	4,648.50	-	-	-	1,170.30	-	-	2,066.70
7. Forestry	42.30	1,024.80	3,084.00	839.30	418.70	-	6,754.10	-	101.40	1,392.20
8. Fishery	-	-	3,492.60	20.80	-	-	231.60	-	-	13,543.10
9. Mining and Quarrying	134.20	990.80	582,290.80	31,098.60	13,324.20	-	1,093.10	123,418.00	398.50	710.70
10. Food Manufacturing	500.90	2,569.90	7,755.90	665.00	152.00	-	4,308.60	-	85.20	62,094.20
11. Textile Industry	202,416.90	605.60	24,818.20	956.80	4,029.70	-	10,270.60	255.80	130.30	8,451.20
12. Paper Industries and	4,227.60	133,182.70	11,155.10	3,974.30	9,250.50	37.40	3,245.90	947.30	154.30	23,161.50
13. Rubber Chemical and Petroleum Industries	49,115.40	31,106.00	522,494.70	37,612.10	137,048.90	481.40	30,912.50	46,793.20	482.40	134,513.20
14. Non Metallic Products	109.60	55.50	2,200.20	23,472.40	23,129.20	17.20	2,808.30	122.10	976.90	2,976.80
15. Metal Product and	4,622.20	4,018.60	15,950.70	10,683.00	1,576,263.30	5,069.40	32,709.30	11,324.60	890.90	77,293.10
16. Agricultural Machinery	-	-	-	-	-	3,709.60	-	-	-	84.20
17. Other Manufacturing	9,131.50	468.80	3,653.40	910.00	11,599.00	97.80	85,730.80	561.50	246.10	9,191.50
18. Electricity, Water Work and Public Utilities	21,662.80	4,414.90	59,042.00	19,515.00	42,291.30	504.10	3,532.00	126,859.60	314.00	31,632.30
19. Construction and Trade	249.00	132.60	2,140.10	207.00	4,733.40	5.00	117.30	656.60	200.90	4,538.10
20. Service Transportation and Communication	15,928.40	5,876.70	31,546.30	10,223.10	39,782.40	650.00	11,070.90	23,501.10	1,416.90	100,619.90

Commodity C	Intermediate input to activity A (Simulation 1, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	-8.41	-	-9.03	-	-7.45	-9.10	-	-	-	-0.60
2. Cassava, Beans and Nuts	-	-6.06	-9.03	-		-9.09	-	-	-	-0.60
3. Vegetables, Sugarcane and Fruits	-	-	-9.04	-	-7.49	-9.10	-	-	-	-0.60
4. Rubber and Latex	-	-		-	-	-	-	-	-	
5. Other Crops	-8.41	-6.06	-9.04	-9.79	-7.45	-9.10	-10.81	-3.02	-	-0.60
6. Livestock	-	-	-	-	-	-9.10	-	-	-	-0.60
7. Forestry	-8.50	-7.32	-8.98	-	-7.38	-9.08	-10.80	-3.25	-0.84	-0.59
8. Fishery	-	-	-	-		-9.10	-	-3.02	-	-0.60
9. Mining and Quarrying	-	-	-9.01		-7.35	-9.08	-	-3.17	-0.84	-0.60
10. Food Manufacturing	-	-	-9.14	-10.00	-7.34	-9.10	-11.11	-3.02	-	-0.60
11. Textile Industry	-8.42	-6.01	-9.04	-9.78	-7.45	-9.07	-10.80	-3.01	-0.84	-0.61
12. Paper Industries and Printing	-	-	-9.04	-	-7.45	-9.15	-10.80	-2.95	-0.84	-0.59
13. Rubber Chemical and Petroleum Industries	-8.41	-6.06	-9.05	-9.79	-7.45	-9.10	-10.80	-3.02	-0.84	-0.60
14. Non Metallic Products	-8.40	-5.38	-9.20	-9.79	-7.44	-9.12	-10.80	-2.99	-0.85	-0.60
15. Metal Product and Machinery	-8.41	-6.06	-9.05	-9.79	-7.45	-9.10	-10.80	-3.02	-0.84	-0.60
16. Agricultural Machinery	-8.42	-6.07	-9.05	-9.78	-7.45	-9.12	-10.80	-3.02	-0.85	-0.41
17. Other Manufacturing	-8.21	-6.06	-9.04	-9.84	-7.44	-9.09	-10.80	-3.04	-0.84	-0.60
18. Electricity, Water Work and Public Utilities	-8.52	-6.25	-9.08	-	-7.44	-9.11	-10.85	-3.01	-0.84	-0.59
19. Construction and Trade	-8.41	-6.13	-9.08	-10.00	-7.45	-9.08	-10.74	-3.02	-0.84	-0.57
20. Service Transportation and Communication	-8.42	-6.05	-9.05	-9.79	-7.45	-9.11	-10.80	-3.02	-0.84	-0.60

Commodity C	Intermediate input to activity A (Simulation 1, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	0.26	-0.71	0.53	-	-	0.16	-	-	-0.07
2. Cassava, Beans and Nuts	-	-	-0.71	-	-	-	-	-	-	-0.07
3. Vegetables, Sugarcane and Fruits	-	-	-0.67	-	-	-	-	-	-	-0.07
4. Rubber and Latex		-	-0.71	-	-	-	-	-	-	
5. Other Crops	1.23	0.26	-0.71	-	-	-	0.12	1.85	0.22	-0.07
6. Livestock	1.23	-	-0.71	-	-	-	0.17	-	-	-0.07
7. Forestry	1.18	0.25	-0.71	0.19	0.29	-	0.17	-	0.30	-0.07
8. Fishery	-	-	-0.71	0.48	-	-	0.17	-	-	-0.07
9. Mining and Quarrying	1.27	0.26	-0.71	0.19	0.30	-	0.17	1.78	0.23	-0.07
10. Food Manufacturing	1.24	0.26	-0.71	0.18	0.33	-	0.18	-	0.23	-0.07
11. Textile Industry	1.23	0.26	-0.71	0.19	0.30	-	0.17	1.80	0.23	-0.07
12. Paper Industries and Printing	1.23	0.26	-0.71	0.19	0.30	-11.50	0.18	1.78	0.19	-0.07
13. Rubber Chemical and Petroleum Industries	1.23	0.26	-0.71	0.19	0.30	-11.61	0.17	1.78	0.23	-0.07
14. Non Metallic Products	1.19	0.18	-0.71	0.19	0.30	-11.63	0.17	1.80	0.24	-0.07
15. Metal Product and Machinery	1.24	0.26	-0.71	0.19	0.30	-11.61	0.17	1.78	0.24	-0.07
16. Agricultural Machinery	-	-	-	-	-	-11.61	-	-	-	-0.12
17. Other Manufacturing	1.24	0.28	-0.71	0.19	0.30	-11.66	0.17	1.78	0.20	-0.07
18. Electricity, Water Work and Public Utilities	1.23	0.26	-0.71	0.19	0.30	-11.62	0.18	1.78	0.22	-0.07
19. Construction and Trade	1.20	0.30	-0.71	0.19	0.30	-12.00	0.17	1.78	0.25	-0.07
20. Service Transportation and Communication	1.23	0.26	-0.71	0.19	0.30	-11.62	0.17	1.78	0.23	-0.07

Commodity C	Intermediate input to activity A (Simulation 1.1, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	-10.87	-	1.02	-	0.47	0.25	-	-	-	0.16
2. Cassava, Beans and Nuts	-	4.20	1.01	-	-	0.26	-	-	-	0.16
3. Vegetables, Sugarcane and Fruits	-	-	1.01	-	0.37	0.25	-	-	-	0.16
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	-10.87	4.20	1.00	0.01	0.48	0.27	1.25	0.72	-	0.16
6. Livestock	-	-	-	-	-	0.25	-	-	-	0.16
7. Forestry	-10.88	2.44	1.06	-	0.54	0.28	1.25	0.65	-0.19	0.15
8. Fishery	-	-	-	-	-	0.26	-	0.72	-	0.16
9. Mining and Quarrying	-	-	1.35	-	0.54	0.14	-	0.58	-0.19	0.16
10. Food Manufacturing	-	-	1.04	-	0.56	0.26	-	0.72	-	0.16
11. Textile Industry	-10.88	4.23	0.99	0.02	0.48	0.22	1.25	0.72	-0.20	0.15
12. Paper Industries and Printing	-	-	1.01	-	0.49	0.20	1.30	0.74	-0.20	0.16
13. Rubber Chemical and Petroleum Industries	-10.87	4.20	1.00	0.01	0.48	0.25	1.25	0.72	-0.19	0.16
14. Non Metallic Products	-11.07	4.30	0.86	-	0.48	0.28	1.25	0.73	-0.21	0.16
15. Metal Product and Machinery	-10.87	4.20	1.00	0.01	0.48	0.25	1.25	0.72	-0.19	0.16
16. Agricultural Machinery	-10.87	4.20	1.00	0.02	0.48	0.28	1.27	0.72	-0.28	0.41
17. Other Manufacturing	-10.64	4.16	1.00	-	0.48	0.26	1.26	0.76	-0.19	0.16
18. Electricity, Water Work and Public Utilities	-10.95	4.17	1.02	-	0.48	0.25	1.30	0.72	-0.19	0.16
19. Construction and Trade	-10.84	4.29	0.99	-	0.41	0.25	1.23	0.70	-0.19	0.16
20. Service Transportation and Communication	-10.87	4.20	1.00	0.01	0.48	0.25	1.25	0.72	-0.19	0.16

Commodity C	Intermediate input to activity A (Simulation 1.1, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	0.09	-0.11	0.53	-	-	0.06	-	-	-0.04
2. Cassava, Beans and Nuts	-	-	-0.12	-	-	-	-	-	-	-0.04
3. Vegetables, Sugarcane and Fruits	-	-	-0.11	-	-	-	-	-	-	-0.04
4. Rubber and Latex	-	-	-0.11	-	-	-	-	-	-	-
5. Other Crops	0.43	0.08	-0.11	-	-	-	-	0.23	-	-0.04
6. Livestock	0.43	-	-0.11	-	-	-	0.06	-	-	-0.03
7. Forestry	0.24	0.08	-0.11	0.24	0.10	-	0.06	-	0.10	-0.04
8. Fishery	-	-	-0.11	0.48	-	-	0.04	-	-	-0.04
9. Mining and Quarrying	0.45	0.08	-0.11	0.24	0.10	-	0.06	0.26	0.03	-0.04
10. Food Manufacturing	0.44	0.09	-0.11	0.23	0.13	-	0.06	-	-	-0.04
11. Textile Industry	0.43	0.10	-0.11	0.24	0.10	-	0.06	0.27	0.08	-0.04
12. Paper Industries and Printing	0.43	0.09	-0.11	0.24	0.10	-10.16	0.06	0.26	-	-0.04
13. Rubber Chemical and Petroleum Industries	0.43	0.09	-0.11	0.24	0.10	-10.22	0.06	0.26	0.02	-0.04
14. Non Metallic Products	0.46	-	-0.11	0.24	0.10	-10.47	0.06	0.33	0.02	-0.04
15. Metal Product and Machinery	0.43	0.09	-0.11	0.24	0.10	-10.23	0.06	0.26	0.02	-0.04
16. Agricultural Machinery	-	-	-	-	-	-10.22	-	-	-	-
17. Other Manufacturing	0.43	0.11	-0.11	0.24	0.10	-10.22	0.06	0.25	-	-0.04
18. Electricity, Water Work and Public Utilities	0.43	0.09	-0.11	0.24	0.10	-10.24	0.06	0.26	0.03	-0.04
19. Construction and Trade	0.40	0.15	-0.11	0.24	0.10	-10.00	0.09	0.26	-	-0.04
20. Service Transportation and Communication	0.43	0.09	-0.11	0.24	0.10	-10.23	0.06	0.26	0.02	-0.04

Commodity C	Intermediate input to activity A (Simulation 1.2, (%∆))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	0.61	-	0.26	-	0.05	-0.02	-	-	-	-0.02
2. Cassava, Beans and Nuts	-	-11.97	0.25	-	-	-0.02	-	-	-	-0.02
3. Vegetables, Sugarcane and Fruits	-	-	0.25	-	-	-0.02	-	-	-	-0.02
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.61	-11.97	0.25	0.02	0.05	-	0.36	0.02	-	-0.02
6. Livestock	-	-	-	-	-	-0.02	-	-	-	-0.02
7. Forestry	0.68	-12.20	0.33	-	0.13	-	0.36	-	-0.12	-0.02
8. Fishery	-	-	-	-	-	-0.02	-	0.03	-	-0.02
9. Mining and Quarrying	-	-	0.45	-	0.11	-	-	-	-0.12	-0.01
10. Food Manufacturing	-	-	0.26	-	-	-0.02	-	0.03	-	-0.02
11. Textile Industry	0.61	-11.95	0.24	0.02	0.06	-	0.36	0.03	-0.12	-0.03
12. Paper Industries and Printing	-	-	0.26	-	0.06	-0.07	0.37	0.15	-0.12	-0.02
13. Rubber Chemical and Petroleum Industries	0.61	-11.97	0.25	0.02	0.05	-0.02	0.36	0.03	-0.12	-0.02
14. Non Metallic Products	0.38	-11.83	0.29	-	0.06	-	0.35	0.06	-0.13	-0.02
15. Metal Product and Machinery	0.61	-11.96	0.25	0.02	0.05	-0.02	0.36	0.03	-0.12	-0.02
16. Agricultural Machinery	0.61	-11.96	0.25	0.02	0.05	-	0.39	0.03	-	-
17. Other Manufacturing	0.61	-12.00	0.24	-	0.05	-	0.36	-	-0.12	-
18. Electricity, Water Work and Public Utilities	0.49	-11.46	0.24	-	0.05	-0.02	0.22	0.03	-0.12	-0.02
19. Construction and Trade	0.65	-12.27	0.17	-	-	-	0.31	0.04	-0.12	-
20. Service Transportation and Communication	0.61	-11.96	0.25	0.02	0.06	-0.03	0.36	0.03	-0.12	-0.02

Commodity C	Intermediate input to activity A (Simulation 1.2, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	-0.15	-	-	-	-0.09	-	-	-0.18
2. Cassava, Beans and Nuts	-	-	-0.15	-	-	-	-	-	-	-0.18
3. Vegetables, Sugarcane and Fruits	-	-	-0.11	-	-	-	-	-	-	-0.18
4. Rubber and Latex	-	-	-0.15	-	-	-	-	-	-	-
5. Other Crops	0.03	-0.01	-0.15	-	-	-	-0.12	-0.23	-	-0.18
6. Livestock	0.03	-	-0.15	-	-	-	-0.09	-	-	-0.18
7. Forestry	-	-0.01	-0.15	-0.14	-0.07	-	-0.10	-	-	-0.19
8. Fishery	-	-	-0.15	-	-	-	-0.09	-	-	-0.18
9. Mining and Quarrying	0.07	-0.01	-0.15	-0.14	-0.08	-	-0.09	-0.14	-0.05	-0.18
10. Food Manufacturing	0.04	-	-0.15	-0.15	-0.07	-	-0.10	-	-	-0.18
11. Textile Industry	0.03	-	-0.15	-0.15	-0.08	-	-0.10	-0.16	-	-0.18
12. Paper Industries and Printing	0.03	-	-0.15	-0.14	-0.08	-4.01	-0.10	-0.14	-0.06	-0.18
13. Rubber Chemical and Petroleum Industries	0.03	-	-0.15	-0.14	-0.08	-4.01	-0.10	-0.14	-0.04	-0.18
14. Non Metallic Products	-	-	-0.15	-0.14	-0.08	-4.07	-0.10	-0.08	-0.04	-0.18
15. Metal Product and Machinery	0.03	-	-0.15	-0.14	-0.08	-4.00	-0.10	-0.14	-0.04	-0.18
16. Agricultural Machinery	-	-	-		-	-4.00	-	-	-	-0.24
17. Other Manufacturing	0.03	-	-0.15	-0.14	-0.08	-3.99	-0.10	-0.16	-0.04	-0.18
18. Electricity, Water Work and Public Utilities	0.03	-	-0.15	-0.14	-0.08	-4.01	-0.10	-0.14	-0.03	-0.18
19. Construction and Trade	-	-	-0.15	-0.14	-0.08	-4.00	-0.09	-0.14	-0.05	-0.18
20. Service Transportation and Communication	0.03	-	-0.15	-0.14	-0.08	-4.02	-0.10	-0.14	-0.04	-0.18

Commodity C	Intermediate input to activity A (Simulation 1.3, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	1.27	-	-10.26	-	0.26	0.05	-	-	-	0.30
2. Cassava, Beans and Nuts	-	2.10	-10.27	-	-	0.05	-	-	-	0.30
3. Vegetables, Sugarcane and Fruits	-	-	-10.28	-	0.37	0.06	-	-	-	0.30
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	1.27	2.10	-10.28	0.07	0.26	0.06	0.62	0.26	-	0.30
6. Livestock	-	-	-	-	-	0.05	-	-	-	0.30
7. Forestry	1.36	0.00	-10.29	-	0.27	0.07	0.62	0.65	-0.36	0.30
8. Fishery	-	-	-	-	-	0.05	-	0.26	-	0.30
9. Mining and Quarrying	-	-	-9.91	-	0.32	0.00	-	0.29	-0.36	0.30
10. Food Manufacturing	-	-	-10.44	0.00	0.56	0.05	0.00	0.26	-	0.30
11. Textile Industry	1.27	2.08	-10.30	0.07	0.26	0.00	0.61	0.26	-0.36	0.27
12. Paper Industries and Printing	-	-	-10.27	-	0.26	0.00	0.56	0.29	-0.37	0.30
13. Rubber Chemical and Petroleum Industries	1.27	2.10	-10.28	0.07	0.26	0.05	0.62	0.26	-0.36	0.30
14. Non Metallic Products	1.15	2.15	-10.34	0.06	0.26	0.28	0.62	0.24	-0.38	0.30
15. Metal Product and Machinery	1.27	2.10	-10.28	0.07	0.26	0.06	0.62	0.26	-0.36	0.30
16. Agricultural Machinery	1.27	2.08	-10.28	0.06	0.26	0.06	0.64	0.26	-0.28	0.41
17. Other Manufacturing	1.52	2.02	-10.28	0.00	0.26	0.07	0.62	0.33	-0.36	0.30
18. Electricity, Water Work and Public Utilities	1.22	2.08	-10.27	-	0.26	0.05	0.65	0.25	-0.36	0.30
19. Construction and Trade	1.29	1.84	-10.23	0.00	0.27	0.08	0.61	0.26	-0.36	0.32
20. Service Transportation and Communication	1.27	2.10	-10.28	0.07	0.27	0.05	0.62	0.26	-0.36	0.30

Commodity C	Intermediate input to activity A (Simulation 1.3, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	0.11	0.02	-	-	-	0.03	-	-	0.11
2. Cassava, Beans and Nuts	-	-	0.03	-	-	-	-	-	-	0.11
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	0.11
4. Rubber and Latex	-	-	0.02	-	-	-	-	-	-	
5. Other Crops	0.22	0.10	0.02	-	-	-	-	0.46	-	0.11
6. Livestock	0.23	-	0.02	-	-	-	0.03	-	-	0.11
7. Forestry	0.24	0.10	0.02	-0.17	0.05	-	0.03	-	0.10	0.11
8. Fishery	-	-	0.02	-	-	-	0.04	-	-	0.11
9. Mining and Quarrying	0.22	0.10	0.02	-0.16	0.04	-	0.03	0.37	0.03	0.11
10. Food Manufacturing	0.22	0.10	0.02	-0.17	0.07	-	0.03	-	-	0.11
11. Textile Industry	0.22	0.10	0.02	-0.16	0.04	-	0.03	0.39	0.08	0.11
12. Paper Industries and Printing	0.22	0.10	0.02	-0.16	0.04	-6.15	0.03	0.37	-	0.11
13. Rubber Chemical and Petroleum Industries	0.22	0.10	0.02	-0.16	0.04	-6.29	0.03	0.37	0.02	0.11
14. Non Metallic Products	0.18	-	0.02	-0.16	0.04	-6.40	0.03	0.41	0.02	0.11
15. Metal Product and Machinery	0.22	0.10	0.02	-0.16	0.04	-6.28	0.03	0.37	0.02	0.11
16. Agricultural Machinery	-	-	-	-	-	-6.28	-	-	-	0.12
17. Other Manufacturing	0.22	0.11	0.02	-0.15	0.04	-6.34	0.03	0.36	-	0.11
18. Electricity, Water Work and Public Utilities	0.22	0.10	0.02	-0.16	0.04	-6.29	0.03	0.37	0.03	0.11
19. Construction and Trade	0.20	0.15	0.02	-0.14	0.04	-6.00	-	0.37	-	0.11
20. Service Transportation and Communication	0.22	0.10	0.02	-0.16	0.04	-6.29	0.03	0.37	0.01	0.11

Commodity C	Intermediate input to activity A (Simulation 1.4, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	0.10		0.08		-0.03	0.05				0.09
2. Cassava, Beans and Nuts		0.37	0.07			0.05				0.09
3. Vegetables, Sugarcane and Fruits			0.07		-	0.06				0.09
4. Rubber and Latex										
5. Other Crops	0.10	0.37	0.07	-9.78	-0.03	0.06	0.32	-0.07		0.09
6. Livestock						0.05				0.09
7. Forestry	-	-	0.08		-	0.07	0.33	-	0.49	0.09
8. Fishery						0.06		-0.06		0.09
9. Mining and Quarrying			0.45		-	-		-0.29	0.49	0.09
10. Food Manufacturing			-	-10.00	-	0.05	-	-0.06		0.09
11. Textile Industry	0.11	0.37	0.04	-9.78	-0.03	-	0.33	-0.06	0.48	0.06
12. Paper Industries and Printing			0.09		-0.03	-	0.37	-	0.49	0.09
13. Rubber Chemical and Petroleum Industries	0.10	0.37	0.07	-9.78	-0.03	0.05	0.32	-0.06	0.49	0.09
14. Non Metallic Products	-	1.08	-	-9.79	-0.03	0.28	0.32	-0.06	0.47	0.09
15. Metal Product and Machinery	0.11	0.37	0.07	-9.78	-0.03	0.06	0.32	-0.06	0.49	0.09
16. Agricultural Machinery	0.10	0.36	0.07	-9.78	-0.03	0.06	0.34	-0.05	0.57	-
17. Other Manufacturing	0.30	0.36	0.06	-9.84	-0.03	0.07	0.32	-	0.49	0.09
18. Electricity, Water Work and Public Utilities	-	-	0.06		-0.03	0.06	0.22	-0.05	0.49	0.09
19. Construction and Trade	0.16	-	-	-10.00	-0.14	0.08	0.31	-0.07	0.49	0.10
20. Service Transportation and Communication	0.10	0.37	0.08	-9.78	-0.03	0.05	0.32	-0.06	0.49	0.09

Commodity C	Intermediate input to activity A (Simulation 1.4, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	0.10	-	-	-	0.09	-	-	0.16
2. Cassava, Beans and Nuts	-	-	0.09	-	-	-	-	-	-	0.17
3. Vegetables, Sugarcane and Fruits	-	-	0.11	-	-	-	-	-	-	0.17
4. Rubber and Latex	-	-	0.10	-	-	-	-	-	-	-
5. Other Crops	0.26	-	0.10	-	-	-	0.12	0.23	0.11	0.16
6. Livestock	0.26	-	0.10	-	-	-	0.09	-	-	0.17
7. Forestry	0.24	-	0.10	0.08	0.07	-	0.09	-	0.10	0.17
8. Fishery	-	-	0.10	-	-	-	0.09	-	-	0.17
9. Mining and Quarrying	0.30	-	0.10	0.09	0.06	-	0.09	0.23	0.08	0.17
10. Food Manufacturing	0.26	-	0.10	0.08	0.07	-	0.09	-	0.12	0.17
11. Textile Industry	0.26	0.02	0.10	0.08	0.06	-	0.09	0.23	0.08	0.17
12. Paper Industries and Printing	0.26	-	0.10	0.09	0.06	-1.07	0.09	0.23	0.06	0.17
13. Rubber Chemical and Petroleum Industries	0.26	-	0.10	0.09	0.06	-1.20	0.09	0.23	0.08	0.17
14. Non Metallic Products	0.27	-	0.10	0.09	0.06	-1.74	0.09	0.25	0.08	0.17
15. Metal Product and Machinery	0.26	-	0.10	0.09	0.06	-1.21	0.09	0.23	0.08	0.17
16. Agricultural Machinery	-	-	-	-	-	-1.21	-	-	-	0.12
17. Other Manufacturing	0.26	0.02	0.10	0.09	0.06	-1.23	0.09	0.21	0.08	0.17
18. Electricity, Water Work and Public Utilities	0.26	-	0.10	0.09	0.06	-1.21	0.09	0.23	0.10	0.17
19. Construction and Trade	0.24	-	0.10	0.10	0.06	-2.00	0.09	0.23	0.10	0.17
20. Service Transportation and Communication	0.26	-	0.10	0.09	0.06	-1.22	0.09	0.23	0.08	0.17

Commodity C	Intermediate input to activity A (Simulation 1.5, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	0.31	-	0.16	-	-8.12	-0.16	-	-	-	-1.38
2. Cassava, Beans and Nuts	-	0.48	0.15	-	-	-0.16	-	-	-	-1.38
3. Vegetables, Sugarcane and Fruits	-	-	0.15	-	-8.24	-0.16	-	-	-	-1.38
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.31	0.48	0.15	-0.15	-8.12	-0.15	-0.06	0.14	-	-1.38
6. Livestock	-	-	-	-	-	-0.16	-	-	-	-1.38
7. Forestry	0.34	-	0.16	-	-8.05	-0.14	-0.06	0.00	-0.61	-1.38
8. Fishery	-	-	-	-	-	-0.16	-	0.16	-	-1.38
9. Mining and Quarrying	-	-	0.45	-	-8.11	-0.14	-	0.00	-0.62	-1.39
10. Food Manufacturing	-	-	0.00	-0.56	-7.91	-0.16	0.00	0.16	-	-1.38
11. Textile Industry	0.32	0.52	0.16	-0.15	-8.12	-	-0.06	0.15	-0.64	-1.40
12. Paper Industries and Printing	-	-	0.13	-	-8.12	-0.20	0.00	0.15	-0.62	-1.38
13. Rubber Chemical and Petroleum Industries	0.31	0.48	0.15	-0.15	-8.12	-0.16	-0.05	0.16	-0.62	-1.38
14. Non Metallic Products	0.00	1.08	0.00	-0.16	-8.11	0.00	-0.06	0.18	-0.64	-1.38
15. Metal Product and Machinery	0.31	0.49	0.15	-0.15	-8.12	-0.16	-0.06	0.16	-0.62	-1.38
16. Agricultural Machinery	0.31	0.48	0.15	-0.15	-8.12	-0.17	-0.05	0.16	-0.57	-1.22
17. Other Manufacturing	0.30	0.48	0.15	-0.17	-8.12	-0.15	-0.06	0.22	-0.61	-1.38
18. Electricity, Water Work and Public Utilities	0.24	1.04	0.12	-	-8.12	-0.16	0.00	0.16	-0.62	-1.38
19. Construction and Trade	0.32	0.61	0.17	-	-8.13	-0.16	0.00	0.15	-0.62	-1.37
20. Service Transportation and Communication	0.31	0.48	0.15	-0.15	-8.12	-0.16	-0.06	0.15	-0.62	-1.38

Commodity C	Intermediate input to activity A (Simulation 1.5, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	0.03	-0.62	-	-	-	-0.12	-	-	-0.32
2. Cassava, Beans and Nuts	-	-	-0.62	-	-	-	-	-	-	-0.32
3. Vegetables, Sugarcane and Fruits	-	-	-0.56	-	-	-	-	-	-	-0.32
4. Rubber and Latex	-	-	-0.62	-	-	-	-	-	-	-
5. Other Crops	0.03	0.02	-0.62	-	-	-	-0.12	0.69	0.11	-0.32
6. Livestock	0.03	-	-0.62	-	-	-	-0.13	-	-	-0.31
7. Forestry	-	0.01	-0.62	0.08	0.02	-	-0.12	-	0.10	-0.32
8. Fishery	-	-	-0.62	-	-	-	-0.13	-	-	-0.32
9. Mining and Quarrying	0.07	0.01	-0.62	0.09	0.02	-	-0.12	0.72	0.08	-0.32
10. Food Manufacturing	0.04	0.02	-0.62	0.08	0.07	-	-0.12	-	0.12	-0.32
11. Textile Industry	0.03	0.02	-0.62	0.08	0.02	-	-0.12	0.74	0.08	-0.32
12. Paper Industries and Printing	0.03	0.02	-0.62	0.09	0.02	12.30	-0.12	0.73	0.06	-0.32
13. Rubber Chemical and Petroleum Industries	0.03	0.02	-0.62	0.09	0.02	12.17	-0.12	0.72	0.08	-0.32
14. Non Metallic Products	-	-	-0.62	0.09	0.02	11.63	-0.12	0.74	0.08	-0.32
15. Metal Product and Machinery	0.03	0.01	-0.62	0.09	0.02	12.18	-0.12	0.72	0.08	-0.32
16. Agricultural Machinery	-	-	-	-	-	12.18	-	-	-	-0.36
17. Other Manufacturing	0.03	0.02	-0.62	0.09	0.02	12.17	-0.12	0.71	0.08	-0.32
18. Electricity, Water Work and Public Utilities	0.03	0.02	-0.62	0.09	0.02	12.16	-0.12	0.72	0.06	-0.32
19. Construction and Trade	-	0.08	-0.62	0.10	0.02	12.00	-0.09	0.72	0.05	-0.32
20. Service Transportation and Communication	0.03	0.02	-0.62	0.09	0.02	12.17	-0.12	0.72	0.07	-0.32

Commodity C	Intermediate input to activity A (Simulation 1.6, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	0.30	-	0.08	-	-0.04	-9.30	-	-	-	0.22
2. Cassava, Beans and Nuts	-	0.19	0.07	-	-	-9.30	-	-	-	0.22
3. Vegetables, Sugarcane and Fruits	-	-	0.06	-	-	-9.31	-	-	-	0.22
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.30	0.19	0.06	0.06	-0.03	-9.31	0.08	0.12	-	0.22
6. Livestock	-	-	-	-	-	-9.30	-	-	-	0.22
7. Forestry	0.34	-	0.08	-	-	-9.30	0.08	-	0.10	0.23
8. Fishery	-	-	-	-	-	-9.30	-	0.13	-	0.22
9. Mining and Quarrying	-	-	0.45	-	-	-9.36	-	-	0.10	0.22
10. Food Manufacturing	-	-	-	-	-	-9.30	-	0.13	-	0.22
11. Textile Industry	0.30	0.22	0.04	0.07	-0.03	-9.29	0.08	0.13	0.08	0.21
12. Paper Industries and Printing	-	-	0.04	-	-0.03	-9.35	0.19	0.15	0.09	0.22
13. Rubber Chemical and Petroleum Industries	0.30	0.19	0.06	0.06	-0.03	-9.30	0.08	0.13	0.10	0.22
14. Non Metallic Products	-	-	-	0.06	-0.03	-9.12	0.08	0.12	0.09	0.23
15. Metal Product and Machinery	0.31	0.20	0.06	0.06	-0.03	-9.30	0.08	0.13	0.10	0.22
16. Agricultural Machinery	0.30	0.18	0.06	0.06	-0.04	-9.29	0.10	0.13	-	0.41
17. Other Manufacturing	0.30	0.12	0.06	-	-0.04	-9.28	0.08	0.11	0.10	0.23
18. Electricity, Water Work and Public Utilities	0.24	-	0.06	-	-0.03	-9.30	-	0.13	0.10	0.22
19. Construction and Trade	0.32	-	-	-	-0.14	-9.28	0.15	0.11	0.10	0.22
20. Service Transportation and Communication	0.30	0.19	0.06	0.06	-0.03	-9.30	0.08	0.13	0.10	0.22

Commodity C	Intermediate input to activity A (Simulation 1.6, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	0.03	0.08	-	-	-	0.12	-	-	0.14
2. Cassava, Beans and Nuts	-	-	0.06	-	-	-	-	-	-	0.14
3. Vegetables, Sugarcane and Fruits	-	-	0.11	-	-	-	-	-	-	0.14
4. Rubber and Latex	-	-	0.08	-	-	-	-	-	-	-
5. Other Crops	0.18	0.02	0.08	-	-	-	0.12	0.23	0.11	0.14
6. Livestock	0.18	-	0.08	-	-	-	0.13	-	-	0.14
7. Forestry	-	0.02	0.08	0.10	0.10	-	0.13	-	0.10	0.14
8. Fishery	-	-	0.08	-	-	-	0.13	-	-	0.14
9. Mining and Quarrying	0.22	0.02	0.08	0.10	0.10	-	0.13	0.24	0.05	0.14
10. Food Manufacturing	0.18	0.03	0.08	0.09	0.13	-	0.13	-	-	0.14
11. Textile Industry	0.18	0.03	0.08	0.09	0.10	-	0.13	0.23	0.08	0.14
12. Paper Industries and Printing	0.18	0.03	0.08	0.10	0.10	-	0.13	0.24	0.06	0.14
13. Rubber Chemical and Petroleum Industries	0.18	0.03	0.08	0.10	0.10	-0.10	0.13	0.24	0.06	0.14
14. Non Metallic Products	0.18	-	0.08	0.10	0.10	-0.58	0.13	0.25	0.06	0.14
15. Metal Product and Machinery	0.18	0.03	0.08	0.10	0.10	-0.10	0.13	0.24	0.06	0.14
16. Agricultural Machinery	-	-	-	-	-	-0.10	-	-	-	0.12
17. Other Manufacturing	0.18	0.04	0.08	0.10	0.10	-0.10	0.13	0.23	0.04	0.14
18. Electricity, Water Work and Public Utilities	0.18	0.03	0.08	0.10	0.10	-0.10	0.13	0.24	0.06	0.14
19. Construction and Trade	0.16	0.08	0.08	0.10	0.10	-	0.17	0.24	0.05	0.14
20. Service Transportation and Communication	0.18	0.03	0.08	0.10	0.10	-0.11	0.13	0.24	0.06	0.14

Commodity C	Intermediate input to activity A (Simulation 1.7, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	0.10	-	0.06	-	0.02	-	-	-	-	0.01
2. Cassava, Beans and Nuts	-	0.21	0.04	-	-	-	-	-	-	0.01
3. Vegetables, Sugarcane and Fruits	-	-	0.04	-	-	-	-	-	-	0.01
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.10	0.21	0.04	0.03	0.02	-	-12.77	-	-	0.01
6. Livestock	-	-	-	-	-	-	-	-	-	0.01
7. Forestry	-	-	0.08	-	0.13	-	-12.77	-	0.04	-
8. Fishery	-	-	-	-	-	-	-	0.01	-	0.01
9. Mining and Quarrying	-	-	0.45	-	0.11	-	-	-	0.04	-
10. Food Manufacturing	-	-	-	-	-	-	-14.81	0.01	-	0.01
11. Textile Industry	0.11	0.22	0.04	0.04	0.03	-	-12.78	-	0.04	-
12. Paper Industries and Printing	-	-	0.04		0.03	-	-12.66	-	0.04	0.01
13. Rubber Chemical and Petroleum Industries	0.10	0.21	0.04	0.03	0.02	-	-12.77	0.01	0.04	0.01
14. Non Metallic Products	-	-	-	0.02	0.02	-	-12.78	-	0.04	0.01
15. Metal Product and Machinery	0.11	0.21	0.04	0.02	0.02	-	-12.77	0.01	0.04	0.01
16. Agricultural Machinery	0.10	0.21	0.04	0.02	0.02	-	-12.76	0.01	-	-
17. Other Manufacturing	0.30	0.24	0.04	-	0.02	-	-12.77	-	0.04	0.02
18. Electricity, Water Work and Public Utilities	-	-	-	-	0.02	-	-12.80	-	0.04	0.01
19. Construction and Trade	0.16	-	-	-	-	-	-12.73	-	0.03	0.03
20. Service Transportation and Communication	0.10	0.21	0.04	0.03	0.02	-0.01	-12.77	0.01	0.04	0.01

Commodity C	Intermediate input to activity A (Simulation 1.7, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	-	-	-	-	0.03	-	-	0.03
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-	0.03
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	0.04
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.04	-	-	-	-	-	-	-	-	0.04
6. Livestock	0.04	-	-	-	-	-	0.04	-		0.04
7. Forestry	-	-	-	0.06	0.02	-	0.04	-	0.10	0.04
8. Fishery	-	-	-	-	-	-	0.04	-		0.04
9. Mining and Quarrying	0.07	-	-	0.06	0.02	-	0.05	-0.02	-	0.03
10. Food Manufacturing	0.04	-	-	0.05	0.07	-	0.04	-	-	0.04
11. Textile Industry	0.04	0.02	-	0.05	0.02	-	0.04	-	-	0.04
12. Paper Industries and Printing	0.04	-	-	0.06	0.02	-0.53	0.05	-0.02	-	0.04
13. Rubber Chemical and Petroleum Industries	0.04	-	-	0.06	0.02	-0.75	0.04	-0.02	-	0.04
14. Non Metallic Products	-	-	-	0.06	0.02	-1.16	0.05	-	0.01	0.04
15. Metal Product and Machinery	0.04	-	-	0.06	0.02	-0.74	0.04	-0.02	0.01	0.04
16. Agricultural Machinery	-	-	-	-	-	-0.74	-	-	-	-
17. Other Manufacturing	0.04	0.02	-	0.05	0.02	-0.72	0.04	-0.04	-	0.04
18. Electricity, Water Work and Public Utilities	0.04	-	-	0.06	0.02	-0.75	0.05	-0.02	-	0.04
19. Construction and Trade	0.04	-	-	0.10	0.02	-	0.09	-0.02	-	0.04
20. Service Transportation and Communication	0.04	-	-	0.06	0.02	-0.75	0.04	-0.02	-	0.04

Commodity C	Intermediate input to activity A (Simulation 1.8, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	0.19	-	0.06	-	0.05	0.01	-	-	-	0.04
2. Cassava, Beans and Nuts	-	0.10	0.06	-	-	0.02	-	-	-	0.04
3. Vegetables, Sugarcane and Fruits	-	-	0.05	-	-	0.01	-	-	-	0.04
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.19	0.10	0.05	-0.06	0.05	0.03	-0.06	-4.09	-	0.04
6. Livestock	-	-	-	-	-	0.01	-	-	-	0.04
7. Forestry	-	-	0.08	-	0.13	-	-0.06	-3.90	-0.16	0.04
8. Fishery	-	-	-	-	-	0.01	-	-4.08	-	0.04
9. Mining and Quarrying	-	-	0.45	-	0.11	-	-	-4.03	-0.17	0.04
10. Food Manufacturing	-	-	-	-	-	0.01	-	-4.07	-	0.04
11. Textile Industry	0.18	0.07	0.04	-0.06	0.05	-	-0.06	-4.08	-0.16	0.03
12. Paper Industries and Printing	-	-	0.04		0.06	-	-	-3.98	-0.17	0.04
13. Rubber Chemical and Petroleum Industries	0.19	0.10	0.05	-0.06	0.05	0.01	-0.06	-4.07	-0.17	0.04
14. Non Metallic Products	-	-	-	-0.08	0.05	0.28	-0.06	-4.09	-0.17	0.04
15. Metal Product and Machinery	0.19	0.11	0.05	-0.06	0.05	0.02	-0.06	-4.07	-0.17	0.04
16. Agricultural Machinery	0.18	0.09	0.05	-0.06	0.05	-	-0.05	-4.07	-0.28	-
17. Other Manufacturing	0.30	0.12	0.05	-0.17	0.05	0.04	-0.06	-4.02	-0.17	0.05
18. Electricity, Water Work and Public Utilities	-	-	0.06	-	0.05	0.01	-	-4.08	-0.17	0.04
19. Construction and Trade	0.16	-	-	-	-	-	-	-4.06	-0.17	0.06
20. Service Transportation and Communication	0.19	0.10	0.05	-0.06	0.05	0.01	-0.06	-4.08	-0.17	0.04

Commodity C	Intermediate input to activity A (Simulation 1.8, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	-0.01	-	-	-	-0.03	-	-	-0.04
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-	-0.04
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	-0.04
4. Rubber and Latex	-	-	-0.01	-	-	-	-	-	-	
5. Other Crops	-0.07	-	-0.01	-	-	-	-	-	-	-0.05
6. Livestock	-0.07	-	-0.01	-	-	-	-0.03	-	-	-0.04
7. Forestry	-0.24	-	-0.01	-0.10	-	-	-0.03	-	-	-0.04
8. Fishery	-	-	-0.01	-	-	-	-0.04	-	-	-0.04
9. Mining and Quarrying	-	-	-0.01	-0.10	-0.01	-	-0.03	-0.07	-	-0.04
10. Food Manufacturing	-0.06	0.01	-0.01	-0.11	-	-	-0.03		-	-0.04
11. Textile Industry	-0.06	0.02	-0.01	-0.09	-0.01	-	-0.03	-0.08	-	-0.04
12. Paper Industries and Printing	-0.06	0.01	-0.01	-0.10	-0.01	-	-0.02	-0.06	-	-0.04
13. Rubber Chemical and Petroleum Industries	-0.06	0.01	-0.01	-0.10	-0.01	-	-0.03	-0.07	-	-0.04
14. Non Metallic Products	-0.09	-	-0.01	-0.10	-0.01	-	-0.02	-0.08	-0.01	-0.04
15. Metal Product and Machinery	-0.06	0.01	-0.01	-0.10	-0.01	-	-0.03	-0.07	-0.01	-0.04
16. Agricultural Machinery	-	-	-	-	-	0.01	-	-	-	-
17. Other Manufacturing	-0.06	0.02	-0.01	-0.10	-0.01	-	-0.03	-0.07	-0.04	-0.04
18. Electricity, Water Work and Public Utilities	-0.07	0.01	-0.01	-0.10	-0.01	-	-0.03	-0.07	-	-0.04
19. Construction and Trade	-0.08	-	-0.01	-0.10	-0.01	-	-	-0.06	-	-0.04
20. Service Transportation and Communication	-0.07	0.01	-0.01	-0.10	-0.01	-	-0.03	-0.07	-0.01	-0.04

Source: Model Simulation 1 and 1.1 – 1.8,

Note: 1/ Million baht

P.6 Percentage change of quantity of investment demand for commodity c ($QINV_c$) from results of Simulations 1 and 1.1 – 1.8 compared with base year

Sectors	Base year[1/]	SIM 1 (%Δ)	SIM 1.1 (%Δ)	SIM 1.2 (%Δ)	SIM 1.3 (%Δ)	SIM 1.4 (%Δ)	SIM 1.5 (%Δ)	SIM 1.6 (%Δ)	SIM 1.7 (%Δ)	SIM 1.8 (%Δ)
1. Paddy and Maize	-	-	-	-	-	-	-	-	-	-
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	-
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	-	-	-	-	-	-	-	-	-	-
6. Livestock	834.90	1.11	1.14	0.93	1.10	1.22	0.91	1.20	1.09	1.03
7. Forestry	-	-	-	-	-	-	-	-	-	-
8. Fishery	-	-	-	-	-	-	-	-	-	-
9. Mining and Quarrying	73.70	0.14	0.14	-0.14	0.14	0.14	-0.14	0.14	-	-
10. Food Manufacturing	-	-	-	-	-	-	-	-	-	-
11. Textile Industry	1,000.00	0.03	0.05	-0.15	0.02	0.13	-0.17	0.12	-	-0.05
12. Paper Industries and Printing	-	-	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum Industries	2,999.80	0.03	0.06	-0.14	0.03	0.14	-0.16	0.12	0.01	-0.05
14. Non Metallic Products	3,815.00	0.03	0.06	-0.14	0.03	0.14	-0.16	0.12	0.01	-0.05
15. Metal Product and Machinery	446,988.10	0.03	0.06	-0.14	0.03	0.14	-0.16	0.12	0.01	-0.05
16. Agricultural Machinery	4,822.60	0.03	0.06	-0.14	0.03	0.14	-0.16	0.12	0.01	-0.05
17. Other Manufacturing	65,564.50	0.03	0.06	-0.14	0.03	0.14	-0.16	0.12	0.01	-0.05
18. Electricity, Water Work and Public Utilities	-	-	-	-	-	-	-	-	-	-
19. Construction and Trade	598,576.10	0.03	0.06	-0.14	0.03	0.14	-0.16	0.12	0.01	-0.05
20. Service Transportation and Communication	864.30	0.03	0.06	-0.14	0.03	0.14	-0.16	0.13	0.01	-0.05

Source: Model Simulations 1 and 1.1 – 1.8,
Note: 1/ Million baht

P.7 Percentage change on other economic variables in the model from results of Simulations 1 and 1.1 – 1.8 compared with base year

Sectors	Base year	SIM 1 (%Δ)	SIM 1.1 (%Δ)	SIM 1.2 (%Δ)	SIM 1.3 (%Δ)	SIM 1.4 (%Δ)	SIM 1.5 (%Δ)	SIM 1.6 (%Δ)	SIM 1.7 (%Δ)	SIM 1.8 (%Δ)
1. Average price of factor f (WF_f)[1/]										
1.1 Labour	5.3	-1.89	-	-	-	-	-	-	-	-
1.2 Capital	14.9	-	-	-	-	-	-	-	-	-
2. Supply of factor f (QFS_f)										
2.1 Labour[2/]	30,444,700	-	-	-	-	-	-	-	-	-
2.2 Capital[1/]	16,661,940	-	-	-	-	-	-	-	-	-
3. Government expenditures (EG)[1/]	627,868.80	-0.29	-0.34	0.02	0.19	-0.04	0.02	-0.09	-0.02	0.001
4. Enterprise Saving ($ENTSAV_{ent}$)[1/]	332,604.00	-1.16	-0.18	-0.15	-0.07	-0.07	-0.36	-0.12	0.03	-0.15
5. Foreign savings ($FSAV$)[1/]	264,045.50	-	-	-	-	0.00	-	-	-	-
6. Foreign exchange rate (EXR)	1.00	-0.50	-0.10	-0.10	-0.20	-	-0.20	0.10	-	-
7. Dummy variable ($WALRAS$) (Zero at equilibrium)[3/]	1.867051E-9	-8.5565E-10	-3.22500E-9	-1.07659E-8	-4.69494E-9	4.075378E-8	-4.78657E-9	1.772986E-8	-1.03716E-8	2.631234E-8

Source: Model Simulations 1 and 1.1 – 1.8,

Note: 1/ Million baht

2/ Persons

3/ Actual values

Appendix Q

Results of Simulations 2 and 2.1 – 2.8

Q.1 Percentage change of level of activity (QA), quantity of domestic output (QX), quantity of export (QE), output c sold domestically (QD), quantity of import (QM) and composite commodity (QQ) from results of Simulations 2.1 – 2.8 compared with base year

Sector	Simulation 2.1 (%Δ)						Simulation 2.2 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	3.80	0.55	0.89	0.50	0.07	0.50	-0.23	0.01	0.09	-	-0.10	-
2. Cassava, Beans and Nuts	-1.49	-0.40	-0.46	-0.38	-0.23	-0.34	4.53	1.22	1.37	1.16	0.75	1.06
3. Vegetables, Sugarcane and Fruits	-0.35	0.04	0.04	0.04	0.03	0.04	-0.09	0.08	0.08	0.08	-0.00	0.08
4. Rubber and Latex	-0.00	0.05	-0.03	0.06	0.20	0.06	-0.01	0.06	0.02	0.07	0.20	0.07
5. Other Crops	-0.15	0.15	-0.05	0.18	1.82	0.50	-0.01	0.09	-0.00	0.10	0.79	0.24
6. Livestock	-0.09	0.10	0.12	0.10	-0.05	0.09	-0.00	0.03	0.03	0.03	0.02	0.03
7. Forestry	-0.43	-0.05	-0.06	-0.05	-0.03	-0.04	-0.13	0.02	0.02	0.02	0.02	0.02
8. Fishery	-0.24	0.03	7.40	-0.07	0.18	-0.07	-0.01	0.05	7.41	-0.05	0.20	-0.05
9. Mining and Quarrying	0.08	0.03	0.02	0.03	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.06
10. Food Manufacturing	-0.04	0.56	0.60	0.54	-0.44	0.34	0.01	0.09	0.09	0.09	-0.01	0.07
11. Textile Industry	-0.14	-0.08	-0.09	-0.08	0.04	-0.05	-0.01	0.01	0.01	0.01	0.04	0.02
12. Paper Industries and Printing	-0.03	-0.00	-0.00	-0.00	-0.01	-0.00	0.00	0.02	0.02	0.02	0.02	0.02
13. Rubber Chemical and Petroleum Industries	0.06	0.04	0.02	0.05	0.25	0.11	0.07	0.05	0.05	0.05	0.05	0.05
14. Non Metallic Products	-0.05	0.01	0.01	0.01	-0.03	-0.00	0.07	0.05	0.05	0.05	0.04	0.05
15. Metal Product and Machinery	-0.02	-0.01	-0.01	-0.01	0.02	0.01	0.03	0.04	0.03	0.04	0.05	0.04
16. Agricultural Machinery	3.89	1.08	0.11	1.11	0.62	0.89	1.68	0.50	-0.46	0.53	0.17	0.37
17. Other Manufacturing	-0.01	-0.02	-0.02	-0.01	0.04	0.01	0.03	0.03	0.03	0.03	0.05	0.04
18. Electricity, Water Work and Public Utilities	-0.08	0.01	-0.06	0.01	-0.03	0.01	0.04	0.05	-0.03	0.05	0.03	0.05
19. Construction and Trade	-0.00	0.01	-0.07	0.01	0.00	0.01	0.02	0.05	-0.02	0.06	0.04	0.06
20. Service Transportation and Communication	0.04	-0.01	-0.02	-0.01	0.09	0.00	0.07	0.05	0.05	0.05	0.02	0.05

Sector	Simulation 2.3 (%Δ)						Simulation 2.4 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	-0.58	-0.09	0.11	-0.12	-0.36	-0.12	-0.05	-0.02	0.002	-0.03	-0.05	-0.03
2. Cassava, Beans and Nuts	-0.97	-0.27	-0.35	-0.25	-0.05	-0.20	-0.18	-0.05	-0.05	-0.05	-0.05	-0.05
3. Vegetables, Sugarcane and Fruits	4.70	0.15	0.17	0.15	-0.09	0.14	-0.03	-0.02	-0.02	-0.02	0.05	-0.02
4. Rubber and Latex	-0.03	0.01	0.06	0.00	0.00	0.00	4.85	-0.03	0.01	-0.04	0.00	-0.04
5. Other Crops	-0.11	0.06	-0.11	0.08	1.42	0.35	0.02	-0.02	-0.06	-0.01	0.33	0.06
6. Livestock	-0.03	-0.06	-0.06	-0.07	-0.07	-0.07	-0.04	-0.04	-0.05	-0.04	0.01	-0.04
7. Forestry	-0.28	-0.04	-0.05	-0.04	-0.02	-0.03	-0.15	-0.05	-0.05	-0.05	-0.05	-0.05
8. Fishery	-0.11	-0.02	7.34	-0.12	0.08	-0.12	0.03	-0.03	7.31	-0.14	0.27	-0.13
9. Mining and Quarrying	0.17	-0.02	-0.03	-0.01	0.00	-0.01	-0.24	-0.07	-0.09	-0.07	-0.05	-0.06
10. Food Manufacturing	-0.13	0.13	0.14	0.12	-0.19	0.06	-0.04	-0.04	-0.04	-0.04	0.05	-0.02
11. Textile Industry	-0.10	-0.08	-0.08	-0.08	-0.03	-0.07	-0.13	-0.10	-0.11	-0.10	0.03	-0.07
12. Paper Industries and Printing	-0.04	-0.04	-0.04	-0.04	-0.02	-0.03	-0.00	-0.02	-0.03	-0.02	0.01	-0.02
13. Rubber Chemical and Petroleum Industries	0.00	0.04	0.03	0.04	0.08	0.05	-0.04	0.14	0.16	0.13	-0.10	0.06
14. Non Metallic Products	0.09	0.01	0.01	0.01	0.01	0.01	-0.03	-0.09	-0.10	-0.07	0.09	-0.04
15. Metal Product and Machinery	-0.01	-0.02	-0.02	-0.01	0.02	0.00	-0.03	-0.04	-0.04	-0.04	-0.02	-0.03
16. Agricultural Machinery	3.11	0.85	-0.17	0.88	0.83	0.86	0.76	0.18	-0.83	0.21	0.28	0.24
17. Other Manufacturing	-0.01	-0.03	-0.03	-0.03	-0.00	-0.01	-0.05	-0.05	-0.06	-0.05	0.00	-0.02
18. Electricity, Water Work and Public Utilities	-0.17	-0.01	-0.08	-0.01	-0.15	-0.01	-0.12	-0.14	-0.25	-0.14	0.17	-0.13
19. Construction and Trade	-0.01	-0.01	-0.09	-0.01	0.00	-0.01	-0.04	-0.06	-0.14	-0.06	-0.04	-0.06
20. Service Transportation and Communication	-0.04	0.14	0.16	0.13	-0.06	0.11	-0.08	-0.05	-0.06	-0.05	0.01	-0.04

Sector	Simulation 2.5 (%Δ)						Simulation 2.6 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	-0.13	0.93	2.66	0.70	-1.40	0.68	-0.16	-0.04	-0.26	-0.01	0.28	-0.01
2. Cassava, Beans and Nuts	-0.19	1.29	2.14	1.01	-1.22	0.46	-0.09	-0.03	-0.07	-0.02	0.10	0.01
3. Vegetables, Sugarcane and Fruits	-0.06	0.91	1.01	0.91	-0.70	0.84	-0.03	-0.02	-0.03	-0.02	0.13	-0.02
4. Rubber and Latex	0.07	0.39	1.49	0.24	-1.19	0.24	-0.03	-0.03	-0.04	-0.03	0.00	-0.03
5. Other Crops	3.62	0.41	0.41	0.41	0.40	0.41	0.02	-0.03	-0.02	-0.03	-0.11	-0.05
6. Livestock	0.06	0.36	0.38	0.36	0.24	0.36	4.93	0.16	0.16	0.16	0.18	0.16
7. Forestry	0.02	0.35	0.41	0.33	0.06	0.25	-0.03	-0.04	-0.05	-0.04	0.01	-0.02
8. Fishery	-0.06	0.24	7.62	0.14	0.37	0.14	-0.06	-0.06	7.26	-0.16	0.68	-0.15
9. Mining and Quarrying	0.26	0.13	0.07	0.13	0.20	0.15	-0.05	-0.06	-0.08	-0.06	-0.04	-0.05
10. Food Manufacturing	0.59	0.16	0.17	0.16	0.09	0.15	-0.12	0.47	0.48	0.47	0.35	0.45
11. Textile Industry	-0.01	0.11	0.11	0.11	-0.01	0.08	-0.10	-0.06	-0.07	-0.06	0.03	-0.04
12. Paper Industries and Printing	-0.01	0.06	0.06	0.06	0.02	0.05	-0.01	-0.03	-0.03	-0.03	0.02	-0.02
13. Rubber Chemical and Petroleum Industries	0.24	0.17	0.16	0.18	0.32	0.22	-0.03	-0.03	-0.04	-0.03	0.01	-0.02
14. Non Metallic Products	-0.01	0.08	0.08	0.08	0.09	0.08	-0.04	-0.06	-0.06	-0.05	0.00	-0.04
15. Metal Product and Machinery	-0.01	0.01	0.01	0.01	0.06	0.04	-0.05	-0.05	-0.05	-0.05	-0.03	-0.04
16. Agricultural Machinery	-4.28	-1.19	-2.53	-1.15	1.57	0.07	0.21	0.02	-1.00	0.05	0.05	0.05
17. Other Manufacturing	0.05	0.06	0.06	0.06	0.08	0.07	-0.07	-0.03	-0.04	-0.03	0.01	-0.01
18. Electricity, Water Work and Public Utilities	-0.26	0.03	-0.04	0.03	-0.08	0.03	-0.14	-0.09	-0.18	-0.08	0.08	-0.08
19. Construction and Trade	-0.03	0.07	-0.01	0.07	0.09	0.07	-0.03	-0.06	-0.14	-0.06	-0.04	-0.06
20. Service Transportation and Communication	0.13	0.15	0.16	0.14	0.04	0.13	-0.07	-0.05	-0.06	-0.05	0.06	-0.04

Sector	Simulation 2.7 (%Δ)						Simulation 2.8 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	-0.04	-0.00	0.01	-0.00	-0.02	-0.00	-0.22	-0.03	0.04	-0.03	-0.11	-0.04
2. Cassava, Beans and Nuts	-0.07	-0.02	-0.02	-0.02	-0.01	-0.01	-0.11	-0.04	-0.05	-0.03	0.02	-0.02
3. Vegetables, Sugarcane and Fruits	-0.01	0.01	0.01	0.01	0.00	0.01	-0.06	0.00	-0.00	0.01	0.12	0.01
4. Rubber and Latex	-0.01	-	-0.02	0.01	0.00	0.01	0.07	0.02	-0.01	0.02	0.00	0.02
5. Other Crops	-0.00	0.01	-0.00	0.02	0.14	0.04	-0.05	0.02	0.04	0.02	-0.18	-0.02
6. Livestock	-0.01	-	-	-	-	-	-0.03	0.15	0.17	0.15	-0.05	0.14
7. Forestry	4.84	0.76	0.80	0.75	0.59	0.70	0.08	0.03	0.02	0.03	0.07	0.04
8. Fishery	0.00	0.00	7.36	-0.10	0.21	-0.09	4.88	0.23	7.60	0.12	0.37	0.13
9. Mining and Quarrying	-0.01	0.00	0.00	0.00	0.00	0.00	0.20	0.05	0.05	0.05	0.04	0.04
10. Food Manufacturing	0.00	-0.01	-0.01	-0.01	0.01	-0.00	-0.04	0.49	0.50	0.48	0.07	0.39
11. Textile Industry	-0.02	-0.01	-0.01	-0.01	0.01	-0.01	0.07	0.05	0.05	0.05	0.11	0.06
12. Paper Industries and Printing	-	0.02	0.02	0.02	-0.04	0.01	-0.01	0.01	0.00	0.01	0.04	0.01
13. Rubber Chemical and Petroleum Industries	0.01	-	-	-	-	-	0.02	0.10	0.09	0.11	0.27	0.15
14. Non Metallic Products	-0.01	0.02	0.01	0.02	0.09	0.04	0.13	0.08	0.08	0.08	0.07	0.08
15. Metal Product and Machinery	-0.01	-0.01	-0.01	-0.00	0.02	0.01	0.01	0.02	0.02	0.02	0.06	0.04
16. Agricultural Machinery	0.42	0.11	-0.88	0.15	0.09	0.12	0.22	0.08	-1.00	0.11	0.62	0.34
17. Other Manufacturing	-0.02	0.11	0.12	0.11	-0.02	0.04	0.02	0.03	0.03	0.03	0.07	0.05
18. Electricity, Water Work and Public Utilities	-	-0.01	-0.09	-	0.01	-	0.06	0.10	0.03	0.10	-0.02	0.10
19. Construction and Trade	-	-	-0.07	-	-	-	0.01	0.06	-0.03	0.06	0.04	0.06
20. Service Transportation and Communication	-0.01	-	-0.00	-0.00	0.01	-	0.05	0.11	0.11	0.11	0.06	0.10

Q.2 Percentage change of price of activity (PA), producer price (PX) ,export price (PE), domestic price (PD), import price (PM), composite commodity price (PQ), value added price (PVA) from results of Simulations 2.1 – 2.8 compared with base year

Sector	Simulation 2.1 (%Δ)							Simulation 2.2 (%Δ)						
	PA	PX	PE	PD	PM	PQ	PVA	PA	PX	PE	PD	PM	PQ	PVA
1. Paddy and Maize	-0.30	-0.30	-	-0.40	-	-0.40	-1.84	-	-0.10	-	-0.10	-	-0.10	-0.52
2. Cassava, Beans and Nuts	-0.20	0.10	-	0.10	-	0.10	-2.78	-0.10	-0.20	-	-0.20	-	-0.20	-1.04
3. Vegetables, Sugarcane and Fruits	-0.10	-	-	-	-	-	-0.86	-	-	-	-	-	-	-0.22
4. Rubber and Latex	0.20	0.80	-	0.90	-	0.90	0.22	-	0.40	-	0.40	-	0.40	-
5. Other Crops	0.10	2.10	-	2.40	-	1.90	-0.67	0.10	0.90	-	1.00	-	0.80	-0.34
6. Livestock	-0.30	-0.20	-	-0.20	-	-0.20	-0.33	-	-	-	-	-	-	-
7. Forestry	0.10	0.10	-	0.10	-	0.10	-0.49	-	-	-	-	-	-	-
8. Fishery	-0.20	0.20	-	0.20	-	0.20	-0.60	-	0.20	-	0.20	-	0.20	-
9. Mining and Quarrying	0.10	0.10	-	0.10	-	0.10	-	-	-	-	-	-	-	-
10. Food Manufacturing	-0.10	-0.40	-	-0.60	-	-0.50	-	-	-	-	-0.10	-	-	-
11. Textile Industry	0.10	0.10	-	0.10	-	0.10	-	-	-	-	-	-	-	-
12. Paper Industries and Printing	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum Industries	0.20	0.20	-	0.30	-	0.20	-	-	-	-	-	-	-	-
14. Non Metallic Products	0.10	-	-	-0.10	-	-	-	-	-	-	-	-	-	0.37
15. Metal Product and Machinery	0.10	-	-	0.10	-	-	-	-	-	-	-	-	-	-
16. Agricultural Machinery	0.40	-0.60	-	-0.60	-	-0.30	3.40	0.10	-0.50	-	-0.50	-	-0.30	1.36
17. Other Manufacturing	0.10	-	-	0.10	-	-	0.23	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	0.10	-	-	-	-	-	-	-	-	-	-	-	-	-
19. Construction and Trade	0.10	0.10	-	0.10	-	0.10	0.11	-	-	-	-	-	-	-
20. Service Transportation and Communication	0.10	0.10	-	0.10	-	0.10	0.15	-	-	-	-	-	-	0.15

Sector	Simulation 2.3 (%Δ)							Simulation 2.4 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*	*PA*	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	-0.10	-0.10	0.10	-0.20	0.10	-0.20	-1.05	-	-0.10	-	-0.10	-	-0.10	-
2. Cassava, Beans and Nuts	-	0.10	0.10	0.20	0.10	0.10	-1.74	-	-	-	-	-	-	-0.35
3. Vegetables, Sugarcane and fruits	-0.10	-0.10	0.10	-0.10	0.10	-0.10	-0.86	-	-	-	-	-	-	-
4. Rubber and Latex	0.10	-0.50	0.10	-0.50	0.10	-0.50	-	-0.30	-0.50	-	-0.60	-	-0.60	-0.43
5. Other Crops	0.10	1.80	0.10	2.00	0.10	1.60	-0.34	-	0.40	-	0.50	-	0.40	-
6. Livestock	-	0.10	0.10	0.10	0.10	0.10	-	-	-	-	-	-	-	-
7. Forestry	0.10	0.10	0.10	0.10	0.10	0.10	-0.49	-	-	-	-	-	-	-
8. Fishery	-	0.20	0.10	0.20	0.10	0.20	-0.30	-	0.20	-	0.20	-	0.20	0.30
9. Mining and Quarrying	0.10	0.20	0.10	0.20	0.10	0.20	-	-0.10	0.10	-	0.10	-	0.10	-0.63
10. Food Manufacturing	-	-0.10	0.10	-0.10	0.10	-0.10	-0.33	-	-	-	-	-	-	-
11. Textile Industry	0.10	0.10	0.10	0.10	0.10	0.10	-	-	-	-	-	-	-	-
12. Paper Industries and Printing	-	0.10	0.10	0.10	0.10	0.10	-0.46	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum Industries	0.10	0.10	0.10	0.10	0.10	0.10	-	-	-0.30	-	-0.30	-	-0.20	-
14. Non Metallic Products	0.10	0.10	0.10	0.10	0.10	0.10	0.37	-	0.10	-	0.30	-	0.20	0.37
15. Metal Product and Machinery	0.10	0.10	0.10	0.10	0.10	0.10	-	-	-	-	-	-	-	-
16. Agricultural Machinery	0.40	-	0.10	-	0.10	-	2.72	0.10	-	-	-	-	-	0.68
17. Other Manufacturing	0.10	0.10	0.10	0.10	0.10	0.10	0.23	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	-	-0.10	0.10	-0.10	0.10	-0.10	-	0.10	0.30	-	0.30	-	0.30	-
19. Construction and Trade	0.10	0.20	0.10	0.20	0.10	0.20	0.11	-	0.10	-	0.10	-	0.10	-
20. Service Transportation and Communication	0.10	-0.10	0.10	-0.20	0.10	-0.10	0.15	-	-	-	-	-	-	0.15

Sector	Simulation 2.5 (%Δ)							Simulation 2.6 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*	*PA*	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	-	-1.60	0.10	-1.90	0.10	-1.90	-0.26	-	0.20	-	0.20	-	0.20	-0.26
2. Cassava, Beans and Nuts	-	-0.80	0.10	-1.10	0.10	-0.80	-0.35	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	-	-0.80	0.10	-0.90	0.10	-0.90	-0.22	-	-	-	-	-	-	-
4. Rubber and Latex	0.20	-	0.10	-	0.10	-	0.22	-	-	-	-	-	-	-
5. Other Crops	-	0.10	0.10	0.10	0.10	0.10	-4.36	-	-	-	-	-	-	-
6. Livestock	0.10	-0.10	0.10	-0.10	0.10	-0.10	0.33	-	-	-	-	-	-	-
7. Forestry	-	-0.50	0.10	-0.60	0.10	-0.40	-	-	-	-	0.10	-	-	-
8. Fishery	0.10	0.30	0.10	0.20	0.10	0.20	-	-	0.50	-	0.40	-	0.40	-
9. Mining and Quarrying	0.20	0.60	0.10	0.70	0.10	0.50	-	-	0.10	-	0.10	-	0.10	-
10. Food Manufacturing	-	0.10	0.10	-	0.10	-	0.98	-	-	-	-	-	-	-0.33
11. Textile Industry	-	-	0.10	-	0.10	-	-	-	-	-	-	-	-	-
12. Paper Industries and Printing	0.10	0.10	0.10	-	0.10	0.10	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum Industries	-	0.20	0.10	0.30	0.10	0.20	0.68	-	-	-	-	-	-	-
14. Non Metallic Products	0.10	0.10	0.10	0.10	0.10	0.10	-	-	-	-	-	-	-	0.37
15. Metal Product and Machinery	0.10	0.10	0.10	0.10	0.10	0.10	-	-	-	-	-	-	-	-
16. Agricultural Machinery	0.10	3.70	0.10	3.80	0.10	2.10	-4.08	-	-	-	-	-	-	-
17. Other Manufacturing	0.10	0.10	0.10	0.10	0.10	0.10	0.23	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	0.10	-	0.10	-	0.10	-	-0.32	-	0.10	-	0.10	-	0.10	-
19. Construction and Trade	-	0.20	0.10	0.20	0.10	0.20	-0.11	-	0.10	-	0.10	-	0.10	-
20. Service Transportation and communication	0.10	-	0.10	-	0.10	-	0.15	-	0.10	-	0.10	-	0.10	0.15

Sector	Simulation 2.7 (%Δ)							Simulation 2.8 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*	*PA*	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	-	-	-	-	-	-	-0.26	-0.10	-	-	-	-	-	-0.52
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-0.35	-0.10	-	-	0.10	-	-	-0.35
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-0.10	0.10	-	0.10	-	0.10	-0.22
4. Rubber and Latex	-	0.30	-	0.30	-	0.30	-	0.20	0.30	-	0.30	-	0.30	0.22
5. Other Crops	-	0.10	-	0.20	-	0.10	-	-	-0.20	-	-0.30	-	-0.20	-0.34
6. Livestock	-	-	-	-	-	-	-	-0.10	-0.20	-	-0.20	-	-0.20	-
7. Forestry	-0.10	-0.40	-	-0.40	-	-0.30	-	0.10	0.10	-	0.10	-	0.10	-
8. Fishery	-	0.20	-	0.20	-	0.20	-	-0.10	0.20	-	0.20	-	0.20	-0.30
9. Mining and Quarrying	-	-	-	-	-	-	-	0.10	-	-	-	-	-	-
10. Food Manufacturing	-	-	-	-	-	-	-	-0.10	-0.10	-	-0.20	-	-0.20	-0.33
11. Textile Industry	-	-	-	-	-	-	-	0.10	0.10	-	0.10	-	0.10	0.31
12. Paper Industries and Printing	-	-0.10	-	-0.10	-	-0.10	-	-	0.10	-	0.10	-	0.10	-0.46
13. Rubber Chemical and Petroleum Industries	-	-	-	-	-	-	-	0.10	0.20	-	0.20	-	0.20	-
14. Non Metallic Products	-	-	-	0.10	-	0.10	-	0.10	-	-	-	-	-	0.37
15. Metal Product and Machinery	-	-	-	-	-	-	-	-	-	-	0.10	-	-	-
16. Agricultural Machinery	-	-0.10	-	-0.10	-	-0.10	-	0.20	0.70	-	0.70	-	0.40	-
17. Other Manufacturing	-	-0.10	-	-0.10	-	-0.10	-	-	-	-	0.10	-	-	-
18. Electricity, Water Work and Public Utilities	-	-	-	-	-	-	-	-	-0.10	-	-0.10	-	-0.10	-
19. Construction and Trade	-	-	-	-	-	-	-	-	0.20	-	0.20	-	0.20	0.11
20. Service Transportation and Communication	-	-	-	-	-	-	0.15	-	-	-	-	-	-	0.15

Source: Model Simulations 2.1 – 2.8

Q.3 Percentage change of wage distortion for factors (labour and capital) in Activity ($WFDIST_{fa}$) from results of Simulations 2 and 2.1 – 2.8 compared with base year

Sectors	Labour									
	Base year[1/]	SIM 2 (%Δ)	SIM 2.1 (%Δ)	SIM 2.2 (%Δ)	SIM 2.3 (%Δ)	SIM 2.4 (%Δ)	SIM 2.5 (%Δ)	SIM 2.6 (%Δ)	SIM 2.7 (%Δ)	SIM 2.8 (%Δ)
1. Paddy and Maize	12.30	-	-	-	-	-	-	-	-	-
2. Cassava, Beans and Nuts	13.90	-	-	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	10.70	-	-	-	-	-	-	-	-	-
4. Rubber and Latex	15.60	-	-	-	-	-	-	-	-	-
5. Other Crops	20.10	-	-	-	-	-	-	-	-	-
6. Livestock	12.00	-	-	-	-	-	-	-	-	-
7. Forestry	14.50	-	-	-	-	-	-	-	-	-
8. Fishery	57.30	-	-	-	-	-	-	-	-	-
9. Mining and Quarrying	1,154.60	-	-	-	-	-	-	-	-	-
10. Food Manufacturing	132.60	-	-	-	-	-	-	-	-	-
11. Textile Industry	152.90	-	-	-	-	-	-	-	-	-
12. Paper Industries and Printing	178.30	-	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum	233.20	-	-	-	-	-	-	-	-	-
14. Non Metallic Products	169.40	-	-	-	-	-	-	-	-	-
15. Metal Product and Machinery	242.80	-	-	-	-	-	-	-	-	-
16. Agricultural Machinery	365.00	-	-	-	-	-	-	-	-	-
17. Other Manufacturing	127.80	-	-	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	1,562.20	-	-	-	-	-	-	-	-	-
19. Construction and Trade	60.70	-	-	-	-	-	-	-	-	-
20. Service Transportation and Communication	182.70	-	-	-	-	-	-	-	-	-

Sectors	Capital									
	Base year	SIM 2 (%Δ)	SIM 2.1 (%Δ)	SIM 2.2 (%Δ)	SIM 2.3 (%Δ)	SIM 2.4 (%Δ)	SIM 2.5 (%Δ)	SIM 2.6 (%Δ)	SIM 2.7 (%Δ)	SIM 2.8 (%Δ)
1. Paddy and Maize	142.90	-6.16	-2.87	-0.63	-1.40	-	-0.35	-0.28	-0.07	-0.56
2. Cassava, Beans and Nuts	161.40	-9.42	-4.03	-1.24	-2.60	-0.37	-0.50	-0.12	-0.19	-0.31
3. Vegetables, Sugarcane and Fruits	124.10	-3.30	-1.29	-0.40	-1.05	-	-0.24	-	-	-0.24
4. Rubber and Latex	181.70	-	0.11	-0.06	-0.06	-0.55	0.33	-0.06	-0.06	0.33
5. Other Crops	234.00	-6.54	-0.56	-0.09	-0.43	0.17	-5.64	0.21	-	-0.21
6. Livestock	139.10	-0.43	-0.36	-0.07	-0.07	-0.07	0.29	-0.29	-0.07	-0.14
7. Forestry	168.80	-2.55	-1.01	-0.36	-0.65	-0.30	0.12	0.06	-0.36	0.24
8. Fishery	135.90	-1.69	-0.74	-	-0.29	0.29	-0.22	-0.07	0.07	-0.44
9. Mining and Quarrying	228.00	1.67	0.35	0.09	0.57	-0.57	0.75	-0.04	-0.04	0.57
10. Food Manufacturing	141.60	0.99	-	-	-0.28	-	1.69	-0.21	-	-0.14
11. Textile Industry	163.00	-0.55	-0.18	-0.06	-0.12	-0.18	-	-0.12	-	0.18
12. Paper Industries and Printing	189.00	-0.11	-	-	-0.11	0.11	-	0.05	0.05	-
13. Rubber Chemical and Petroleum Industries	252.60	1.27	0.28	0.16	0.08	-0.04	0.71	-	-	0.04
14. Non Metallic Products	179.70	0.72	-0.06	0.17	0.39	0.06	-	-	-	0.39
15. Metal Product and Machinery	265.70	0.15	0.04	0.08	0.04	0.04	-	-0.04	-	0.04
16. Agricultural Machinery	386.70	10.45	7.47	3.13	5.97	1.53	-7.84	0.49	0.80	0.41
17. Other Manufacturing	133.60	2.10	1.87	1.80	1.80	1.72	1.95	1.72	1.72	1.80
18. Electricity, Water Work and Public	39.40	-0.76	-	0.25	-0.25	-	-0.51	-	-	0.25
19. Construction and Trade	271.30	0.04	0.07	0.04	0.04	-0.07	-0.15	-0.07	-0.04	0.04
20. Service Transportation and Communication	32.50	0.31	-	-	-	-	-	-	-	-

Source: Model Simulations 2 and 2.1 – 2.8,

Note: 1/ Million baht

Q.4 Percentage change of quantity of consumption of commodity c by household h (QH_{ch}) from results of Simulations 2 and 2.1 – 2.8 compared with base year

Sectors	Base year[1/]	SIM 2 (%Δ)	SIM 2.1 (%Δ)	SIM 2.2 (%Δ)	SIM 2.3 (%Δ)	SIM 2.4 (%Δ)	SIM 2.5 (%Δ)	SIM 2.6 (%Δ)	SIM 2.7 (%Δ)	SIM 2.8 (%Δ)
1. Paddy and Maize	20,041.70	2.78	0.46	0.14	0.21	0.06	2.05	-0.20	0.02	0.16
2. Cassava, Beans and Nuts	10,689.10	1.08	-	0.21	-0.10	0.04	0.95	0.01	0.01	0.06
3. Vegetables, Sugarcane and Fruits	120,716.90	1.24	0.06	0.09	0.12	-0.01	1.02	-0.04	0.01	0.02
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	12,166.80	-4.08	-1.80	-0.75	-1.54	-0.36	0.08	0.14	-0.13	0.30
6. Livestock	53,940.80	0.83	0.25	0.05	-0.02	-0.03	0.22	0.03	0.01	0.34
7. Forestry	8,107.10	0.82	0.01	0.05	-0.07	0.02	0.58	-0.04	0.31	0.01
8. Fishery	81,989.70	-0.06	-0.09	-0.11	-0.14	-0.21	-0.07	-0.44	-0.17	-0.07
9. Mining and Quarrying	638.00	-0.47	-	0.05	-0.11	-0.09	-0.36	-0.08	-	0.13
10. Food Manufacturing	477,990.30	1.19	0.54	0.09	0.13	-0.01	0.10	0.11	-	0.28
11. Textile Industry	259,761.10	0.08	-0.01	0.03	-0.05	-0.04	0.13	0.01	-0.01	0.05
12. Paper Industries and Printing	35,156.90	0.22	0.06	0.04	-0.04	0.01	0.09	0.02	0.05	0.05
13. Rubber Chemical and Petroleum Industries	290,586.30	-0.03	-0.11	0.04	-0.06	0.23	-0.05	0.02	0.01	-0.05
14. Non Metallic Products	15,507.30	-0.03	0.12	0.06	-0.02	-0.22	0.06	-0.03	-0.09	0.09
15. Metal Product and Machinery	353,855.40	0.15	0.05	0.04	-0.04	0.03	0.04	0.05	-	0.06
16. Agricultural Machinery	116.30	-1.89	0.43	0.34	-	-	-1.89	0.09	0.09	-0.26
17. Other Manufacturing	214,743.60	0.21	0.03	0.04	-0.04	0.01	0.06	0.03	0.07	0.06
18. Electricity, Water Work and Public Utilities	113,459.20	0.24	0.10	0.07	0.11	-0.28	0.18	-0.11	-0.01	0.21
19. Construction and Trade	55,438.10	-0.30	0.01	0.01	-0.13	-0.08	-0.04	-0.09	-	-0.05
20. Service Transportation and Communication	695,835.20	0.38	0.46	0.07	0.18	-0.03	0.17	-0.06	-0.01	0.13

Source: Model Simulation 2 and 2.1 – 2.8
Note: 1/ Million baht

Q.5 Percentage change of quantity of intermediate use of commodity c by activity a ($QINT_{ca}$) from results of Simulations 2 and 2.1 – 2.8 compared with base year[1/]

Commodity C	Intermediate input to activity A (Simulation 2, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	2.34	-	4.04	-	3.30	4.84	-	-	-	0.21
2. Cassava, Beans and Nuts	-	1.25	4.04	-	-	4.83	-	-	-	0.21
3. Vegetables, Sugarcane and Fruits	-	-	4.03	-	3.37	4.84	-	-	-	0.21
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	2.34	1.25	4.03	4.92	3.31	4.85	3.86	4.39	-	0.21
6. Livestock	-	-	-	-	-	4.84	-	-	-	0.21
7. Forestry	2.38	-	4.08	-	3.36	4.83	3.86	4.55	0.44	0.21
8. Fishery	-	-	-	-	-	4.84	-	4.40	-	0.21
9. Mining and Quarrying	-	-	4.05	-	3.35	4.82	-	4.32	0.45	0.22
10. Food Manufacturing	-	-	3.92	5.00	3.39	4.84	3.70	4.40	-	0.21
11. Textile Industry	2.34	1.26	4.03	4.93	3.31	4.87	3.86	4.40	0.44	0.21
12. Paper Industries and Printing	-	-	4.01	-	3.32	4.84	3.91	4.42	0.44	0.21
13. Rubber Chemical and Petroleum Industries	2.34	1.25	4.03	4.92	3.31	4.84	3.86	4.40	0.45	0.21
14. Non Metallic Products	2.29	1.08	4.02	4.91	3.31	5.13	3.86	4.40	0.43	0.21
15. Metal Product and Machinery	2.34	1.25	4.03	4.92	3.31	4.84	3.86	4.40	0.45	0.21
16. Agricultural Machinery	2.34	1.24	4.03	4.92	3.31	4.84	3.86	4.40	0.57	0.41
17. Other Manufacturing	2.43	1.19	4.03	4.84	3.31	4.84	3.86	4.46	0.44	0.23
18. Electricity, Water Work and Public Utilities	2.19	1.04	4.00	-	3.31	4.84	3.90	4.39	0.45	0.21
19. Construction and Trade	2.27	1.23	3.96	5.00	3.25	4.87	3.83	4.39	0.44	0.22
20. Service Transportation and Communication	2.34	1.25	4.03	4.92	3.31	4.84	3.86	4.40	0.45	0.21

Commodity C	Intermediate input to activity A (Simulation 2, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-0.09	0.30	0.00	-	-	-0.06	-	-	0.09
2. Cassava, Beans and Nuts	-	-	0.31	-	-	-	-	-	-	0.09
3. Vegetables, Sugarcane and Fruits	-	-	0.34	-	-	-	-	-	-	0.09
4. Rubber and Latex	-	-	0.30	-	-	-	-	-	-	-
5. Other Crops	-0.42	-0.10	0.30	-	-	-	-0.12	-0.69	-0.11	0.09
6. Livestock	-0.42	-	0.30	-	-	-	-0.03	-	-	0.09
7. Forestry	-0.47	-0.10	0.30	0.11	-0.10	-	-0.04	-	0.00	0.09
8. Fishery	-	-	0.30	0.48	-	-	-0.04	-	-	0.09
9. Mining and Quarrying	-0.37	-0.10	0.30	0.10	-0.08	-	-0.04	-0.60	-0.08	0.08
10. Food Manufacturing	-0.42	-0.09	0.30	0.09	-0.07	-	-0.03	-	-0.12	0.09
11. Textile Industry	-0.42	-0.08	0.30	0.10	-0.08	-	-0.04	-0.59	-0.08	0.09
12. Paper Industries and Printing	-0.42	-0.10	0.30	0.10	-0.08	5.35	-0.04	-0.59	-0.06	0.09
13. Rubber Chemical and Petroleum Industries	-0.42	-0.10	0.30	0.10	-0.08	5.26	-0.04	-0.60	-0.06	0.09
14. Non Metallic Products	-0.46	-0.18	0.30	0.10	-0.08	5.23	-0.04	-0.57	-0.07	0.09
15. Metal Product and Machinery	-0.42	-0.10	0.30	0.10	-0.08	5.26	-0.04	-0.60	-0.07	0.09
16. Agricultural Machinery	-	-	-	-	-	5.26	-	-	-	0.12
17. Other Manufacturing	-0.42	-0.09	0.30	0.11	-0.08	5.21	-0.04	-0.61	-0.08	0.09
18. Electricity, Water Work and Public Utilities	-0.42	-0.10	0.30	0.10	-0.08	5.26	-0.04	-0.60	-0.06	0.09
19. Construction and Trade	-0.44	-0.08	0.30	0.14	-0.08	6.00	-	-0.59	-0.10	0.09
20. Service Transportation and Communication	-0.42	-0.10	0.30	0.10	-0.08	5.25	-0.04	-0.60	-0.08	0.09

Commodity C	Intermediate input to activity A (Simulation 2.1, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	3.80	-	-0.33	-	-0.16	-0.09	-	-	-	-0.04
2. Cassava, Beans and Nuts	-	-1.49	-0.35	-	-	-0.09	-	-	-	-0.04
3. Vegetables, Sugarcane and Fruits	-	-	-0.35	-	-	-0.09	-	-	-	-0.04
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	3.80	-1.49	-0.35	-	-0.15	-0.09	-0.43	-0.23	-	-0.04
6. Livestock	-	-	-	-	-	-0.09	-	-	-	-0.04
7. Forestry	3.74	-2.44	-0.33	-	-0.13	-0.07	-0.42	-	0.08	-0.04
8. Fishery	-	-	-	-	-	-0.09	-	-0.24		-0.04
9. Mining and Quarrying	-	-	-	-	-0.11	-0.14	-	-0.29	0.08	-0.04
10. Food Manufacturing	-	-	-0.26	-	-	-0.09	-	-0.24		-0.04
11. Textile Industry	3.79	-1.48	-0.36	-	-0.15	-	-0.42	-0.23	0.08	-0.06
12. Paper Industries and Printing	-	-	-0.35	-	-0.15	-0.13	-0.37	-0.15	0.07	-0.04
13. Rubber Chemical and Petroleum Industries	3.80	-1.49	-0.35	-	-0.15	-0.09	-0.42	-0.24	0.08	-0.04
14. Non Metallic Products	3.44	-1.08	-0.29	-	-0.15	-	-0.43	-0.24	0.09	-0.04
15. Metal Product and Machinery	3.80	-1.48	-0.35	-	-0.15	-0.09	-0.43	-0.24	0.08	-0.04
16. Agricultural Machinery	3.80	-1.48	-0.35	-	-0.15	-0.11	-0.39	-0.23	-	-
17. Other Manufacturing	3.95	-1.54	-0.35	-	-0.15	-0.07	-0.42	-0.22	0.08	-0.02
18. Electricity, Water Work and Public Utilities	3.65	-1.04	-0.36		-0.15	-0.09	-0.43	-0.24	0.08	-0.04
19. Construction and Trade	3.72	-1.84	-0.33	-	-0.27	-0.08	-0.46	-0.22	0.08	-0.03
20. Service Transportation and Communication	3.80	-1.49	-0.35	-	-0.15	-0.09	-0.43	-0.24	0.08	-0.04

Commodity C	Intermediate input to activity A (Simulation 2.1, (%∆))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-0.03	0.06	-	-	-	-0.03	-	-	0.04
2. Cassava, Beans and Nuts	-	-	0.06	-	-	-	-	-	-	0.04
3. Vegetables, Sugarcane and Fruits	-	-	0.11	-	-	-	-	-	-	0.04
4. Rubber and Latex	-	-	0.06	-	-	-	-	-	-	-
5. Other Crops	-0.14	-0.03	0.06	-	-	-	-	-	-	0.04
6. Livestock	-0.14	-	0.06	-	-	-	-0.02	-	-	0.04
7. Forestry	-0.24	-0.03	0.06	-0.05	-0.02	-	-0.01	-	-	0.04
8. Fishery	-	-	0.06	-		-	-	-	-	0.04
9. Mining and Quarrying	-0.07	-0.03	0.06	-0.05	-0.02	-	-0.01	-0.08	-	0.04
10. Food Manufacturing	-0.14	-0.03	0.06	-0.06	-	-	-0.01		-	0.04
11. Textile Industry	-0.14	-0.02	0.06	-0.05	-0.02	-	-0.01	-0.08	-	0.04
12. Paper Industries and Printing	-0.14	-0.03	0.06	-0.05	-0.02	4.01	-0.01	-0.07	-	0.04
13. Rubber Chemical and Petroleum Industries	-0.14	-0.03	0.06	-0.05	-0.02	3.88	-0.01	-0.08	-	0.04
14. Non Metallic Products	-0.18	-0.18	0.06	-0.05	-0.02	3.49	-0.01	-0.08	-	0.04
15. Metal Product and Machinery	-0.14	-0.03	0.06	-0.05	-0.02	3.89	-0.01	-0.08	-	0.04
16. Agricultural Machinery	-	-	-	-	-	3.89	-	-	-	-
17. Other Manufacturing	-0.14	-0.02	0.06	-0.04	-0.02	3.89	-0.01	-0.09	-	0.04
18. Electricity, Water Work and Public Utilities	-0.14	-0.03	0.06	-0.05	-0.02	3.89	-0.01	-0.08	-	0.04
19. Construction and Trade	-0.16	-	0.07	-0.05	-0.02	4.00	-	-0.08	-	0.04
20. Service Transportation and Communication	-0.14	-0.03	0.06	-0.05	-0.02	3.88	-0.01	-0.08	-0.01	0.04

Commodity C	Intermediate input to activity A (Simulation 2.2, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	-0.23	-	-0.08	-	-0.02	-	-	-	-	0.01
2. Cassava, Beans and Nuts	-	4.53	-0.08	-	-	-	-	-	-	0.01
3. Vegetables, Sugarcane and Fruits	-	-	-0.09	-	-	-	-	-	-	0.01
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	
5. Other Crops	-0.23	4.53	-0.09	-0.01	-0.02	-	-0.13	-0.02	-	0.01
6. Livestock	-	-	-	-	-	-	-	-	-	0.01
7. Forestry	-0.34	2.44	-0.08	-	-	-	-0.13	-	0.04	0.02
8. Fishery	-	-	-	-	-	-	-	-0.01	-	0.01
9. Mining and Quarrying	-	-	-	-	-	-	-	-	0.05	-
10. Food Manufacturing	-	-	-0.26	-	-	-	-	-0.01	-	0.01
11. Textile Industry	-0.23	4.53	-0.12	-	-0.01	-	-0.13	-0.01	0.04	-
12. Paper Industries and Printing	-	-	-0.09	-	-	-	-0.19	-	0.04	0.01
13. Rubber Chemical and Petroleum Industries	-0.23	4.53	-0.09	-0.01	-0.01	-	-0.13	-0.01	0.04	0.01
14. Non Metallic Products	-0.38	5.38	-	-0.02	-0.01	-	-0.13	-	0.04	0.01
15. Metal Product and Machinery	-0.23	4.54	-0.09	-0.01	-0.01	-	-0.13	-0.01	0.05	0.01
16. Agricultural Machinery	-0.24	4.53	-0.10	-	-0.01	-	-0.10	-0.01	-	-
17. Other Manufacturing	-	4.51	-0.10	-	-0.01	-	-0.13	-	0.04	0.02
18. Electricity, Water Work and Public Utilities	-0.24	4.17	-0.12	-	-0.01	-	-0.22	-	0.05	0.01
19. Construction and Trade	-0.16	4.29	-0.17	-	-	-	-0.15	-	0.04	0.03
20. Service Transportation and Communication	-0.23	4.53	-0.09	-0.01	-0.01	-	-0.13	-0.01	0.04	0.01

Commodity C	Intermediate input to activity A (Simulation 2.2, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	0.07	-	-	-	0.03	-	-	0.07
2. Cassava, Beans and Nuts	-	-	0.06	-	-	-	-	-	-	0.07
3. Vegetables, Sugarcane and Fruits	-	-	0.11	-	-	-	-	-	-	0.07
4. Rubber and Latex	-	-	0.07	-	-	-	-	-	-	
5. Other Crops	-0.01	-	0.07	-	-	-	-	-	-	0.07
6. Livestock	-0.02	-	0.07	-	-	-	0.03	-	-	0.07
7. Forestry	-	-	0.06	0.06	0.02	-	0.03	-	0.10	0.07
8. Fishery	-	-	0.07	-	-	-	0.04	-	-	0.07
9. Mining and Quarrying	-	-	0.07	0.07	0.03	-	0.04	0.04	0.03	0.07
10. Food Manufacturing	-	-	0.07	0.06	0.07	-	0.03	-	-	0.07
11. Textile Industry	-0.01	0.02	0.07	0.06	0.03	-	0.03	0.04	0.08	0.07
12. Paper Industries and Printing	-0.01	-	0.07	0.07	0.03	1.87	0.03	0.04	-	0.07
13. Rubber Chemical and Petroleum Industries	-0.01	-	0.07	0.07	0.03	1.68	0.03	0.04	0.02	0.07
14. Non Metallic Products	-	-	0.06	0.07	0.03	1.16	0.03	0.08	0.02	0.07
15. Metal Product and Machinery	-0.01	-	0.07	0.07	0.03	1.68	0.03	0.04	0.02	0.07
16. Agricultural Machinery	-	-	-	-	-	1.68	-	-	-	0.12
17. Other Manufacturing	-0.01	0.02	0.07	0.07	0.03	1.64	0.03	0.04	-	0.07
18. Electricity, Water Work and Public Utilities	-0.01	-	0.07	0.07	0.03	1.69	0.03	0.04	0.03	0.07
19. Construction and Trade	-0.04	-	0.07	0.10	0.03	2.00	-	0.05	-	0.07
20. Service Transportation and Communication	-0.01	-	0.07	0.07	0.03	1.68	0.03	0.04	0.01	0.07

Commodity C	Intermediate input to activity A (Simulation 2.3, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	-0.58	-	4.71	-	-0.11	-0.03	-	-	-	-0.13
2. Cassava, Beans and Nuts	-	-0.97	4.70	-	-	-0.03	-	-	-	-0.13
3. Vegetables, Sugarcane and Fruits	-	-	4.70	-	-	-0.03	-	-	-	-0.13
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	-0.58	-0.97	4.70	-0.03	-0.11	-0.03	-0.28	-0.12	-	-0.13
6. Livestock	-	-	-	-	-	-0.03	-	-	-	-0.13
7. Forestry	-0.68	-2.44	4.73	-	-	-	-0.27	-	0.17	-0.13
8. Fishery	-	-	-	-	-	-0.03	-	-0.11	-	-0.13
9. Mining and Quarrying	-	-	4.95	-	-0.11	-0.14	-	-0.29	0.17	-0.13
10. Food Manufacturing	-	-	4.70	-	-	-0.03	-	-0.11	-	-0.13
11. Textile Industry	-0.59	-0.97	4.70	-0.02	-0.11	-	-0.27	-0.12	0.16	-0.15
12. Paper Industries and Printing	-	-	4.72	-	-0.12	-0.07	-0.19	-	0.17	-0.13
13. Rubber Chemical and Petroleum Industries	-0.58	-0.97	4.70	-0.03	-0.11	-0.03	-0.27	-0.11	0.17	-0.13
14. Non Metallic Products	-0.76	-1.08	4.60	-0.04	-0.11	-	-0.28	-0.12	0.17	-0.13
15. Metal Product and Machinery	-0.58	-0.97	4.70	-0.03	-0.11	-0.03	-0.28	-0.11	0.17	-0.13
16. Agricultural Machinery	-0.58	-0.97	4.70	-0.04	-0.11	-	-0.24	-0.11	0.28	-
17. Other Manufacturing	-0.61	-0.95	4.70	-0.17	-0.11	-	-0.28	-0.11	0.17	-0.11
18. Electricity, Water Work and Public Utilities	-0.73	-1.04	4.66	-	-0.11	-0.03	-0.22	-0.11	0.17	-0.13
19. Construction and Trade	-0.65	-1.23	4.62	-	-0.14	-0.04	-0.31	-0.11	0.17	-0.13
20. Service Transportation and Communication	-0.58	-0.97	4.70	-0.03	-0.11	-0.04	-0.28	-0.11	0.17	-0.13

Commodity C	Intermediate input to activity A (Simulation 2.3, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-0.03	0.01	-	-	-	-0.03	-	-	-0.04
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-	-0.04
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	-0.04
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	
5. Other Crops	-0.10	-0.05	-	-	-	-	-	-0.23	-	-0.04
6. Livestock	-0.11	-	-	-	-	-	-0.02	-	-	-0.04
7. Forestry	-0.24	-0.05	-	0.10	-0.02	-	-0.01	-	-	-0.04
8. Fishery	-	-	-	-	-	-	-	-	-	-0.04
9. Mining and Quarrying	-0.07	-0.05	-	0.09	-0.01	-	-0.01	-0.17	-	-0.04
10. Food Manufacturing	-0.10	-0.04	-	0.09	-	-	-0.01		-	-0.04
11. Textile Industry	-0.10	-0.03	-	0.09	-0.01	-	-0.01	-0.16	-	-0.04
12. Paper Industries and Printing	-0.10	-0.04	-	0.09	-0.01	3.21	-0.01	-0.17	-	-0.04
13. Rubber Chemical and Petroleum Industries	-0.10	-0.04	-	0.09	-0.01	3.10	-0.01	-0.17	-	-0.04
14. Non Metallic Products	-0.09	-0.18	-	0.09	-0.01	2.91	-0.01	-0.16	-	-0.04
15. Metal Product and Machinery	-0.10	-0.04	-	0.09	-0.01	3.11	-0.01	-0.17	-	-0.04
16. Agricultural Machinery	-	-	-	-	-	3.11	-	-	-	-
17. Other Manufacturing	-0.10	-0.04	-	0.09	-0.01	3.07	-0.01	-0.18	-	-0.04
18. Electricity, Water Work and Public Utilities	-0.10	-0.05	-	0.09	-0.01	3.09	-0.01	-0.17	-	-0.04
19. Construction and Trade	-0.12	-	-	0.10	-0.01	4.00	-	-0.17	-	-0.04
20. Service Transportation and Communication	-0.10	-0.04	-	0.09	-0.01	3.11	-0.01	-0.17	-0.01	-0.04

Commodity C	Intermediate input to activity A (Simulation 2.4, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	-0.05	-	-0.02	-	0.02	-0.04	-	-	-	-0.04
2. Cassava, Beans and Nuts	-	-0.18	-0.03	-	-	-0.03	-	-	-	-0.04
3. Vegetables, Sugarcane and Fruits	-	-	-0.03	-	-	-0.04	-	-	-	-0.04
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	-0.05	-0.18	-0.03	4.85	0.02	-0.03	-0.15	0.02	-	-0.04
6. Livestock	-	-	-	-	-	-0.04	-	-	-	-0.04
7. Forestry	-	-	-	-	0.13	-	-0.15	-	-0.24	-0.04
8. Fishery	-	-		-	-	-0.04	-	0.03	-	-0.04
9. Mining and Quarrying	-	-	-	-	0.11	-0.14	-	-	-0.24	-0.04
10. Food Manufacturing	-	-	-	4.44	-	-0.04	-	0.03	-	-0.04
11. Textile Industry	-0.05	-0.15	-0.04	4.85	0.03	-	-0.15	0.03	-0.24	-0.06
12. Paper Industries and Printing	-	-	-0.04	-	0.03	-0.07	-0.19	0.15	-0.24	-0.04
13. Rubber Chemical and Petroleum Industries	-0.05	-0.18	-0.03	4.85	0.02	-0.04	-0.15	0.03	-0.24	-0.04
14. Non Metallic Products	-0.38	-	-	4.84	0.02	-	-0.16	0.06	-0.26	-0.04
15. Metal Product and Machinery	-0.05	-0.18	-0.03	4.85	0.02	-0.03	-0.15	0.03	-0.24	-0.04
16. Agricultural Machinery	-0.05	-0.18	-0.04	4.84	0.02	-0.06	-0.15	0.03	-0.28	-
17. Other Manufacturing	-	-0.24	-0.04	4.84	0.02	-0.04	-0.15	-	-0.24	-0.02
18. Electricity, Water Work and Public Utilities	-0.24	-	-0.06	-	0.02	-0.04	-0.22	0.03	-0.24	-0.04
19. Construction and Trade	-	-	-	5.00	-	-0.04	-0.15	0.04	-0.24	-0.03
20. Service Transportation and Communication	-0.05	-0.18	-0.03	4.85	0.02	-0.04	-0.15	0.03	-0.24	-0.04

Commodity C	Intermediate input to activity A (Simulation 2.4, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	-0.04	-	-	-	-0.06	-	-	-0.08
2. Cassava, Beans and Nuts	-	-	-0.03	-	-	-	-	-	-	-0.08
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	-0.08
4. Rubber and Latex	-	-	-0.04	-	-	-	-	-	-	
5. Other Crops	-0.13	-0.01	-0.04	-	-	-	-0.12	-0.23	-	-0.08
6. Livestock	-0.14	-	-0.04	-	-	-	-0.05	-	-	-0.08
7. Forestry	-0.24	-0.01	-0.04	-0.04	-0.02	-	-0.05	-	-	-0.08
8. Fishery	-	-	-0.04	-	-	-	-0.04	-	-	-0.08
9. Mining and Quarrying	-0.07	-	-0.04	-0.03	-0.03	-	-0.05	-0.12	-0.05	-0.08
10. Food Manufacturing	-0.12	-	-0.04	-0.05	-	-	-0.05	-	-	-0.08
11. Textile Industry	-0.13	-	-0.04	-0.03	-0.03	-	-0.05	-0.12	-	-0.08
12. Paper Industries and Printing	-0.13	-	-0.04	-0.03	-0.03	0.80	-0.05	-0.12	-0.06	-0.08
13. Rubber Chemical and Petroleum Industries	-0.13	-	-0.04	-0.03	-0.03	0.75	-0.05	-0.12	-0.04	-0.08
14. Non Metallic Products	-0.09	-	-0.04	-0.03	-0.03	0.58	-0.05	-0.08	-0.04	-0.08
15. Metal Product and Machinery	-0.13	-	-0.04	-0.03	-0.03	0.76	-0.05	-0.12	-0.03	-0.08
16. Agricultural Machinery	-	-	-	-	-	0.76	-	-	-	-0.12
17. Other Manufacturing	-0.13	-	-0.04	-0.03	-0.03	0.72	-0.05	-0.12	-0.04	-0.08
18. Electricity, Water Work and Public Utilities	-0.13	-	-0.04	-0.03	-0.03	0.75	-0.05	-0.12	-0.03	-0.08
19. Construction and Trade	-0.16	-	-0.04	-	-0.03	-	-0.09	-0.12	-0.05	-0.08
20. Service Transportation and Communication	-0.13	-	-0.04	-0.03	-0.03	0.75	-0.05	-0.12	-0.04	-0.08

Commodity C	Intermediate input to activity A (Simulation 2.5, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	-0.13	-	-0.06	-	3.62	0.06	-	-	-	0.59
2. Cassava, Beans and Nuts	-	-0.19	-0.06	-	-	0.05	-	-	-	0.59
3. Vegetables, Sugarcane and Fruits	-	-	-0.06	-	3.75	0.06	-	-	-	0.59
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	-0.13	-0.19	-0.06	0.07	3.62	0.06	0.02	-0.07	-	0.59
6. Livestock	-	-	-	-	-	0.06	-	-	-	0.59
7. Forestry	-0.34	-	-	-	3.62	0.07	0.02	-	0.26	0.59
8. Fishery	-	-	-	-	-	0.06	-	-0.06	-	0.59
9. Mining and Quarrying	-	-	-	-	3.68	-	-	-0.29	0.26	0.59
10. Food Manufacturing	-	-	-	-	3.95	0.06	-	-0.06	-	0.59
11. Textile Industry	-0.14	-0.15	-0.08	0.07	3.63	0.22	0.02	-0.06	0.24	0.58
12. Paper Industries and Printing	-	-	-0.04	-	3.64	-	-	-	0.25	0.59
13. Rubber Chemical and Petroleum Industries	-0.13	-0.19	-0.06	0.07	3.62	0.06	0.02	-0.06	0.26	0.59
14. Non Metallic Products	-0.38	-	-	0.06	3.62	0.28	0.02	-0.06	0.26	0.59
15. Metal Product and Machinery	-0.13	-0.19	-0.06	0.07	3.62	0.06	0.02	-0.06	0.26	0.59
16. Agricultural Machinery	-0.13	-0.18	-0.06	0.08	3.62	0.06	0.05	-0.06	0.28	0.82
17. Other Manufacturing	-	-0.24	-0.06	-	3.62	0.07	0.02	-	0.26	0.60
18. Electricity, Water Work and Public Utilities	-0.24	-	-0.06	-	3.63	0.06	-	-0.06	0.26	0.59
19. Construction and Trade	-0.16	-	-	-	3.52	0.08	-	-0.07	0.26	0.60
20. Service Transportation and Communication	-0.13	-0.19	-0.06	0.07	3.62	0.06	0.02	-0.06	0.26	0.59

Commodity C	Intermediate input to activity A (Simulation 2.5, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	0.24	-	-	-	0.03	-	-	0.13
2. Cassava, Beans and Nuts	-	-	0.25	-	-	-	-	-	-	0.13
3. Vegetables, Sugarcane and Fruits	-	-	0.22	-	-	-	-	-	-	0.13
4. Rubber and Latex	-	-	0.24	-	-	-	-	-	-	-
5. Other Crops	-0.01	-0.01	0.24	-	-	-	-	-0.23	-	0.13
6. Livestock	-0.02	-	0.24	-	-	-	0.05	-	-	0.13
7. Forestry	-	-0.01	0.24	-0.01	-	-	0.05	-	-	0.13
8. Fishery	-	-	0.24	-	-	-	0.04	-	-	0.13
9. Mining and Quarrying	-	-0.01	0.24	-0.01	-0.01	-	0.05	-0.26	-0.03	0.13
10. Food Manufacturing	-	-	0.24	-0.02	-	-	0.05		-	0.13
11. Textile Industry	-0.01	-	0.24	-0.01	-	-	0.05	-0.27	-	0.13
12. Paper Industries and Printing	-0.01	-0.01	0.24	-0.01	-0.01	-4.28	0.05	-0.25	-0.06	0.13
13. Rubber Chemical and Petroleum Industries	-0.01	-	0.24	-0.01	-0.01	-4.28	0.05	-0.26	-0.02	0.13
14. Non Metallic Products	-	-	0.24	-0.01	-0.01	-4.65	0.05	-0.25	-0.02	0.13
15. Metal Product and Machinery	-0.01	-	0.24	-0.01	-0.01	-4.28	0.05	-0.26	-0.02	0.13
16. Agricultural Machinery	-	-	-	-	-	-4.28	-	-	-	0.12
17. Other Manufacturing	-0.01	-	0.24	-0.01	-0.01	-4.29	0.05	-0.27	-0.04	0.13
18. Electricity, Water Work and Public Utilities	-0.01	-	0.24	-0.01	-0.01	-4.28	0.05	-0.26	-0.03	0.13
19. Construction and Trade	-0.04	-	0.24	-	-0.01	-4.00	0.09	-0.26	-0.05	0.13
20. Service Transportation and Communication	-0.01	-0.01	0.24	-0.01	-0.01	-4.29	0.05	-0.26	-0.03	0.13

Commodity C	Intermediate input to activity A (Simulation 2.6, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	-0.16	-	-0.02	-	0.02	4.93	-	-	-	-0.12
2. Cassava, Beans and Nuts	-	-0.09	-0.03	-	-	4.94	-	-	-	-0.12
3. Vegetables, Sugarcane and Fruits	-	-	-0.03	-	-	4.93	-	-	-	-0.12
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	
5. Other Crops	-0.16	-0.09	-0.03	-0.04	0.02	4.94	-0.04	-0.07	-	-0.12
6. Livestock	-	-	-	-	-	4.93	-	-	-	-0.12
7. Forestry	-0.34	-	-	-	0.13	4.97	-0.03	-	-0.06	-0.11
8. Fishery	-	-	-	-	-	4.93	-	-0.06	-	-0.12
9. Mining and Quarrying	-	-	-	-	0.11	4.82	-	-0.29	-0.05	-0.11
10. Food Manufacturing	-	-	-	-	-	4.93	-	-0.06	-	-0.12
11. Textile Industry	-0.16	-0.07	-0.04	-0.04	0.03	5.09	-0.04	-0.06	-0.08	-0.12
12. Paper Industries and Printing	-	-	-0.04	-	0.03	4.91	-	-	-0.06	-0.12
13. Rubber Chemical and Petroleum Industries	-0.16	-0.09	-0.03	-0.03	0.02	4.93	-0.03	-0.06	-0.05	-0.12
14. Non Metallic Products	-0.38	-	-	-0.04	0.03	5.13	-0.04	-0.06	-0.09	-0.11
15. Metal Product and Machinery	-0.16	-0.09	-0.03	-0.03	0.02	4.93	-0.03	-0.06	-0.05	-0.12
16. Agricultural Machinery	-0.16	-0.09	-0.03	-0.04	0.02	4.96	-	-0.06	-	-
17. Other Manufacturing	-	-0.12	-0.04	-0.17	0.02	4.95	-0.03	-	-0.05	-0.11
18. Electricity, Water Work and Public Utilities	-0.24	-	-0.06	-	0.03	4.93	-	-0.06	-0.05	-0.12
19. Construction and Trade	-0.16	-	-	-	-	4.95	-	-0.07	-0.06	-0.10
20. Service Transportation and Communication	-0.16	-0.09	-0.03	-0.03	0.02	4.93	-0.04	-0.06	-0.05	-0.12

Commodity C	Intermediate input to activity A (Simulation 2.6, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	-0.04	-	-	-	-0.09	-	-	-0.07
2. Cassava, Beans and Nuts	-	-	-0.03	-	-	-	-	-	-	-0.07
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	-0.07
4. Rubber and Latex	-	-	-0.03	-	-	-	-	-	-	-
5. Other Crops	-0.10	-0.02	-0.03	-	-	-	-0.12	-0.23	-	-0.07
6. Livestock	-0.10	-	-0.03	-	-	-	-0.08	-	-	-0.07
7. Forestry	-0.24	-0.02	-0.03	-0.04	-0.05	-	-0.07	-	-	-0.07
8. Fishery	-	-	-0.03	-	-	-	-0.09	-	-	-0.07
9. Mining and Quarrying	-0.07	-0.02	-0.03	-0.04	-0.05	-	-0.07	-0.14	-0.03	-0.07
10. Food Manufacturing	-0.10	-0.01	-0.03	-0.05	-0.07	-	-0.07	-	-	-0.07
11. Textile Industry	-0.10	-	-0.03	-0.04	-0.05	-	-0.07	-0.12	-	-0.07
12. Paper Industries and Printing	-0.10	-0.01	-0.03	-0.04	-0.05	0.27	-0.07	-0.14	-0.06	-0.07
13. Rubber Chemical and Petroleum Industries	-0.10	-0.01	-0.03	-0.04	-0.05	0.21	-0.07	-0.14	-0.02	-0.07
14. Non Metallic Products	-0.09	-	-0.03	-0.04	-0.05	-	-0.07	-0.08	-0.03	-0.07
15. Metal Product and Machinery	-0.10	-0.01	-0.03	-0.04	-0.05	0.21	-0.07	-0.14	-0.03	-0.07
16. Agricultural Machinery	-	-	-	-	-	0.21	-	-	-	-0.12
17. Other Manufacturing	-0.10	-	-0.03	-0.03	-0.05	0.20	-0.07	-0.14	-0.04	-0.07
18. Electricity, Water Work and Public Utilities	-0.10	-0.01	-0.03	-0.04	-0.05	0.20	-0.07	-0.14	-0.03	-0.07
19. Construction and Trade	-0.12	-	-0.03	-	-0.05	-	-0.09	-0.14	-0.05	-0.07
20. Service Transportation and Communication	-0.10	-0.02	-0.03	-0.04	-0.05	0.20	-0.07	-0.14	-0.04	-0.07

Commodity C	Intermediate input to activity A (Simulation 2.7, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	-0.04	-	-	-	-0.01	-0.01	-	-	-	-
2. Cassava, Beans and Nuts	-	-0.07	-0.01	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	-	-	-0.01	-	-	-0.01	-	-	-	-
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	
5. Other Crops	-0.04	-0.07	-0.01	-0.01	-	-	4.84	-	-	-
6. Livestock	-	-	-	-	-	-0.01	-	-	-	-
7. Forestry	-	-	-	-	-	-	4.84	-	-0.01	-
8. Fishery	-	-	-	-	-	-0.01	-	-	-	-
9. Mining and Quarrying	-	-	-	-	-	-	-	-	-0.02	-
10. Food Manufacturing	-	-	-	-	-	-0.01	3.70	-	-	-
11. Textile Industry	-0.05	-0.07	-0.04	-	-	-	4.86	-	-0.04	-
12. Paper Industries and Printing	-	-	-	-	-	-0.07	4.84	-	-0.02	-
13. Rubber Chemical and Petroleum Industries	-0.04	-0.07	-0.01	-0.01	-	-0.01	4.85	-	-0.01	-
14. Non Metallic Products	-0.38	-	-	-0.02	-	-	4.84	-	-0.04	-
15. Metal Product and Machinery	-0.04	-0.07	-0.01	-0.01	-	-0.01	4.84	-	-0.01	-
16. Agricultural Machinery	-0.04	-0.06	-0.02	-0.02	-	-	4.89	-	-	-
17. Other Manufacturing	-	-0.12	-0.02	-	-	-	4.84	-	-0.01	-
18. Electricity, Water Work and Public Utilities	-	-	-0.06	-	-	-0.01	4.77	-	-0.01	-
19. Construction and Trade	-	-	-	-	-	-	4.91	-	-0.02	-
20. Service Transportation and Communication	-0.04	-0.07	-0.01	-0.01	-	-0.01	4.84	-	-0.01	-

Commodity C	Intermediate input to activity A (Simulation 2.7, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	0.01	-	-	-	-0.03	-	-	-0.01
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-	-0.01
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	-0.01
4. Rubber and Latex	-	-	0.01	-	-	-	-	-	-	
5. Other Crops	-0.02	-0.01	0.01	-	-	-	-	-	-	-0.02
6. Livestock	-0.02	-	0.01	-	-	-	-0.03	-	-	-0.01
7. Forestry	-	-0.01	0.01	-0.01	-	-	-0.02	-	-	-0.01
8. Fishery	-	-	0.01	-	-	-	-0.04	-	-	-0.01
9. Mining and Quarrying	-	-	0.01	-0.01	-0.01	-	-0.02	-	-	-0.01
10. Food Manufacturing	-0.02	-	0.01	-0.02	-	-	-0.02	-	-	-0.01
11. Textile Industry	-0.02	-	0.01	-0.01	-	-	-0.02	-	-	-0.01
12. Paper Industries and Printing	-0.02	-	0.01	-0.01	-0.01	0.53	-0.02	-	-	-0.01
13. Rubber Chemical and Petroleum Industries	-0.02	-	0.01	-0.01	-0.01	0.42	-0.02	-	-	-0.01
14. Non Metallic Products	-	-	0.01	-0.01	-0.01	-	-0.02	-	-	-0.01
15. Metal Product and Machinery	-0.02	-	0.01	-0.01	-0.01	0.42	-0.02	-	-	-0.01
16. Agricultural Machinery	-	-	-	-	-	0.42	-	-	-	-
17. Other Manufacturing	-0.02	-	0.01	-0.01	-0.01	0.41	-0.02	-0.02	-	-0.01
18. Electricity, Water Work and Public Utilities	-0.02	-	0.01	-0.01	-0.01	0.42	-0.02	-	-	-0.01
19. Construction and Trade	-0.04	-	0.01	-	-0.01	-	-	-	-	-0.01
20. Service Transportation and Communication	-0.02	-	0.01	-0.01	-0.01	0.42	-0.02	-	-0.01	-0.01

Commodity C	Intermediate input to activity A (Simulation 2.8, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	-0.22	-	-0.04	-	-0.06	-0.03	-	-	-	-0.04
2. Cassava, Beans and Nuts	-	-0.11	-0.06	-	-	-0.02	-	-	-	-0.04
3. Vegetables, Sugarcane and Fruits	-	-	-0.05	-	-	-0.03	-	-	-	-0.04
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	-0.22	-0.11	-0.06	0.07	-0.05	-0.03	0.08	4.87	-	-0.04
6. Livestock	-	-	-	-	-	-0.03	-	-	-	-0.04
7. Forestry	-0.34	-	-	-	-	-	0.08	5.19	0.20	-0.04
8. Fishery	-	-	-	-	-	-0.03	-	4.88	-	-0.04
9. Mining and Quarrying	-	-	-	-	-	-0.14	-	4.90	0.20	-0.04
10. Food Manufacturing	-	-	-	-	-	-0.03	-	4.88	-	-0.04
11. Textile Industry	-0.23	-0.07	-0.08	0.07	-0.05	-	0.10	4.87	0.20	-0.06
12. Paper Industries and Printing	-	-	-0.04	-	-0.06	-0.07	0.19	5.01	0.20	-0.04
13. Rubber Chemical and Petroleum Industries	-0.22	-0.11	-0.06	0.07	-0.05	-0.03	0.08	4.88	0.20	-0.04
14. Non Metallic Products	-0.38	-	-	0.06	-0.05	-	0.08	4.88	0.17	-0.04
15. Metal Product and Machinery	-0.22	-0.11	-0.06	0.07	-0.05	-0.02	0.08	4.88	0.20	-0.04
16. Agricultural Machinery	-0.22	-0.12	-0.06	0.08	-0.05	-	0.10	4.88	0.28	-
17. Other Manufacturing	-	-0.12	-0.06	-	-0.05	-	0.09	4.89	0.20	-0.05
18. Electricity, Water Work and Public Utilities	-0.24	-	-0.06	-	-0.05	-0.03	-	4.87	0.20	-0.04
19. Construction and Trade	-0.16	-	-	-	-0.14	-	0.15	4.87	0.20	-0.03
20. Service Transportation and Communication	-0.22	-0.11	-0.06	0.07	-0.05	-0.03	0.09	4.88	0.20	-0.04

Commodity C	Intermediate input to activity A (Simulation 2.8, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	0.03	-	-	-	-	-	-	0.05
2. Cassava, Beans and Nuts	-	-	0.03	-	-	-	-	-	-	0.05
3. Vegetables, Sugarcane and Fruits	-	-	0.11	-	-	-	-	-	-	0.05
4. Rubber and Latex	-	-	0.02	-	-	-	-	-	-	
5. Other Crops	0.07	-0.01	0.02	-	-	-	-	-	-	0.05
6. Livestock	0.07	-	0.03	-	-	-	0.03	-	-	0.05
7. Forestry	-	-0.01	0.02	0.13	-	-	0.02	-	0.10	0.05
8. Fishery	-	-	0.03	0.48	-	-	-	-	-	0.05
9. Mining and Quarrying	0.07	-0.01	0.02	0.13	0.01	-	0.03	0.06	0.03	0.04
10. Food Manufacturing	0.08	-0.01	0.02	0.12	-	-	0.02	-	-	0.05
11. Textile Industry	0.07	-	0.02	0.14	0.01	-	0.02	0.08	0.08	0.05
12. Paper Industries and Printing	0.07	-0.01	0.02	0.13	0.01	0.27	0.02	0.06	-	0.05
13. Rubber Chemical and Petroleum Industries	0.07	-0.01	0.02	0.13	0.01	0.21	0.02	0.06	0.02	0.05
14. Non Metallic Products	0.09	-	0.02	0.13	0.01	-	0.02	0.08	0.02	0.05
15. Metal Product and Machinery	0.07	-0.01	0.02	0.13	0.01	0.22	0.02	0.06	0.01	0.05
16. Agricultural Machinery	-	-	-	-	-	0.22	-	-	-	-
17. Other Manufacturing	0.07	-	0.02	0.13	0.01	0.20	0.02	0.05	-	0.05
18. Electricity, Water Work and Public Utilities	0.07	-0.01	0.02	0.13	0.01	0.22	0.02	0.06	0.03	0.05
19. Construction and Trade	0.04	-	0.02	0.14	0.01	-	-	0.06	-	0.05
20. Service Transportation and Communication	0.07	-0.01	0.02	0.13	0.01	0.22	0.02	0.06	0.01	0.05

Source: Model Simulations 2 and 2.1 – 2.8,

Note: 1/ base year values equal to as in Appendix P.5

Q.6 Percentage change of quantity of investment demand for commodity c ($QINV_c$) from results of Simulations 2 and 2.1 – 2.8 compared with base year

Sectors	Base[1/] year	SIM 2 (%Δ)	SIM 2.1 (%Δ)	SIM 2.2 (%Δ)	SIM 2.3 (%Δ)	SIM 2.4 (%Δ)	SIM 2.5 (%Δ)	SIM 2.6 (%Δ)	SIM 2.7 (%Δ)	SIM 2.8 (%Δ)
1. Paddy and Maize	-	-	-	-	-	-	-	-	-	-
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	-
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	-	-	-	-	-	-	-	-	-	-
6. Livestock	834.90	1.15	1.09	1.14	1.08	1.02	1.15	1.02	-	1.14
7. Forestry	-	-	-	-	-	-	-	-	-	
8. Fishery	-	-	-	-	-	-	-	-	-	
9. Mining and Quarrying	73.70	0.14	-	0.14	-	-	0.14	-	-	0.14
10. Food Manufacturing	-	-	-	-	-	-	-	-	-	-
11. Textile Industry	1,000.00	0.06	-	0.06	-	-0.07	0.07	-0.06	-	0.06
12. Paper Industries and Printing	-	-	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum	2,999.80	0.07	0.01	0.06	-	-0.06	0.08	-0.06	-	0.07
14. Non Metallic Products	3,815.00	0.07	0.01	0.06	-	-0.06	0.08	-0.06	-	0.07
15. Metal Product and Machinery	446,988.10	0.07	0.01	0.06	-	-0.06	0.07	-0.06	-	0.06
16. Agricultural Machinery	4,822.60	0.07	0.01	0.06	-	-0.06	0.07	-0.06	-	0.06
17. Other Manufacturing	65,564.50	0.07	0.01	0.06	-	-0.06	0.07	-0.06	-	0.06
18. Electricity, Water Work and Public	-	-	-	-	-	-	-	-	-	-
19. Construction and Trade	598,576.10	0.07	0.01	0.06	-	-0.06	0.07	-0.06	-	0.06
20. Service Transportation and Communication	864.30	0.07	0.01	0.07	-	-0.06	0.08	-0.06	0.01	0.07

Source: Model Simulations 2 and 2.1 – 2.8

Note: 1/ Million baht

Q.7 Percentage change on other economic variables in the model from results of Simulations 2 and 2.1 – 2.8 compared with base year

Sectors	Base year	SIM 2 (%Δ)	SIM 2.1 (%Δ)	SIM 2.2 (%Δ)	SIM 2.3 (%Δ)	SIM 2.4 (%Δ)	SIM 2.5 (%Δ)	SIM 2.6 (%Δ)	SIM 2.7 (%Δ)	SIM 2.8 (%Δ)
1. Average price of factor f (WF_f) 1/										
1.1 Labour	5.3	-	-	-	-	-	-	-	-	-
1.2 Capital	14.9	-	-	-	-	-	-	-	-	-
2. supply of factor f (QFS_f)										
2.1 Labour 2/	30,444,700	-	-	-	-	-	-	-	-	-
2.2 Capital 1/	16,661,940	0.31	0.06	0.01	0.08	0.03	0.03	0.04	0.004	0.05
3. Government expenditures (EG) 1/	627,868.80	0.07	0.11	-0.01	-0.09	0.02	-0.006	0.04	0.003	-0.01
4. Enterprise Saving ($ENTSAV_{ent}$) 1/	332,604.00	0.67	0.10	0.08	0.06	0.06	0.18	0.08	0.008	0.21
5. Foreign savings ($FSAV$) 1/	264,045.50	-	-	-	-	-	-	-	-	-
6. Foreign exchange rate (EXR)	1.00	0.20	-	-	0.10	-	0.10	-0.10	-	-
7. Dummy variable ($WALRAS$) (Zero at equilibrium) 3/	1.867051E-9	-1.16177E-9	-1.67698E-9	1.179168E-8	-2.08591E-9	3.787336E-8	2.143935E-9	2.528745E-8	5.643187E-9	5.170030E-8

Source: Model Simulation 2 and 2.1 – 2.8,

Note: 1/ Million baht

2/ Persons

3/ Actual values

Appendix R
Results of Simulation 3

R.1 Percentage change of wage distortion for factors in activities ($WFDIST_{fa}$) from results of Simulation 3 compared with base year

Sector	Base year (Million baht)		Simulation 3 (%Δ)	
	Labour	Capital	Labour	Capital
1. Paddy and Maize	12.30	142.90	-	0.07
2. Cassava, Beans and Nuts	13.90	161.40	-	0.19
3. Vegetables, Sugarcane and Fruits	10.70	124.10	-	0.16
4. Rubber and Latex	15.60	181.70	-	0.06
5. Other Crops	20.10	234.00	-	0.30
6. Livestock	12.00	139.10	-	-0.07
7. Forestry	14.50	168.80	-	0.30
8. Fishery	57.30	135.90	-	0.15
9. Mining and Quarrying	1,154.60	228.00	-	-
10. Food Manufacturing	132.60	141.60	-	0.07
11. Textile Industry	152.90	163.00	-	-
12. Paper Industries and Printing	178.30	189.00	-	-
13. Rubber Chemical and Petroleum Industries	233.20	252.60	-	-
14. Non Metallic Products	169.40	179.70	-	-0.11
15. Metal Product and Machinery	242.80	265.70	-	-0.08
16. Agricultural Machinery	365.00	386.70	-	2.12
17. Other Manufacturing	127.80	133.60	-	1.72
18. Electricity, Water Work and Public Utilities	1,562.20	39.40	-	-
19. Construction and Trade	60.70	271.30	-	-0.04
20. Service Transportation and Communication	182.70	32.50	-	-

Source: Model Simulation 3

R.2 Percentage change of quantity of consumption of commodity c by household h (QH_{ch}) from results of Simulation 3 compared with base year

Sector	Base year (Million baht)	Simulation 3 (%Δ)
1. Paddy and Maize	20,041.70	0.05
2. Cassava, Beans and Nuts	10,689.10	0.02
3. Vegetables, Sugarcane and Fruits	120,716.90	0.03
4. Rubber and Latex	-	-
5. Other Crops	12,166.80	0.02
6. Livestock	53,940.80	0.00
7. Forestry	8,107.10	0.01
8. Fishery	81,989.70	-0.18
9. Mining and Quarrying	638.00	-0.08
10. Food Manufacturing	477,990.30	0.00
11. Textile Industry	259,761.10	-0.02
12. Paper Industries and Printing	35,156.90	-0.01
13. Rubber Chemical and Petroleum Industries	290,586.30	-0.02
14. Non Metallic Products	15,507.30	-0.01
15. Metal Product and Machinery	353,855.40	-0.01
16. Agricultural Machinery	116.30	4.30
17. Other Manufacturing	214,743.60	-0.01
18. Electricity, Water Work and Public Utilities	113,459.20	-0.03
19. Construction and Trade	55,438.10	-0.01
20. Service Transportation and Communication	695,835.20	-0.02

Source: Model Simulation 3

R.3 Percentage change of quantity of intermediate use of commodity c by activity a ($QINT_{ca}$) from results of Simulation 3 compared to base year

Commodity C	Intermediate input to activity A (Simulation 3, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	0.02	-	0.04	-	0.07	-0.01	-	-	-	0.01
2. Cassava, Beans and Nuts	-	0.04	0.03	-	-	-	-	-	-	0.01
3. Vegetables, Sugarcane and Fruits	-	-	0.03	-	-	-0.01	-	-	-	0.01
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.02	0.04	0.03	0.01	0.07	-	0.08	0.02	-	0.01
6. Livestock	-	-	-	-	-	-0.01	-	-	-	0.01
7. Forestry	-	-	0.08	-	0.13	-	0.08	-	-0.01	0.02
8. Fishery	-	-	-	-	-	-0.01	-	0.03	-	0.01
9. Mining and Quarrying	-	-	0.45	-	0.11	-	-	-	-0.01	-
10. Food Manufacturing	-	-	-	-	-	-0.01	-	0.03	-	0.01
11. Textile Industry	0.02	0.07	-	0.02	0.08	-	0.08	0.03	-0.04	-
12. Paper Industries and Printing	-	-	0.04	-	0.06	-0.07	0.19	0.15	-0.02	0.01
13. Rubber Chemical and Petroleum Industries	0.02	0.04	0.03	0.01	0.07	-0.01	0.08	0.03	-0.01	0.01
14. Non Metallic Products	-	-	-	-	0.07	-	0.08	0.06	-0.04	0.01
15. Metal Product and Machinery	0.02	0.04	0.03	0.01	0.07	-0.01	0.08	0.03	-0.01	0.01
16. Agricultural Machinery	0.02	0.03	0.03	0.02	0.07	-	0.10	0.03	-	-
17. Other Manufacturing	-	-	0.02	-	0.07	-	0.09	-	-0.01	0.02
18. Electricity, Water Work and Public Utilities	-	-	-	-	0.07	-0.01	-	0.03	-0.01	0.01
19. Construction and Trade	-	-	-	-	-	-	0.15	0.04	-0.01	0.03
20. Service Transportation and Communication	0.02	0.04	0.03	0.01	0.07	-0.01	0.08	0.03	-0.01	0.01

Commodity C	Intermediate input to activity A (Simulation 3, (%∆))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	-0.01	-	-	-	-0.03	-	-	-0.03
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-	-0.03
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	-0.03
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	-0.03	-0.01	-	-	-	-	-	-	-	-0.03
6. Livestock	-0.02	-	-	-	-	-	-0.02	-	-	-0.03
7. Forestry	-	-0.01	-	-0.05	-0.05	-	-0.02	-	-	-0.03
8. Fishery	-	-	-0.01	-	-	-	-0.04	-	-	-0.03
9. Mining and Quarrying	-	-0.01	-	-0.05	-0.04	-	-0.02	-0.09	-	-0.03
10. Food Manufacturing	-0.02	-	-	-0.06	-	-	-0.02	-	-	-0.03
11. Textile Industry	-0.02	-	-	-0.05	-0.03	-	-0.02	-0.08	-	-0.03
12. Paper Industries and Printing	-0.02	-0.01	-	-0.05	-0.04	1.34	-0.02	-0.08	-	-0.03
13. Rubber Chemical and Petroleum Industries	-0.02	-0.01	-	-0.05	-0.04	1.12	-0.02	-0.09	-	-0.03
14. Non Metallic Products	-	-	-	-0.05	-0.04	0.58	-0.02	-0.08	-0.01	-0.03
15. Metal Product and Machinery	-0.02	-	-0.01	-0.05	-0.04	1.12	-0.02	-0.09	-0.01	-0.03
16. Agricultural Machinery	-	-	-	-	-	1.12	-	-	-	-
17. Other Manufacturing	-0.02	-	-0.01	-0.04	-0.04	1.12	-0.02	-0.09	-0.04	-0.03
18. Electricity, Water Work and Public Utilities	-0.02	-0.01	-	-0.05	-0.04	1.11	-0.02	-0.09	-	-0.03
19. Construction and Trade	-0.04	-	-	-0.05	-0.04	2.00	-	-0.09	-	-0.03
20. Service Transportation and Communication	-0.03	-0.01	-	-0.05	-0.04	1.12	-0.02	-0.09	-0.01	-0.03

Source: Model Simulation 3

Note: 1/ Base year value is equal to as in Simulations 1 and 2

R.4 Percentage change of quantity of investment demand for commodity c ($QINV_c$) from results of Simulation 3 compared with base year

Sector	Base year	Simulation 3
1. Paddy and Maize	-	-
2. Cassava, Beans and Nuts	-	-
3. Vegetables, Sugarcane and Fruits	-	-
4. Rubber and Latex	-	-
5. Other Crops	-	-
6. Livestock	834.90	1.04
7. Forestry	-	-
8. Fishery	-	-
9. Mining and Quarrying	73.70	-
10. Food Manufacturing	-	-
11. Textile Industry	1,000.00	-0.04
12. Paper Industries and Printing	-	-
13. Rubber Chemical and Petroleum Industries	2,999.80	-0.03
14. Non Metallic Products	3,815.00	-0.03
15. Metal Product and Machinery	446,988.10	-0.03
16. Agricultural Machinery	4,822.60	-0.03
17. Other Manufacturing	65,564.50	-0.03
18. Electricity, Water Work and Public Utilities	-	-
19. Construction and Trade	598,576.10	-0.03
20. Service Transportation and Communication	864.30	-0.02

Source: Model Simulation 3

R.5 Percentage change on other economic variables in the model from results of Simulation 3 compared with base year

Sectors	Base year	SIM 3 (%Δ)
1. Average price of factor f (WF_f)1/		
1.1 Labour	5.3	-
1.2 Capital	14.9	-
2. Supply of factor f (QFS_f)		
2.1 Labour2/	30,444,700	-
2.2 Capital1/	16,661,940	-
3. Government expenditures (EG)1/	627,868.80	0.003
4. Enterprise Saving ($ENTSAV_{ent}$)1/	332,604.00	-0.02
5. Foreign savings ($FSAV$)1/	264,045.50	-
6. Foreign exchange rate (EXR)	1.00	0.10
7. Dummy variable ($WALRAS$) (Zero at equilibrium)3/	1.867051E-9	-2.6246E-10

Source: Model Simulation 3,

Note: 1/ Million baht

2/ Persons

3/ Actual values

Appendix S

Results of Simulations 4 and 4.1 – 4.9

S.1 Percentage change of share parameters of factor input (α_{fa}) in the production functions from results of Simulations 4 and 4.1 – 4.9 compared with base year

Sectors	α_{fa} (Base		α_{fa} SIM 4(%Δ)		α_{fa} SIM 4.1(%Δ)		α_{fa} SIM 4.2(%Δ)		α_{fa} SIM4.3 (%Δ)		α_{fa} SIM 4.4 (%Δ)	
	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital
1. Paddy and Maize	0.381	0.619	-7.87	4.85	-7.87	4.85	-	-	-	-	-	-
2. Cassava, Beans and Nuts	0.353	0.647	-9.07	4.95	-	-	-9.07	4.95	-	-	-	-
3. Vegetables, Sugarcane and Fruits	0.248	0.752	-15.32	5.05	-	-	-	-	-15.32	5.05		
4. Rubber and Latex	0.217	0.783	-17.97	4.98	-	-	-	-	-	-	-17.97	4.98
5. Other Crops	0.228	0.772	-17.11	5.05			-	-	-	-	-	-
6. Livestock	0.194	0.806	-21.13	5.09	-	-	-	-	-	-	-	-
4. Forestry	0.367	0.633	-8.72	5.06	-	-	-	-	-	-	-	-
8. Fishery	0.266	0.734	-13.53	4.90	-	-	-	-	-	-	-	-
9. Mining and Quarrying	0.349	0.651	-	-	-	-	-	-	-	-	-	-
10. Food Manufacturing	0.343	0.657	-	-	-	-	-	-	-	-	-	-
11. Textile Industry	0.428	0.572	-	-	-	-	-	-	-	-	-	-
12. Paper Industries and Printing	0.182	0.818	-	-	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum Industries	0.341	0.659	-	-	-	-	-	-	-	-	-	-
14. Non Metallic Products	0.342	0.658	-	-	-	-	-	-	-	-	-	-
15. Metal Product and Machinery	0.37	0.63	-	-	-	-	-	-	-	-	-	-
16. Agricultural Machinery	0.536	0.464	-	-	-	-	-	-	-	-	-	-
17. Other Manufacturing	0.381	0.619	-	-	-	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	0.532	0.468	-	-	-	-	-	-	-	-	-	-
19. Construction and Trade	0.214	0.786	-	-	-	-	-	-	-	-	-	-
20. Service Transportation and Communication	0.604	0.396	-	-	-	-	-	-	-	-	-	-

Sectors	α_{fa} SIM 4.5(%Δ)		α_{fa} SIM 4.6(%Δ)		α_{fa} SIM 4.7(%Δ)		α_{fa} SIM 4.8(%Δ)		α_{fa} SIM 4.9(%Δ)	
	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital	Labour	Capital
1. Paddy and Maize	-	-	-	-	-	-	-	-	-7.87	4.85
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-9.07	4.95
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-15.32	5.05
4. Rubber and Latex	-	-	-	-	-	-	-	-	-17.97	4.98
5. Other Crops	-17.11	5.05	-	-	-	-	-	-	-17.11	5.05
6. Livestock	-	-	-21.13	5.09	-	-	-	-	-21.13	5.09
4. Forestry	-	-	-	-	-8.72	5.06	-	-	-8.72	5.06
8. Fishery	-	-	-	-	-	-	-13.53	4.90	-13.53	4.90
9. Mining and Quarrying	-	-	-	-	-	-	-	-	-	-
10. Food Manufacturing	-	-	-	-	-	-	-	-	-	-
11. Textile Industry	-	-	-	-	-	-	-	-	-	-
12. Paper Industries and Printing	-	-	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum Industries	-	-	-	-	-	-	-	-	-	-
14. Non Metallic Products	-	-	-	-	-	-	-	-	-	-
15. Metal Product and Machinery	-	-	-	-	-	-	-	-	-	-
16. Agricultural Machinery	-	-	-	-	-	-	-	-	-	-
17. Other Manufacturing	-	-	-	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	-	-	-	-	-	-	-	-	-	-
19. Construction and Trade	-	-	-	-	-	-	-	-	-	-
20. Service Transportation and Communication	-	-	-	-	-	-	-	-	-	-

Source: Model Simulations 4 and 4.1 – 4.9

S.2 Percentage change of level of activity (QA), quantity of domestic output (QX), quantity of export (QE), output c sold domestically (QD), quantity of import (QM) and composite commodity (QQ) from results of Simulations 4.1 – 4.9 compared with base year

Sector	Simulation 4.1 (%Δ)						Simulation 4.2 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	-7.28	-1.02	-1.66	-0.93	-0.13	-0.93	0.40	-0.01	-0.14	0.01	0.18	0.01
2. Cassava, Beans and Nuts	2.83	0.79	0.90	0.75	0.46	0.68	-7.88	-2.10	-2.38	-2.01	-1.28	-1.83
3. Vegetables, Sugarcane and Fruits	0.67	-0.04	-0.04	-0.04	-0.01	-0.03	0.17	-0.13	-0.13	-0.12	0.06	-0.12
4. Rubber and Latex	0.01	-0.07	0.05	-0.08	-0.20	-0.08	0.01	-0.09	-0.06	-0.10	-0.20	-0.10
5. Other Crops	0.32	-0.25	0.15	-0.30	-3.43	-0.94	0.04	-0.13	0.02	-0.15	-1.38	-0.40
6. Livestock	0.16	-0.17	-0.21	-0.17	0.13	-0.16	-0.02	-0.05	-0.06	-0.05	-0.01	-0.05
7. Forestry	0.84	0.13	0.13	0.12	0.08	0.11	0.24	-0.03	-0.03	-0.03	-0.02	-0.03
8. Fishery	0.48	-0.03	7.31	-0.13	0.30	-0.13	0.02	-0.08	7.26	-0.18	0.25	-0.18
9. Mining and Quarrying	-0.14	-0.03	-0.02	-0.03	-0.05	-0.04	-0.08	-0.10	-0.10	-0.10	-0.09	-0.10
10. Food Manufacturing	0.10	-1.06	-1.14	-1.02	0.91	-0.62	-0.01	-0.15	-0.16	-0.15	0.06	-0.11
11. Textile Industry	0.28	0.17	0.18	0.17	-0.03	0.13	0.02	-0.02	-0.02	-0.02	-0.03	-0.02
12. Paper Industries and Printing	0.06	0.02	0.02	0.02	0.04	0.02	-0.00	-0.03	-0.03	-0.03	-0.02	-0.03
13. Rubber Chemical and Petroleum Industries	-0.08	-0.05	-0.02	-0.06	-0.44	-0.18	-0.10	-0.08	-0.08	-0.08	-0.07	-0.08
14. Non Metallic Products	0.15	0.01	0.00	0.02	0.11	0.04	-0.09	-0.08	-0.09	-0.08	-0.04	-0.07
15. Metal Product and Machinery	0.06	0.04	0.04	0.04	-	0.02	-0.05	-0.06	-0.06	-0.06	-0.07	-0.07
16. Agricultural Machinery	-6.90	-1.90	-2.96	-1.86	-1.24	-1.58	-2.62	-0.77	-1.82	-0.74	-0.37	-0.57
17. Other Manufacturing	0.03	0.05	0.05	0.04	-0.03	0.01	-0.06	-0.05	-0.05	-0.05	-0.05	-0.05
18. Electricity, Water Work and Public Utilities	0.16	0.00	-0.08	0.01	0.10	0.01	-0.10	-0.09	-0.18	-0.09	-0.03	-0.09
19. Construction and Trade	0.01	0.02	-0.04	0.02	-	0.02	-0.03	-0.09	-0.16	-0.09	-0.09	-0.09
20. Service Transportation and Communication	-0.04	0.05	0.07	0.05	-0.14	0.02	-0.12	-0.08	-0.09	-0.08	-0.02	-0.07

Sector	Simulation 4.3 (%Δ)						Simulation 4.4 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	0.74	0.13	-0.12	0.16	0.47	0.16	0.06	0.03	0.01	0.04	0.07	0.04
2. Cassava, Beans and Nuts	1.23	0.36	0.45	0.33	0.09	0.27	0.21	0.07	0.06	0.07	0.07	0.07
3. Vegetables, Sugarcane and Fruits	-5.99	-0.18	-0.20	-0.18	0.15	-0.17	0.04	0.03	0.03	0.03	-0.02	0.03
4. Rubber and Latex	0.04	0.00	-0.10	0.01	0.20	0.01	-5.37	0.05	-0.03	0.05	0.20	0.06
5. Other Crops	0.15	-0.06	0.16	-0.09	-1.79	-0.43	-0.01	0.03	0.08	0.02	-0.37	-0.06
6. Livestock	0.03	0.09	0.09	0.09	0.11	0.09	0.03	0.05	0.05	0.05	0.01	0.05
7. Forestry	0.36	0.06	0.07	0.06	0.03	0.05	0.18	0.06	0.06	0.06	0.06	0.06
8. Fishery	0.15	0.04	7.39	-0.06	0.41	-0.06	-0.03	0.05	7.41	-0.06	0.17	-0.06
9. Mining and Quarrying	-0.21	0.03	0.04	0.03	0.01	0.02	0.27	0.08	0.10	0.08	0.06	0.08
10. Food Manufacturing	0.17	-0.17	-0.18	-0.16	0.28	-0.07	0.05	0.04	0.05	0.04	-0.02	0.03
11. Textile Industry	0.13	0.10	0.10	0.10	0.07	0.09	0.14	0.11	0.11	0.10	-0.01	0.08
12. Paper Industries and Printing	0.06	0.05	0.05	0.05	0.04	0.05	0.00	0.03	0.03	0.03	-0.00	0.02
13. Rubber Chemical and Petroleum Industries	0.01	-0.04	-0.04	-0.04	-0.08	-0.05	0.06	-0.15	-0.18	-0.14	0.13	-0.06
14. Non Metallic Products	-0.09	-0.01	-0.01	-0.01	0.01	-0.00	0.05	0.10	0.12	0.09	-0.08	0.05
15. Metal Product and Machinery	0.02	0.02	0.03	0.02	-0.01	0.01	0.03	0.04	0.04	0.04	0.03	0.04
16. Agricultural Machinery	-3.65	-0.99	-1.97	-0.96	-1.11	-1.03	-0.62	-0.14	-1.11	-0.11	-0.36	-0.22
17. Other Manufacturing	0.01	0.04	0.04	0.04	0.03	0.03	0.05	0.06	0.06	0.06	0.02	0.04
18. Electricity, Water Work and Public Utilities	0.21	0.02	-0.08	0.02	0.21	0.02	0.12	0.15	0.11	0.15	-0.17	0.15
19. Construction and Trade	0.01	0.02	-0.03	0.02	0.00	0.02	0.04	0.08	0.02	0.08	0.04	0.08
20. Service Transportation and Communication	0.06	-0.17	-0.19	-0.16	0.10	-0.13	0.09	0.06	0.07	0.06	0.01	0.05

Sector	Simulation 4.5 (%Δ)						Simulation 4.6 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	0.17	-1.16	-3.30	-0.88	1.84	-0.86	0.16	0.04	0.27	0.02	-0.26	0.01
2. Cassava, Beans and Nuts	0.26	-1.59	-2.64	-1.26	1.57	-0.57	0.10	0.04	0.08	0.03	-0.08	0.00
3. Vegetables, Sugarcane and Fruits	0.08	-1.13	-1.25	-1.13	0.93	-1.05	0.03	0.03	0.04	0.03	-0.09	0.03
4. Rubber and Latex	-0.08	-0.49	-1.86	-0.33	1.39	-0.33	0.03	0.04	0.02	0.04	0.00	0.04
5. Other Crops	-4.53	-0.49	-0.49	-0.50	-0.52	-0.50	-0.02	0.04	0.03	0.04	0.10	0.05
6. Livestock	-0.09	-0.46	-0.48	-0.46	-0.29	-0.46	-4.81	-0.15	-0.15	-0.15	-0.15	-0.15
7. Forestry	-0.03	-0.43	-0.50	-0.41	-0.08	-0.31	0.04	0.04	0.05	0.04	0.00	0.03
8. Fishery	0.09	-0.31	7.01	-0.41	0.04	-0.41	0.07	0.07	7.46	-0.04	-0.22	-0.04
9. Mining and Quarrying	-0.34	-0.17	-0.10	-0.18	-0.27	-0.20	0.05	0.06	0.07	0.06	0.04	0.05
10. Food Manufacturing	-0.76	-0.21	-0.21	-0.21	-0.08	-0.18	0.12	-0.46	-0.47	-0.46	-0.31	-0.43
11. Textile Industry	0.01	-0.14	-0.14	-0.13	0.04	-0.10	0.09	0.06	0.06	0.06	-0.00	0.04
12. Paper Industries and Printing	0.01	-0.07	-0.08	-0.07	-0.01	-0.06	0.01	0.03	0.03	0.03	-0.01	0.02
13. Rubber Chemical and Petroleum Industries	-0.33	-0.23	-0.21	-0.23	-0.39	-0.28	0.04	0.03	0.04	0.03	0.01	0.03
14. Non Metallic Products	0.05	-0.10	-0.11	-0.10	-0.08	-0.10	0.05	0.06	0.06	0.05	0.02	0.05
15. Metal Product and Machinery	0.01	-0.01	-0.01	-0.01	-0.06	-0.04	0.05	0.05	0.05	0.05	0.04	0.04
16. Agricultural Machinery	6.46	1.80	1.28	1.82	-1.88	0.12	-0.01	0.04	-0.94	0.07	-0.10	-0.01
17. Other Manufacturing	-0.07	-0.08	-0.08	-0.08	-0.08	-0.08	0.06	0.03	0.03	0.03	0.01	0.02
18. Electricity, Water Work and Public Utilities	0.37	-0.03	-0.12	-0.03	0.12	-0.02	0.12	0.08	0.01	0.08	-0.06	0.08
19. Construction and Trade	0.04	-0.08	-0.14	-0.08	-0.09	-0.08	0.03	0.06	0.01	0.06	0.04	0.06
20. Service Transportation and Communication	-0.17	-0.19	-0.21	-0.19	-0.03	-0.17	0.07	0.05	0.06	0.05	-0.04	0.04

Sector	Simulation 4.7 (%Δ)						Simulation 4.8 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	0.07	0.01	-	0.01	0.03	0.01	-0.03	-	0.01	-	-0.01	-
2. Cassava, Beans and Nuts	0.14	0.04	0.04	0.04	0.04	0.04	-0.01	-	-	-	0.01	-
3. Vegetables, Sugarcane and Fruits	0.03	-	-0.01	-	0.05	-	-0.01	-	-	-	0.03	-
4. Rubber and Latex	0.02	-	0.02	-	-	-	0.01	0.01	-0.01	0.01	-	0.01
5. Other Crops	0.01	-0.01	0.02	-0.01	-0.25	-0.06	-	0.01	0.01	0.01	-0.03	-
6. Livestock	-	-	-0.01	-	0.02	-	-0.01	0.02	0.02	0.02	-	0.02
7. Forestry	-8.52	-1.33	-1.39	-1.32	-1.04	-1.23	0.02	0.01	-	0.01	0.01	0.01
8. Fishery	-	-	7.35	-0.10	0.25	-0.10	0.63	0.03	7.39	-0.07	0.24	-0.07
9. Mining and Quarrying	0.02	-	-	-	0.01	-	0.02	0.01	0.01	0.01	0.01	0.01
10. Food Manufacturing	-	0.01	0.01	0.01	0.02	0.02	-	0.06	0.06	0.06	0.02	0.05
11. Textile Industry	0.03	0.02	0.02	0.02	0.01	0.02	0.01	-	-	0.01	0.02	0.01
12. Paper Industries and Printing	-	-0.03	-0.04	-0.03	0.08	-0.01	-	-	-	-	0.01	-
13. Rubber Chemical and Petroleum Industries	-	-	-	-	0.02	-	0.01	0.01	0.01	0.01	0.04	0.02
14. Non Metallic Products	0.04	-0.03	-0.02	-0.04	-0.13	-0.06	0.02	0.01	0.01	0.01	0.02	0.01
15. Metal Product and Machinery	0.01	0.01	0.01	0.01	-0.02	-0.01	-	-	-	-	0.01	0.01
16. Agricultural Machinery	-0.46	-0.12	-1.11	-0.09	-0.23	-0.15	0.12	0.03	-0.97	0.07	0.06	0.06
17. Other Manufacturing	0.03	-0.20	-0.22	-0.19	0.05	-0.07	-	-	-	-	0.02	0.01
18. Electricity, Water Work and Public Utilities	-0.02	-	-0.07	0.01	-	0.01	-	0.01	-0.07	0.01	-	0.01
19. Construction and Trade	-	-	-0.07	-	-	-	-	0.01	-0.06	0.01	-	0.01
20. Service Transportation and Communication	0.02	-	0.01	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01

Sector	Simulation 4.9 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	-5.90	-2.03	-5.06	-1.64	2.24	-1.61
2. Cassava, Beans and Nuts	-4.04	-2.69	-3.81	-2.33	0.71	-1.58
3. Vegetables, Sugarcane and Fruits	-5.19	-1.46	-1.60	-1.45	1.01	-1.36
4. Rubber and Latex	-5.34	-0.58	-1.94	-0.42	1.39	-0.42
5. Other Crops	-4.12	-0.91	-0.02	-1.04	-7.84	-2.45
6. Livestock	-4.69	-0.71	-0.77	-0.71	-0.23	-0.70
7. Forestry	-7.19	-1.54	-1.65	-1.52	-1.01	-1.36
8. Fishery	1.30	-0.26	7.08	-0.36	-0.12	-0.36
9. Mining and Quarrying	-0.41	-0.12	0.02	-0.12	-0.29	-0.17
10. Food Manufacturing	-0.34	-2.01	-2.12	-1.95	0.84	-1.38
11. Textile Industry	0.76	0.34	0.36	0.33	-0.01	0.26
12. Paper Industries and Printing	0.15	0.00	-0.01	0.00	0.09	0.02
13. Rubber Chemical and Petroleum Industries	-0.42	-0.51	-0.47	-0.52	-0.87	-0.62
14. Non Metallic Products	0.15	-0.03	-0.02	-0.05	-0.23	-0.09
15. Metal Product and Machinery	0.15	0.12	0.13	0.11	-0.10	-0.01
16. Agricultural Machinery	-8.73	-2.33	-2.93	-2.31	-5.25	-3.66
17. Other Manufacturing	0.09	-0.15	-0.15	-0.14	-0.10	-0.12
18. Electricity, Water Work and Public Utilities	0.98	0.19	0.11	0.19	0.14	0.19
19. Construction and Trade	0.12	0.03	0.02	0.03	-0.04	0.03
20. Service Transportation and Communication	-0.06	-0.26	-0.27	-0.26	-0.17	-0.25

Source: Model Simulations 4 and 4.1-4.9

S.3 Percentage change of price of activity (PA), producer price (PX) ,export price (PE), domestic price (PD), import price (PM), composite commodity price (PQ), value added price (PVA) from results of Simulations 4.1 – 4.9 compared with base year

Sector	Simulation 4.1 (%Δ)							Simulation 4.2 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*	*PA*	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	0.60	0.60	-	0.70	-	0.70	3.15	-	0.10	-	0.10	-	0.10	0.52
2. Cassava, Beans and Nuts	0.30	-	-	-	-	-	4.86	0.10	0.30	-	0.30	-	0.20	1.39
3. Vegetables, Sugarcane and Fruits	0.20	-	-	-	-	-	1.94	-	0.10	-	0.10	-	0.10	0.65
4. Rubber and Latex	-	-	-	-	-	-	-0.22	-	-	-	-	-	-	0.22
5. Other Crops	-	-	-	-	-	-	0.67	-	-	-	-	-	-	-
6. Livestock	0.60	0.30	-	0.30	-	0.30	0.65	-	-	-	-	-	-	-
7. Forestry	-	-	-	-	-	-	1.47	-	-	-	-	-	-	0.49
8. Fishery	0.40	0.20	-	0.20	-	0.20	1.19	-	0.20	-	0.20	-	0.20	0.30
9. Mining and Quarrying	-	-	-	-	-	-	-0.63	-	-	-	-	-	-	-0.63
10. Food Manufacturing	0.20	0.70	-	1.10	-	0.90	-	-	-	-	0.10	-	0.10	-
11. Textile Industry	-	-	-	-	-	-	0.31	-	-	-	-	-	-	0.31
12. Paper Industries and Printing	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum Industries	-	-	-	-	-	-	-0.68	-	-	-	-	-	-	-
14. Non Metallic Products	-	-	-	0.10	-	0.10	0.37	-	-	-	-	-	-	-
15. Metal Product and Machinery	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16. Agricultural Machinery	-	0.80	-	0.80	-	0.40	-6.12	-	0.40	-	0.50	-	0.20	-2.72
17. Other Manufacturing	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	-	-	-	-	-	-	-0.32	-	-	-	-	-	-	-
19. Construction and Trade	-	-	-	-	-	-	-0.22	-	-	-	-	-	-	-
20. Service Transportation and Communication	-	-	-	-	-	-	-0.15	-	-	-	-	-	-	-

Sector	Simulation 4.3 (%Δ)							Simulation 4.4 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*	*PA*	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	0.10	0.10	-	0.20	-	0.20	1.05	-	-	-	-	-	-	-0.26
2. Cassava, Beans and Nuts	-	-	-	-	-	-	2.08	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	0.10	0.10	-	0.10	-	0.10	1.08	-	-	-	-	-	-	-
4. Rubber and Latex	-	0.90	-	1.00	-	1.00	-	0.30	0.80	-	0.90	-	0.90	0.43
5. Other Crops	-	-	-	-	-	-	0.34	-	-	-	-	-	-	-0.34
6. Livestock	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7. Forestry	-	-	-	-	-	-	0.49	-	-	-	-	-	-	0.49
8. Fishery	0.10	0.20	-	0.20	-	0.20	0.30	-	0.20	-	0.20	-	0.20	-0.30
9. Mining and Quarrying	-	-	-	-	-	-	-0.63	0.10	-	-	-	-	-	-
10. Food Manufacturing	0.10	0.10	-	0.20	-	0.10	-	-	-	-	-	-	-	-
11. Textile Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12. Paper Industries and Printing	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.46
13. Rubber Chemical and Petroleum Industries	-	-	-	-	-	-	-	0.10	0.30	-	0.30	-	0.20	-
14. Non Metallic Products	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15. Metal Product and Machinery	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16. Agricultural Machinery	-	-	-	-	-	-	-3.40	-	-	-	-	-	-	-0.68
17. Other Manufacturing	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	-	0.10	-	0.10	-	0.10	-	-	-	-	-	-	-	-
19. Construction and Trade	-	-	-	-	-	-	-0.11	-	-	-	-	-	-	-
20. Service Transportation and Communication	-	0.20	-	0.20	-	0.20	-	-	-	-	-	-	-	-

Sector	Simulation 4.5 (%Δ)							Simulation 4.6 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*	*PA*	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	0.20	2.10	-	2.40	-	2.40	0.26	0.10	-	-	-	-	-	-
2. Cassava, Beans and Nuts	0.20	1.00	-	1.40	-	1.00	0.35	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	-	1.10	-	1.10	-	1.10	0.22	-	-	-	-	-	-	-
4. Rubber and Latex	-	14.70	-	16.60	-	16.60	-0.22	-	0.20	-	0.20	-	0.20	-
5. Other Crops	1.50	-0.20	-	-0.20	-	-0.20	5.70	-	0.10	-	0.10	-	0.10	-0.34
6. Livestock	-	0.10	-	0.10	-	0.10	-0.33	0.10	-	-	-	-	-	-
7. Forestry	-	0.60	-	0.80	-	0.50	-	-	-	-	-	-	-	-
8. Fishery	-	0.20	-	0.10	-	0.10	0.30	-	-	-	-	-	-	-
9. Mining and Quarrying	-	-0.90	-	-0.90	-	-0.70	-0.63	-	-	-	-	-	-	-
10. Food Manufacturing	-	-0.10	-	-0.10	-	-0.10	-1.64	-	0.10	-	0.10	-	0.10	-
11. Textile Industry	-	-0.10	-	-	-	-	-	-	-	-	-	-	-	-
12. Paper Industries and Printing	-	-0.10	-	-0.10	-	-0.10	-	-	-	-	-	-	-	-0.46
13. Rubber Chemical and Petroleum Industries	0.20	-0.30	-	-0.30	-	-0.30	-0.68	-	-	-	-	-	-	-
14. Non Metallic Products	-	-0.10	-	-0.10	-	-0.10	0.37	-	-	-	-	-	-	-
15. Metal Product and Machinery	-	-0.20	-	-0.20	-	-0.20	-	-	-	-	-	-	-	-
16. Agricultural Machinery	-	-4.90	-	-5.00	-	-2.80	5.44	-	-	-	-	-	-	-0.68
17. Other Manufacturing	-	-0.10	-	-0.10	-	-0.10	-	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	-	-	-	-	-	-	0.32	-	-	-	-	-	-	-
19. Construction and Trade	0.10	-0.20	-	-0.20	-	-0.20	0.11	-	-	-	-	-	-	-
20. Service Transportation and Communication	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sector	Simulation 4.7 (%Δ)							Simulation 4.8 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*	*PA*	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.26
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4. Rubber and Latex	-	-0.20	-	-0.20	-	-0.20	-	-	0.10	-	0.10	-	0.10	-
5. Other Crops	-	-0.30	-	-0.40	-	-0.30	-	-	-	-	-0.10	-	-	-0.34
6. Livestock	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7. Forestry	0.10	0.60	-	0.80	-	0.50	0.49	-	-	-	-	-	-	-
8. Fishery	-	0.20	-	0.20	-	0.20	-	-	0.20	-	0.20	-	0.20	-
9. Mining and Quarrying	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Food Manufacturing	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11. Textile Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12. Paper Industries and Printing	-	0.10	-	0.10	-	0.10	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum Industries	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14. Non Metallic Products	-	-0.10	-	-0.20	-	-0.20	0.37	-	-	-	-	-	-	0.37
15. Metal Product and Machinery	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16. Agricultural Machinery	-0.10	-0.20	-	-0.20	-	-0.10	-0.68	-	-	-	-	-	-	-
17. Other Manufacturing	-	0.10	-	0.20	-	0.10	-	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19. Construction and Trade	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20. Service Transportation and Communication	-	-	-	-	-	-	-	-	-	-	-	-	-	0.15

Sector	Simulation 4.9 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	1.00	3.00	-0.30	3.40	-0.30	3.40	5.77
2. Cassava, Beans and Nuts	0.80	1.00	-0.30	1.30	-0.30	0.90	9.72
3. Vegetables, Sugarcane and Fruits	0.30	1.20	-0.30	1.30	-0.30	1.20	3.66
4. Rubber and Latex	-0.60	14.50	-0.30	16.40	-0.30	16.40	0.22
5. Other Crops	1.00	-8.70	-0.30	-10.00	-0.30	-8.10	7.05
6. Livestock	0.70	0.30	-0.30	0.40	-0.30	0.40	0.33
7. Forestry	-0.20	0.90	-0.30	1.20	-0.30	0.70	2.94
8. Fishery	0.50	-0.10	-0.30	-0.10	-0.30	-0.10	1.79
9. Mining and Quarrying	-0.60	-1.60	-0.30	-1.70	-0.30	-1.30	-1.90
10. Food Manufacturing	0.20	0.90	-0.30	1.50	-0.30	1.10	-1.31
11. Textile Industry	-0.40	-0.40	-0.30	-0.50	-0.30	-0.50	0.61
12. Paper Industries and Printing	-0.20	-0.20	-0.30	-0.20	-0.30	-0.20	-
13. Rubber Chemical and Petroleum Industries	-0.30	-0.60	-0.30	-0.70	-0.30	-0.60	-1.36
14. Non Metallic Products	-0.50	-0.40	-0.30	-0.60	-0.30	-0.50	-
15. Metal Product and Machinery	-0.40	-0.40	-0.30	-0.50	-0.30	-0.40	-0.47
16. Agricultural Machinery	-2.10	-4.20	-0.30	-4.30	-0.30	-2.50	-8.16
17. Other Manufacturing	-0.30	-0.20	-0.30	-0.20	-0.30	-0.20	-0.46
18. Electricity, Water Work and Public Utilities	-0.40	-0.30	-0.30	-0.30	-0.30	-0.30	-
19. Construction and Trade	-0.20	-0.70	-0.30	-0.70	-0.30	-0.70	-0.11
20. Service Transportation and Communication	-0.50	-0.20	-0.30	-0.20	-0.30	-0.20	-0.61

Source: Model Simulation 4.1 – 4.9

S.4 Percentage change of wage distortion for factors (labour and capital) in activity ($WFDIST_{fa}$) from results of Simulations 4 and 4.1 – 4.9 compared with base year

Sectors	Labour										
	Base year[1/]	SIM 4 (%Δ)	SIM 4.1 (%Δ)	SIM 4.2 (%Δ)	SIM 4.3 (%Δ)	SIM 4.4 (%Δ)	SIM 4.5 (%Δ)	SIM 4.6 (%Δ)	SIM 4.7 (%Δ)	SIM 4.8 (%Δ)	SIM 4.9 (%Δ)
1. Paddy and Maize	12.30	-	-	-	-	-	-	-	-	-	-
2. Cassava, Beans and Nuts	13.90	-	-	-	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	10.70	-	-	-	-	-	-	-	-	-	-
4. Rubber and Latex	15.60	-	-	-	-	-	-	-	-	-	-
5. Other Crops	20.10	-	-	-	-	-	-	-	-	-	-
6. Livestock	12.00	-	-	-	-	-	-	-	-	-	-
7. Forestry	14.50	-	-	-	-	-	-	-	-	-	-
8. Fishery	57.30	-	-	-	-	-	-	-	-	-	-
9. Mining and Quarrying	1,154.60	-	-	-	-	-	-	-	-	-	-
10. Food Manufacturing	132.60	-	-	-	-	-	-	-	-	-	-
11. Textile Industry	152.90	-	-	-	-	-	-	-	-	-	-
12. Paper Industries and Printing	178.30	-	-	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum Industries	233.20	-	-	-	-	-	-	-	-	-	-
14. Non Metallic Products	169.40	-	-	-	-	-	-	-	-	-	-
15. Metal Product and Machinery	242.80	-	-	-	-	-	-	-	-	-	-
16. Agricultural Machinery	365.00	-	-	-	-	-	-	-	-	-	-
17. Other Manufacturing	127.80	-	-	-	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	1,562.20	-	-	-	-	-	-	-	-	-	-
19. Construction and Trade	60.70	-	-	-	-	-	-	-	-	-	-
20. Service Transportation and Communication	182.70	-	-	-	-	-	-	-	-	-	-

Sectors	Capital										
	Base year	SIM 4 (%Δ)	SIM 4.1 (%Δ)	SIM 4.2 (%Δ)	SIM 4.3 (%Δ)	SIM 4.4 (%Δ)	SIM 4.5 (%Δ)	SIM 4.6 (%Δ)	SIM 4.7 (%Δ)	SIM 4.8 (%Δ)	SIM 4.9 (%Δ)
1. Paddy and Maize	142.90	-5.04	-8.75	1.12	1.82	0.07	0.42	0.28	0.14	-0.07	-5.18
2. Cassava, Beans and Nuts	161.40	0.62	7.99	-10.97	3.41	0.50	0.74	0.19	0.37	-	0.50
3. Vegetables, Sugarcane and Fruits	124.10	-6.20	2.58	0.73	-9.59	0.08	0.32	0.08	0.08	-	-6.29
4. Rubber and Latex	181.70	-9.69	-0.17	0.11	0.06	-9.47	-0.39	0.06	0.06	0.06	-9.74
5. Other Crops	234.00	-1.97	1.15	0.21	0.56	-0.21	-3.80	-0.17	0.04	-0.04	-2.22
6. Livestock	139.10	-8.99	0.58	-0.07	-	-	-0.50	-9.27	-0.07	-0.07	-8.99
7. Forestry	168.80	-8.89	2.07	0.71	0.89	0.41	-0.06	0.06	-12.44	0.06	-9.12
8. Fishery	135.90	-1.84	1.62	0.15	0.52	-0.22	0.37	0.15	-	-4.19	-1.99
9. Mining and Quarrying	228.00	-1.75	-0.61	-0.18	-0.75	0.66	-1.01	0.04	0.04	0.09	-1.75
10. Food Manufacturing	141.60	-1.55	0.07	-	0.35	-	-2.19	0.21	-	-	-1.62
11. Textile Industry	163.00	1.17	0.43	0.12	0.18	0.25	0.06	0.12	0.06	0.06	1.17
12. Paper Industries and Printing	189.00	0.21	0.11	0.05	0.21	-0.11	0.05	-	-	-	0.21
13. Rubber Chemical and Petroleum Industries	252.60	-1.82	-0.48	-0.24	-0.12	0.04	-0.99	-	-0.04	-	-1.82
14. Non Metallic Products	179.70	-0.28	0.22	-0.22	-0.39	0.06	0.11	0.06	0.11	0.11	-0.17
15. Metal Product and Machinery	265.70	-0.26	-0.08	-0.08	-0.08	-0.04	-	0.04	-	-	-0.19
16. Agricultural Machinery	386.70	-	-12.70	-4.78	-6.83	-1.29	12.36	-0.13	-0.88	0.21	-16.19
17. Other Manufacturing	133.60	1.42	1.65	1.65	1.72	1.80	1.57	1.87	1.80	1.80	1.42
18. Electricity, Water Work and Public Utilities	39.40	1.27	0.25	-	0.25	0.25	0.76	0.25	-	-	1.27
19. Construction and Trade	271.30	-0.11	-0.18	-0.11	-0.11	0.07	0.15	-	-0.04	-	-0.07
20. Service Transportation and Communication	32.50	-0.92	-0.31	-0.31	-	-	-0.31	-	-	-	-0.92

Source: Model Simulations 4 and 4.1 – 4.9

Note: 1/ Million baht

S.5 Percentage change of quantity of consumption of commodity c by household h (QH_{ch}) from results of Simulations 4, 4.1 – 4.9 compared with base year

Sectors	Base year[1/]	SIM 4 (%Δ)	SIM 4.1 (%Δ)	SIM 4.2 (%Δ)	SIM 4.3 (%Δ)	SIM 4.4 (%Δ)	SIM 4.5 (%Δ)	SIM 4.6 (%Δ)	SIM 4.7 (%Δ)	SIM 4.8 (%Δ)	SIM 4.9 (%Δ)
1. Paddy and Maize	20,041.70	-3.67	-0.80	-0.20	-0.22	-0.04	-2.53	0.23	0.01	0.03	-3.69
2. Cassava, Beans and Nuts	10,689.10	-1.37	0.05	-0.33	0.16	-0.01	-1.16	0.01	0.02	0.02	-1.37
3. Vegetables, Sugarcane and Fruits	120,716.90	-1.59	-0.08	-0.15	-0.13	0.02	-1.26	0.05	-0.01	0.01	-1.61
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-	-
5. Other Crops	12,166.80	8.34	3.66	1.39	2.06	0.45	-0.02	-0.10	0.30	0.06	8.32
6. Livestock	53,940.80	-0.79	-0.45	-0.09	0.03	0.04	-0.28	-0.03	-0.01	0.04	-0.79
7. Forestry	8,107.10	-1.16	0.02	-0.06	0.11	-0.01	-0.69	0.06	-0.53	0.01	-1.16
8. Fishery	81,989.70	-0.32	-0.32	-0.30	-0.22	-0.14	-0.32	0.08	-0.19	-0.16	-0.32
9. Mining and Quarrying	638.00	0.82	0.05	-0.08	0.16	0.11	0.53	0.08	0.00	0.02	0.89
10. Food Manufacturing	477,990.30	-1.54	-1.00	-0.14	-0.15	0.02	-0.12	-0.10	0.02	0.04	-1.54
11. Textile Industry	259,761.10	-0.01	0.05	-0.04	0.08	0.05	-0.15	0.00	0.03	0.01	0.01
12. Paper Industries and Printing	35,156.90	-0.26	-0.07	-0.04	0.07	0.01	-0.10	-0.00	-0.06	0.01	-0.24
13. Rubber Chemical and Petroleum Industries	290,586.30	0.11	0.26	-0.04	0.09	-0.24	0.08	-0.01	0.01	0.00	0.13
14. Non Metallic Products	15,507.30	0.09	-0.20	-0.09	0.03	0.25	-0.08	0.03	0.17	0.01	0.11
15. Metal Product and Machinery	353,855.40	-0.10	-0.04	-0.03	0.08	-0.01	-0.03	-0.02	0.04	0.02	-0.08
16. Agricultural Machinery	116.30	6.45	-0.52	-0.34	0.17	0.17	2.75	0.09	0.17	0.00	2.15
17. Other Manufacturing	214,743.60	-0.22	-0.03	-0.04	0.07	0.01	-0.06	-0.02	-0.10	0.02	-0.20
18. Electricity, Water Work and Public Utilities	113,459.20	-0.16	-0.15	-0.10	-0.13	0.32	-0.21	0.12	0.02	0.03	-0.13
19. Construction and Trade	55,438.10	0.30	-0.03	-0.04	0.14	0.07	0.03	0.07	-0.02	-0.01	0.29
20. Service Transportation and Communication	695,835.20	-0.29	-0.80	-0.11	-0.21	0.04	-0.22	0.07	0.03	0.02	-0.26

Source: Model Simulation 4 and 4.1 – 4.9

Note: 1/ Million baht

S.6 Percentage change of quantity of intermediate use of commodity c by activity *a* ($QINT_{ca}$) from results of Simulations 4 and 4.1 – 4.9 compared with base year[1/]

Commodity C	Intermediate input to activity A (Simulation 4, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	-5.88	-	-5.16	-	-4.08	-4.69	-	-	-	-0.34
2. Cassava, Beans and Nuts	-	-4.00	-5.16	-	-	-4.69	-	-	-	-0.33
3. Vegetables, Sugarcane and Fruits	-	-	-5.17	-	-4.12	-4.69	-	-	-	-0.34
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	-5.88	-4.00	-5.17	-5.33	-4.08	-4.67	-7.13	1.32	-	-0.34
6. Livestock	-	-	-	-	-	-4.69	-	-	-	-0.34
7. Forestry	-5.78	-4.88	-5.14	-	-4.03	-4.68	-7.12	1.30	-0.42	-0.34
8. Fishery	-	-	-	-	-	-4.69	-	1.32	-	-0.34
9. Mining and Quarrying	-	-	-4.95	-	-4.00	-4.68	-	1.15	-0.42	-0.34
10. Food Manufacturing	-	-	-5.22	-5.56	-3.95	-4.69	-7.41	1.32	-	-0.34
11. Textile Industry	-5.88	-4.01	-5.17	-5.32	-4.07	-4.65	-7.12	1.32	-0.44	-0.34
12. Paper Industries and Printing	-	-	-5.16	-	-4.07	-4.71	-7.08	1.33	-0.42	-0.34
13. Rubber Chemical and Petroleum Industries	-5.88	-4.00	-5.17	-5.33	-4.08	-4.69	-7.12	1.32	-0.42	-0.34
14. Non Metallic Products	-6.11	-3.23	-5.17	-5.33	-4.07	-4.56	-7.13	1.34	-0.43	-0.33
15. Metal Product and Machinery	-5.88	-4.00	-5.17	-5.33	-4.08	-4.69	-7.13	1.32	-0.42	-0.34
16. Agricultural Machinery	-5.88	-4.02	-5.17	-5.32	-4.08	-4.67	-7.09	1.32	-0.57	-0.41
17. Other Manufacturing	-5.78	-4.04	-5.17	-5.35	-4.07	-4.69	-7.13	1.30	-0.42	-0.32
18. Electricity, Water Work and Public Utilities	-5.84	-4.17	-5.20	-	-4.07	-4.69	-7.16	1.32	-0.42	-0.33
19. Construction and Trade	-5.83	-4.29	-5.12	-5.63	-4.07	-4.66	-7.06	1.33	-0.42	-0.32
20. Service Transportation and Communication	-5.88	-4.00	-5.17	-5.33	-4.08	-4.69	-7.13	1.32	-0.42	-0.34

Commodity C	Intermediate input to activity A (Simulation 4, (%∆))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	0.14	-0.42	-	-	-	0.06	-	-	-0.09
2. Cassava, Beans and Nuts	-	-	-0.43	-	-	-	-	-	-	-0.08
3. Vegetables, Sugarcane and Fruits	-	-	-0.45	-	-	-	-	-	-	-0.08
4. Rubber and Latex	-	-	-0.42	-	-	-	-	-	-	-
5. Other Crops	0.74	0.14	-0.43	-	-	-	0.00	0.93	0.11	-0.09
6. Livestock	0.74	-	-0.42	-	-	-	0.08	-	-	-0.08
7. Forestry	0.71	0.14	-0.42	0.10	0.12	-	0.08	-	0.20	-0.09
8. Fishery	-	-	-0.42	0.00	-	-	0.09	-	-	-0.08
9. Mining and Quarrying	0.75	0.14	-0.42	0.10	0.12	-	0.07	0.90	0.10	-0.08
10. Food Manufacturing	0.74	0.14	-0.42	0.09	0.13	-	0.08	-	0.12	-0.08
11. Textile Industry	0.74	0.15	-0.43	0.09	0.12	-	0.08	0.90	0.15	-0.08
12. Paper Industries and Printing	0.74	0.14	-0.42	0.10	0.12	-7.49	0.08	0.90	0.06	-0.08
13. Rubber Chemical and Petroleum Industries	0.74	0.14	-0.42	0.10	0.12	-7.67	0.08	0.90	0.10	-0.08
14. Non Metallic Products	0.73	0.00	-0.43	0.10	0.12	-8.14	0.08	0.90	0.11	-0.08
15. Metal Product and Machinery	0.74	0.14	-0.43	0.10	0.12	-7.65	0.08	0.90	0.11	-0.08
16. Agricultural Machinery	-	-	-	-	-	-7.65	-	-	-	-0.12
17. Other Manufacturing	0.74	0.15	-0.43	0.10	0.12	-7.67	0.08	0.89	0.08	-0.08
18. Electricity, Water Work and Public Utilities	0.74	0.14	-0.42	0.10	0.12	-7.66	0.08	0.90	0.13	-0.08
19. Construction and Trade	0.72	0.15	-0.43	0.10	0.12	-8.00	0.09	0.90	0.10	-0.08
20. Service Transportation and Communication	0.74	0.14	-0.42	0.10	0.12	-7.66	0.08	0.90	0.11	-0.08

Commodity C	Intermediate input to activity A (Simulation 4.1, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	-7.28	-	0.69	-	0.32	0.17	-	-	-	0.10
2. Cassava, Beans and Nuts	-	2.83	0.68	-	-	0.17	-	-	-	0.10
3. Vegetables, Sugarcane and Fruits	-	-	0.67	-	0.37	0.17	-	-	-	0.10
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	-7.28	2.83	0.67	0.01	0.32	0.18	0.84	0.46	-	0.10
6. Livestock	-	-	-	-	-	0.16	-	-	-	0.10
7. Forestry	-7.48	2.44	0.73	-	0.40	0.14	0.84	0.65	-0.13	0.09
8. Fishery	-	-	-	-	-	0.17	-	0.47	-	0.10
9. Mining and Quarrying	-	-	0.90	-	0.32	0.14	-	0.29	-0.14	0.10
10. Food Manufacturing	-	-	0.52	-	0.56	0.16	-	0.48	-	0.10
11. Textile Industry	-7.29	2.82	0.67	0.02	0.32	0.22	0.84	0.47	-0.16	0.09
12. Paper Industries and Printing	-	-	0.66	-	0.32	0.13	0.93	0.59	-0.14	0.10
13. Rubber Chemical and Petroleum Industries	-7.28	2.83	0.67	0.01	0.32	0.16	0.84	0.48	-0.14	0.10
14. Non Metallic Products	-7.25	3.23	0.57	-	0.32	0.28	0.83	0.49	-0.13	0.10
15. Metal Product and Machinery	-7.28	2.83	0.67	0.01	0.32	0.16	0.84	0.48	-0.14	0.10
16. Agricultural Machinery	-7.28	2.81	0.67	-	0.32	0.17	0.88	0.47	-0.28	-
17. Other Manufacturing	-7.29	2.85	0.67	-	0.32	0.18	0.84	0.54	-0.13	0.11
18. Electricity, Water Work and Public Utilities	-7.30	3.13	0.66	-	0.32	0.17	0.87	0.48	-0.14	0.10
19. Construction and Trade	-7.28	2.45	0.66	-	0.27	0.16	0.77	0.48	-0.14	0.13
20. Service Transportation and Communication	-7.28	2.83	0.67	0.01	0.32	0.16	0.84	0.48	-0.14	0.10

Commodity C	Intermediate input to activity A (Simulation 4.1, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	0.06	-0.08	-	-	-	0.03	-	-	-0.04
2. Cassava, Beans and Nuts	-	-	-0.09	-	-	-	-	-	-	-0.04
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	-0.04
4. Rubber and Latex	-	-	-0.08	-	-	-	-	-	-	-
5. Other Crops	0.28	0.05	-0.08	-	-	-	-	0.23	-	-0.04
6. Livestock	0.28	-	-0.08	-	-	-	0.03	-	-	-0.03
7. Forestry	0.24	0.05	-0.08	0.15	0.05	-	0.03	-	0.10	-0.04
8. Fishery	-	-	-0.08	0.48	-	-	0.04	-	-	-0.04
9. Mining and Quarrying	0.30	0.05	-0.08	0.15	0.06	-	0.04	0.16	-	-0.04
10. Food Manufacturing	0.28	0.06	-0.08	0.15	0.07	-	0.03	-	-	-0.04
11. Textile Industry	0.28	0.07	-0.08	0.15	0.06	-	0.03	0.16	0.08	-0.04
12. Paper Industries and Printing	0.28	0.06	-0.08	0.15	0.06	-6.68	0.03	0.16	-	-0.04
13. Rubber Chemical and Petroleum Industries	0.28	0.06	-0.08	0.15	0.06	-6.90	0.03	0.16	0.02	-0.04
14. Non Metallic Products	0.27	-	-0.08	0.15	0.06	-6.98	0.03	0.16	0.01	-0.04
15. Metal Product and Machinery	0.28	0.06	-0.08	0.15	0.06	-6.90	0.03	0.16	0.01	-0.04
16. Agricultural Machinery	-	-	-	-	-	-6.90	-	-	-	-
17. Other Manufacturing	0.28	0.06	-0.08	0.15	0.06	-6.95	0.03	0.16	-	-0.04
18. Electricity, Water Work and Public Utilities	0.28	0.06	-0.08	0.15	0.06	-6.90	0.03	0.16	-	-0.04
19. Construction and Trade	0.28	0.08	-0.08	0.19	0.06	-6.00	-	0.17	-	-0.04
20. Service Transportation and Communication	0.28	0.06	-0.08	0.15	0.06	-6.91	0.03	0.16	0.01	-0.04

Commodity C	Intermediate input to activity A (Simulation 4.2, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	0.40	-	0.18	-	0.04	-0.02	-	-	-	-0.01
2. Cassava, Beans and Nuts	-	-7.88	0.17	-	-	-0.02	-	-	-	-0.01
3. Vegetables, Sugarcane and Fruits	-	-	0.17	-	-	-0.02	-	-	-	-0.01
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.40	-7.88	0.17	0.01	0.04	-	0.24	0.02	-	-0.01
6. Livestock	-	-	-	-	-	-0.02	-	-	-	-0.01
7. Forestry	0.34	-9.76	0.24	-	0.13	-	0.24	-	-0.08	-
8. Fishery	-	-	-	-	-	-0.02	-	0.02	-	-0.01
9. Mining and Quarrying	-	-	0.45	-	0.11	-	-	-	-0.08	-0.01
10. Food Manufacturing	-	-	-	-	-	-0.02	-	0.02	-	-0.01
11. Textile Industry	0.41	-7.87	0.16	0.02	0.04	-	0.25	0.03	-0.08	-0.03
12. Paper Industries and Printing	-	-	0.18	-	0.03	-0.07	0.19	0.15	-0.08	-0.01
13. Rubber Chemical and Petroleum Industries	0.40	-7.88	0.17	0.01	0.04	-0.02	0.24	0.02	-0.08	-0.01
14. Non Metallic Products	0.38	-7.53	-	-	0.04	-	0.24	0.06	-0.09	-0.01
15. Metal Product and Machinery	0.41	-7.88	0.17	0.01	0.04	-0.02	0.24	0.02	-0.08	-0.01
16. Agricultural Machinery	0.40	-7.89	0.17	0.02	0.04	-	0.24	0.02	-	-
17. Other Manufacturing	0.61	-7.96	0.16	-	0.04	-	0.24	-	-0.08	-
18. Electricity, Water Work and Public Utilities	0.24	-7.29	0.18	-	0.04	-0.02	0.22	0.02	-0.08	-0.01
19. Construction and Trade	0.32	-7.98	0.17	-	-	-	0.31	0.04	-0.08	-
20. Service Transportation and Communication	0.40	-7.88	0.17	0.01	0.04	-0.02	0.24	0.02	-0.08	-0.01

Commodity C	Intermediate input to activity A (Simulation 4.2, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	-0.10	-	-	-	-0.06	-	-	-0.12
2. Cassava, Beans and Nuts	-		-0.09	-	-	-	-	-	-	-0.12
3. Vegetables, Sugarcane and Fruits	-		-0.11	-	-	-	-	-	-	-0.12
4. Rubber and Latex	-		-0.10	-	-	-	-	-	-	-
5. Other Crops	0.02	-0.01	-0.10	-	-	-	-0.12	-	-	-0.12
6. Livestock	0.02		-0.10	-	-	-	-0.07	-	-	-0.12
7. Forestry	-	-0.01	-0.10	-0.10	-0.05	-	-0.07	-	-	-0.12
8. Fishery	-		-0.10	-	-	-	-0.09	-	-	-0.12
9. Mining and Quarrying	0.07	-0.01	-0.10	-0.09	-0.05	-	-0.06	-0.10	-0.03	-0.13
10. Food Manufacturing	0.02	-	-0.10	-0.11	-0.07	-	-0.06	-	-	-0.12
11. Textile Industry	0.02	-	-0.10	-0.09	-0.05	-	-0.07	-0.08	-	-0.12
12. Paper Industries and Printing	0.02	-	-0.10	-0.09	-0.05	-2.41	-0.06	-0.10	-0.06	-0.12
13. Rubber Chemical and Petroleum Industries	0.02	-	-0.10	-0.09	-0.05	-2.62	-0.07	-0.10	-0.02	-0.12
14. Non Metallic Products	-	-	-0.10	-0.09	-0.05	-2.91	-0.06	-0.08	-0.02	-0.12
15. Metal Product and Machinery	0.02	-	-0.10	-0.09	-0.05	-2.62	-0.06	-0.10	-0.02	-0.12
16. Agricultural Machinery	-	-	-	-	-	-2.61	-	-	-	-0.12
17. Other Manufacturing	0.02	-	-0.10	-0.09	-0.05	-2.66	-0.06	-0.11	-0.04	-0.12
18. Electricity, Water Work and Public Utilities	0.02	-	-0.10	-0.09	-0.05	-2.62	-0.07	-0.10	-0.03	-0.12
19. Construction and Trade	-	-	-0.10	-0.05	-0.05	-2.00	-0.09	-0.09	-0.05	-0.12
20. Service Transportation and Communication	0.02	-	-0.10	-0.09	-0.05	-2.63	-0.07	-0.10	-0.03	-0.12

Commodity C	Intermediate input to activity A (Simulation 4.3, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	0.74	-	-5.99	-	0.15	0.03	-	-	-	0.17
2. Cassava, Beans and Nuts	-	1.23	-5.98	-	-	0.03	-	-	-	0.17
3. Vegetables, Sugarcane and Fruits	-	-	-5.99	-	-	0.03	-	-	-	0.17
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.74	1.23	-5.99	0.04	0.15	0.03	0.36	0.14	-	0.17
6. Livestock	-	-	-	-	-	0.03	-	-	-	0.17
7. Forestry	0.68	-	-5.96	-	0.27	0.07	0.36	-	-0.21	0.17
8. Fishery	-	-	-	-	-	0.03	-	0.15	-	0.17
9. Mining and Quarrying	-	-	-5.86	-	0.22	-	-	-	-0.21	0.17
10. Food Manufacturing	-	-	-6.01	-	0.56	0.03	-	0.15	-	0.17
11. Textile Industry	0.75	1.26	-6.00	0.04	0.16	-	0.36	0.15	-0.24	0.15
12. Paper Industries and Printing	-	-	-6.00	-	0.15	-	0.37	0.15	-0.22	0.17
13. Rubber Chemical and Petroleum Industries	0.74	1.23	-5.99	0.04	0.15	0.03	0.36	0.15	-0.21	0.17
14. Non Metallic Products	0.38	1.08	-6.03	0.02	0.16	0.28	0.36	0.18	-0.21	0.17
15. Metal Product and Machinery	0.74	1.23	-5.99	0.04	0.15	0.03	0.36	0.15	-0.21	0.17
16. Agricultural Machinery	0.74	1.24	-5.99	0.04	0.15	0.06	0.39	0.15	-0.28	0.41
17. Other Manufacturing	0.91	1.19	-6.00	-	0.16	0.04	0.36	0.22	-0.21	0.18
18. Electricity, Water Work and Public Utilities	0.73	1.04	-6.03	-	0.15	0.03	0.22	0.16	-0.21	0.17
19. Construction and Trade	0.81	1.23	-5.94	-	0.14	0.04	0.31	0.15	-0.21	0.19
20. Service Transportation and Communication	0.74	1.23	-5.99	0.04	0.15	0.03	0.36	0.15	-0.21	0.17

Commodity C	Intermediate input to activity A (Simulation 4.3, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	0.06	0.01	-	-	-	-	-	-	0.06
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-	0.06
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	0.06
4. Rubber and Latex	-	-	0.01	-	-	-	-	-	-	
5. Other Crops	0.13	0.05	0.01	-	-	-	-	0.23	-	0.06
6. Livestock	0.13	-	0.01	-	-	-	0.02	-	-	0.06
7. Forestry	-	0.05	0.01	-0.10	0.02	-	0.01	-	0.10	0.06
8. Fishery	-	-	0.01	-	-	-	-	-	-	0.06
9. Mining and Quarrying	0.15	0.05	0.01	-0.09	0.02	-	0.02	0.21	-	0.06
10. Food Manufacturing	0.14	0.06	0.01	-0.11	0.07	-	0.01	-	-	0.06
11. Textile Industry	0.13	0.07	0.01	-0.09	0.02	-	0.01	0.20	0.08	0.06
12. Paper Industries and Printing	0.13	0.06	0.01	-0.09	0.02	-3.48	0.02	0.21	-	0.06
13. Rubber Chemical and Petroleum Industries	0.13	0.06	0.01	-0.09	0.02	-3.66	0.01	0.21	0.02	0.06
14. Non Metallic Products	0.09	-	0.01	-0.09	0.02	-4.07	0.01	0.25	0.01	0.06
15. Metal Product and Machinery	0.13	0.06	0.01	-0.09	0.02	-3.65	0.01	0.21	0.01	0.06
16. Agricultural Machinery	-	-	-	-	-	-3.65	-	-	-	-
17. Other Manufacturing	0.13	0.06	0.01	-0.09	0.02	-3.68	0.01	0.20	-	0.06
18. Electricity, Water Work and Public Utilities	0.13	0.06	0.01	-0.09	0.02	-3.65	0.01	0.21	-	0.06
19. Construction and Trade	0.12	0.08	0.01	-0.10	0.02	-4.00	-	0.21	-	0.06
20. Service Transportation and Communication	0.13	0.06	0.01	-0.09	0.02	-3.66	0.01	0.21	0.01	0.06

Commodity C	Intermediate input to activity A (Simulation 4.4, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	0.06	-	0.04	-	-0.02	0.02	-	-	-	0.05
2. Cassava, Beans and Nuts	-	0.21	0.04	-	-	0.03	-	-	-	0.05
3. Vegetables, Sugarcane and Fruits	-	-	0.04	-	-	0.03	-	-	-	0.05
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.06	0.21	0.04	-5.37	-0.01	0.03	0.18	-0.05	-	0.05
6. Livestock	-	-	-	-	-	0.03	-	-	-	0.05
7. Forestry	-	-	0.08	-	-	0.07	0.18	-	0.27	0.06
8. Fishery	-	-	-	-	-	0.03	-	-0.03	-	0.05
9. Mining and Quarrying	-	-	0.45	-	-	-	-	-	0.27	0.04
10. Food Manufacturing	-	-	-	-5.56	-	0.03	-	-0.03	-	0.05
11. Textile Industry	0.07	0.22	0.04	-5.36	-0.01	-	0.19	-0.03	0.24	0.03
12. Paper Industries and Printing	-	-	0.04	-	-	-	0.19	-	0.26	0.05
13. Rubber Chemical and Petroleum Industries	0.06	0.21	0.04	-5.37	-0.01	0.03	0.18	-0.03	0.27	0.05
14. Non Metallic Products	-	-	-	-5.37	-0.01	0.28	0.18	-	0.26	0.05
15. Metal Product and Machinery	0.06	0.21	0.04	-5.37	-0.01	0.03	0.18	-0.03	0.27	0.05
16. Agricultural Machinery	0.05	0.21	0.04	-5.36	-0.01	0.06	0.20	-0.03	0.28	-
17. Other Manufacturing	0.30	0.24	0.04	-5.35	-0.01	0.04	0.19	-	0.27	0.07
18. Electricity, Water Work and Public Utilities	-	-	-	-	-0.01	0.03	0.22	-0.03	0.27	0.05
19. Construction and Trade	-	-	-	-5.63	-	0.04	0.15	-0.04	0.27	0.06
20. Service Transportation and Communication	0.06	0.21	0.04	-5.37	-0.01	0.03	0.18	-0.03	0.27	0.05

Commodity C	Intermediate input to activity A (Simulation 4.4, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	0.06	-	-	-	0.03	-	-	0.09
2. Cassava, Beans and Nuts	-	-	0.06	-	-	-		-	-	0.09
3. Vegetables, Sugarcane and Fruits	-	-	0.11	-	-	-		-	-	0.09
4. Rubber and Latex	-	-	0.05	-	-	-		-	-	-
5. Other Crops	0.14	-	0.05	-	-	-	-	0.23	-	0.09
6. Livestock	0.14	-	0.06	-	-	-	0.05	-	-	0.09
7. Forestry	-	-	0.06	0.05	0.02	-	0.05	-	0.10	0.09
8. Fishery	-	-	0.05	-	-	-	0.04	-	-	0.09
9. Mining and Quarrying	0.15	-	0.06	0.05	0.03	-	0.05	0.12	0.05	0.08
10. Food Manufacturing	0.14	-	0.06	0.05	0.07	-	0.05	-	-	0.09
11. Textile Industry	0.14	0.02	0.05	0.05	0.03	-	0.05	0.12	0.08	0.09
12. Paper Industries and Printing	0.14	-	0.06	0.05	0.03	-0.53	0.05	0.13	-	0.09
13. Rubber Chemical and Petroleum Industries	0.14	-	0.06	0.05	0.03	-0.62	0.05	0.12	0.04	0.09
14. Non Metallic Products	0.09	-	0.05	0.05	0.03	-0.58	0.05	0.16	0.04	0.09
15. Metal Product and Machinery	0.14	-	0.05	0.05	0.03	-0.62	0.05	0.12	0.04	0.09
16. Agricultural Machinery	-	-	-	-	-	-0.62	-	-	-	0.12
17. Other Manufacturing	0.14	0.02	0.05	0.05	0.03	-0.61	0.05	0.11	0.04	0.09
18. Electricity, Water Work and Public Utilities	0.14	-	0.06	0.05	0.03	-0.63	0.05	0.12	0.03	0.09
19. Construction and Trade	0.12	-	0.06	0.05	0.03	-	0.09	0.12	0.05	0.09
20. Service Transportation and Communication	0.14	-	0.06	0.05	0.03	-0.63	0.05	0.12	0.04	0.09

Commodity C	Intermediate input to activity A (Simulation 4.5, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	0.17	-	0.10	-	-4.53	-0.09	-	-	-	-0.76
2. Cassava, Beans and Nuts	-	0.26	0.08	-	-	-0.09	-	-	-	-0.76
3. Vegetables, Sugarcane and Fruits	-	-	0.08	-	-4.49	-0.09	-	-	-	-0.76
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.17	0.26	0.08	-0.08	-4.53	-0.09	-0.03	0.09	-	-0.76
6. Livestock	-	-	-	-	-	-0.09	-	-	-	-0.76
7. Forestry	-	-	0.16	-	-4.43	-0.07	-0.03	-	-0.34	-0.76
8. Fishery	-	-	-	-	-	-0.09	-	0.09	-	-0.76
9. Mining and Quarrying	-	-	0.45	-	-4.43	-0.14	-	-	-0.34	-0.76
10. Food Manufacturing	-	-	-	-	-4.52	-0.09	-	0.09	-	-0.76
11. Textile Industry	0.18	0.30	0.08	-0.07	-4.52	-	-0.02	0.09	-0.36	-0.76
12. Paper Industries and Printing	-	-	0.09	-	-4.54	-0.13	-	0.15	-0.35	-0.76
13. Rubber Chemical and Petroleum Industries	0.17	0.26	0.08	-0.08	-4.53	-0.09	-0.02	0.09	-0.34	-0.76
14. Non Metallic Products	-	1.08	-	-0.10	-4.53	-	-0.03	0.12	-0.34	-0.76
15. Metal Product and Machinery	0.17	0.27	0.08	-0.08	-4.53	-0.09	-0.03	0.09	-0.34	-0.76
16. Agricultural Machinery	0.17	0.27	0.08	-0.08	-4.53	-0.11	-	0.09	-0.28	-0.82
17. Other Manufacturing	0.30	0.24	0.08	-0.17	-4.52	-0.07	-0.02	0.11	-0.34	-0.76
18. Electricity, Water Work and Public Utilities	-	-	0.06	-	-4.52	-0.09	-	0.10	-0.34	-0.76
19. Construction and Trade	0.16	-	-	-	-4.61	-0.08	-	0.07	-0.34	-0.73
20. Service Transportation and Communication	0.17	0.26	0.08	-0.08	-4.53	-0.09	-0.03	0.09	-0.34	-0.76

Commodity C	Intermediate input to activity A (Simulation 4.5, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	-0.33	-	-	-	-0.09	-	-	-0.17
2. Cassava, Beans and Nuts	-	-	-0.34	-	-	-	-	-	-	-0.17
3. Vegetables, Sugarcane and Fruits	-	-	-0.34	-	-	-	-	-	-	-0.17
4. Rubber and Latex	-	-	-0.33	-	-	-	-	-	-	
5. Other Crops	0.01	0.01	-0.33	-	-	-	-0.12	0.46	-	-0.17
6. Livestock	0.02	-	-0.33	-	-	-	-0.07	-	-	-0.17
7. Forestry	-	-	-0.33	0.05	-	-	-0.07	-	0.10	-0.17
8. Fishery	-	-	-0.33	-	-	-	-0.09	-	-	-0.17
9. Mining and Quarrying	0.07	0.01	-0.33	0.05	0.01	-	-0.07	0.37	0.05	-0.17
10. Food Manufacturing	0.02	0.01	-0.33	0.05	-	-	-0.07	-	-	-0.17
11. Textile Industry	0.01	0.02	-0.33	0.04	0.01	-	-0.07	0.39	0.08	-0.17
12. Paper Industries and Printing	0.01	0.01	-0.33	0.05	0.01	6.68	-0.07	0.37	-	-0.17
13. Rubber Chemical and Petroleum Industries	0.01	0.01	-0.33	0.05	0.01	6.46	-0.07	0.37	0.04	-0.17
14. Non Metallic Products	-	-	-0.33	0.05	0.01	6.40	-0.07	0.41	0.04	-0.17
15. Metal Product and Machinery	0.01	0.01	-0.33	0.05	0.01	6.46	-0.07	0.37	0.04	-0.17
16. Agricultural Machinery	-	-	-	-	-	6.46	-	-	-	-0.24
17. Other Manufacturing	0.01	0.02	-0.33	0.04	0.01	6.44	-0.07	0.36	0.04	-0.17
18. Electricity, Water Work and Public Utilities	0.01	0.01	-0.33	0.05	0.01	6.45	-0.07	0.37	0.03	-0.17
19. Construction and Trade	-	-	-0.33	0.05	0.01	6.00	-0.09	0.37	0.05	-0.17
20. Service Transportation and Communication	0.01	0.01	-0.33	0.05	0.01	6.45	-0.07	0.37	0.04	-0.17

Commodity C	Intermediate input to activity A (Simulation 4.6, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	0.16	-	0.04	-	-0.02	-4.81	-	-	-	0.12
2. Cassava, Beans and Nuts	-	0.10	0.04	-	-	-4.80	-	-	-	0.12
3. Vegetables, Sugarcane and Fruits	-	-	0.03	-	-	-4.81	-	-	-	0.12
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.16	0.10	0.03	0.03	-0.02	-4.79	0.04	0.07	-	0.12
6. Livestock	-	-	-	-	-	-4.81	-	-	-	0.12
7. Forestry	-	-	0.08	-	-	-4.83	0.04	-	0.05	0.11
8. Fishery	-	-	-	-	-	-4.81	-	0.07	-	0.12
9. Mining and Quarrying	-	-	0.45	-	-	-4.82	-	-	0.05	0.11
10. Food Manufacturing	-	-	-	-	-	-4.81	-	0.07	-	0.12
11. Textile Industry	0.16	0.07	-	0.04	-0.01	-4.65	0.04	0.06	0.04	0.09
12. Paper Industries and Printing	-	-	0.04	-	-0.03	-4.84	-	0.15	0.05	0.12
13. Rubber Chemical and Petroleum Industries	0.16	0.10	0.03	0.03	-0.02	-4.81	0.04	0.07	0.05	0.12
14. Non Metallic Products	-	-	-	0.02	-0.01	-4.56	0.04	0.06	0.04	0.12
15. Metal Product and Machinery	0.16	0.11	0.03	0.03	-0.02	-4.81	0.04	0.07	0.05	0.12
16. Agricultural Machinery	0.16	0.09	0.03	0.04	-0.02	-4.79	0.05	0.07	-	-
17. Other Manufacturing	0.30	0.12	0.02	-	-0.02	-4.80	0.05	0.11	0.05	0.11
18. Electricity, Water Work and Public Utilities	-	-	-	-	-0.01	-4.80	-	0.06	0.05	0.12
19. Construction and Trade	0.16	-	-	-	-0.14	-4.79	-	0.07	0.05	0.13
20. Service Transportation and Communication	0.16	0.10	0.03	0.03	-0.02	-4.81	0.04	0.07	0.05	0.12

Commodity C	Intermediate input to activity A (Simulation 4.6, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	0.03	0.04	-	-	-	0.06	-	-	0.07
2. Cassava, Beans and Nuts	-	-	0.03	-	-	-	-	-	-	0.07
3. Vegetables, Sugarcane and Fruits	-	-	0.11	-	-	-	-	-	-	0.07
4. Rubber and Latex	-	-	0.04	-	-	-	-	-		-
5. Other Crops	0.09	0.01	0.04	-	-	-	-	0.23	-	0.07
6. Livestock	0.09	-	0.04	-	-	-	0.06	-	-	0.07
7. Forestry	-	0.01	0.04	0.05	0.05	-	0.06	-	0.10	0.07
8. Fishery	-	-	0.04	-	-	-	0.04	-	-	0.07
9. Mining and Quarrying	0.15	0.01	0.04	0.05	0.05	-	0.06	0.12	0.03	0.07
10. Food Manufacturing	0.10	0.02	0.04	0.05	0.07	-	0.06		-	0.07
11. Textile Industry	0.09	0.02	0.04	0.05	0.05	-	0.06	0.12	0.08	0.07
12. Paper Industries and Printing	0.09	0.01	0.04	0.06	0.05	-	0.06	0.12	-	0.07
13. Rubber Chemical and Petroleum Industries	0.09	0.01	0.04	0.05	0.05	-	0.06	0.12	0.04	0.07
14. Non Metallic Products	0.09	-	0.04	0.05	0.05	-	0.06	0.16	0.03	0.07
15. Metal Product and Machinery	0.09	0.01	0.04	0.05	0.05	-0.01	0.06	0.12	0.03	0.07
16. Agricultural Machinery	-	-	-	-	-	-0.01	-	-	-	0.12
17. Other Manufacturing	0.09	0.02	0.04	0.05	0.05	-	0.06	0.11	0.04	0.07
18. Electricity, Water Work and Public Utilities	0.09	0.01	0.04	0.05	0.05	-0.02	0.06	0.12	0.03	0.07
19. Construction and Trade	0.08	0.08	0.04	0.10	0.05	-	0.09	0.12	0.05	0.07
20. Service Transportation and Communication	0.09	0.01	0.04	0.05	0.05	-0.02	0.06	0.12	0.03	0.07

Commodity C	Intermediate input to activity A (Simulation 4.7, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	0.07	-	0.04	-	0.01	-	-	-	-	-
2. Cassava, Beans and Nuts	-	0.14	0.03	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	-	-	0.03	-	-	-	-	-	-	-
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.07	0.14	0.03	0.02	0.01	-	-8.52	-	-	-
6. Livestock	-	-	-	-	-	-	-	-	-	-
7. Forestry	-	-	0.08	-	0.13	-	-8.52	-	0.03	-
8. Fishery	-	-	-	-	-	-	-	-	-	-
9. Mining and Quarrying	-	-	0.45	-	0.11	-	-	-	0.02	-
10. Food Manufacturing	-	-	-	-	-	-	-11.11	-	-	-
11. Textile Industry	0.07	0.15	-	0.02	0.01	-	-8.52	-	-	-
12. Paper Industries and Printing	-	-	0.04	-	0.03	-	-8.57	-	0.02	-
13. Rubber Chemical and Petroleum Industries	0.07	0.14	0.03	0.02	0.01	-	-8.52	-	0.02	-
14. Non Metallic Products	-	-	-	-	0.02	-	-8.53	-	-	0.01
15. Metal Product and Machinery	0.07	0.14	0.03	0.02	0.01	-	-8.52	0.01	0.02	-
16. Agricultural Machinery	0.07	0.15	0.03	0.02	0.01	-	-8.50	0.01	-	-
17. Other Manufacturing	0.30	0.12	0.02	-	0.02	-	-8.52	-	0.03	0.02
18. Electricity, Water Work and Public Utilities	-	-	-	-	0.02	-	-8.46	-	0.02	0.01
19. Construction and Trade	-	-	-	-	-	-	-8.59	-	0.02	0.03
20. Service Transportation and Communication	0.07	0.14	0.03	0.02	0.02	-0.01	-8.52	-	0.02	-

Commodity C	Intermediate input to activity A (Simulation 4.7, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	-	-	-	-	0.03	-	-	0.02
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-	0.02
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	0.02
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	0.03	-	-	-	-	-	-	-	-	0.02
6. Livestock	0.02	-	-	-	-	-	0.03	-	-	0.02
7. Forestry	-	-	-	0.04	-	-	0.03	-	-	0.02
8. Fishery	-	-	-	-	-	-	0.04	-	-	0.02
9. Mining and Quarrying	0.07	-	-	0.04	0.01	-	0.03	-0.02	-	0.03
10. Food Manufacturing	0.04	-	-	0.03	-	-	0.03	-	-	0.02
11. Textile Industry	0.03	0.02	-	0.04	0.01	-	0.03	-	-	0.02
12. Paper Industries and Printing	0.03	-	-	0.04	0.01	-0.27	0.03	-0.01	-	0.02
13. Rubber Chemical and Petroleum Industries	0.03	-	-	0.04	0.01	-0.46	0.03	-0.02	-	0.02
14. Non Metallic Products	-	-	-	0.04	0.01	-0.58	0.03	-	0.01	0.02
15. Metal Product and Machinery	0.03	-	-	0.04	0.01	-0.46	0.03	-0.02	0.01	0.02
16. Agricultural Machinery	-	-	-	-	-	-0.46	-	-	-	-
17. Other Manufacturing	0.03	0.02	-	0.04	0.01	-0.51	0.03	-0.02	-	0.02
18. Electricity, Water Work and Public Utilities	0.03	-	-	0.04	0.01	-0.48	0.03	-0.02	-	0.02
19. Construction and Trade	-	-	-	0.05	0.01	-	-	-0.02	-	0.02
20. Service Transportation and Communication	0.03	-	-	0.04	0.01	-0.48	0.03	-0.02	-	0.02

Commodity C	Intermediate input to activity A (Simulation 4.8, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	-0.03	-	-	-	-0.01	-0.01	-	-	-	-
2. Cassava, Beans and Nuts	-	-0.01	-	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-0.01	-	-	-	-
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	-0.03	-0.01	-0.01	0.01	-	-	0.02	0.63	-	-
6. Livestock	-	-	-	-	-	-0.01	-	-	-	-
7. Forestry	-	-	-	-	-	-	0.02	0.65	0.03	-
8. Fishery	-	-	-	-	-	-0.01	-	0.63	-	-
9. Mining and Quarrying	-	-	-	-	-	-	-	0.58	0.02	-0.01
10. Food Manufacturing	-	-	-	-	-	-0.01	-	0.63	-	-
11. Textile Industry	-0.02	-	-0.04	0.02	-	-	0.02	0.63	-	-0.03
12. Paper Industries and Printing	-	-	-		-	-0.07	-	0.74	0.02	-
13. Rubber Chemical and Petroleum Industries	-0.03	-0.01	-0.01	0.01	-	-0.01	0.01	0.63	0.02	-
14. Non Metallic Products	-0.38	-	-	-	-	-	0.01	0.61	-	-0.01
15. Metal Product and Machinery	-0.03	-0.01	-0.01	0.01	-	-0.01	0.02	0.63	0.02	-
16. Agricultural Machinery	-0.03	-	-0.01	-	-	-	0.05	0.62	-	-
17. Other Manufacturing	-	-	-0.01	-	-	-	0.02	0.65	0.03	-
18. Electricity, Water Work and Public Utilities	-	-	-	-	-	-0.01	-	0.62	0.02	-
19. Construction and Trade	-	-	-	-	-	-	-	0.63	0.02	-
20. Service Transportation and Communication	-0.03	-0.01	-0.01	0.01	-	-0.01	0.01	0.63	0.02	-

Commodity C	Intermediate input to activity A (Simulation 4.8, (%∆))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	-	0.005	-	-	-	-	-	-	0.006
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-	0.006
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	0.008
4. Rubber and Latex	-	-	0.007	-	-	-	-	-	-	-
5. Other Crops	0.006	-0.008	0.008	-	-	-	-	-	-	0.005
6. Livestock	0.008	-	0.009	-	-	-	-	-	-	0.010
7. Forestry	-	-0.010	0.006	0.024	-	-	-	-	-	0.007
8. Fishery	-	-	0.009	-	-	-	-	-	-	0.008
9. Mining and Quarrying	-	-	0.008	0.023	0.001	-	-	-0.001	-	-
10. Food Manufacturing	0.020	-	0.008	0.015	-	-	-	-	-	0.008
11. Textile Industry	0.006	-	0.007	0.021	0.002	-	-0.001	-	-	0.008
12. Paper Industries and Printing	0.007	-0.001	0.008	0.025	0.001	0.267	-	-	-	0.008
13. Rubber Chemical and Petroleum Industries	0.006	-0.001	0.008	0.023	0.001	0.104	-0.001	-0.001	-	0.008
14. Non Metallic Products	-	-	0.009	0.023	0.001	-	-	-	-	0.007
15. Metal Product and Machinery	0.006	-	0.008	0.023	0.001	0.114	-0.001	-0.002	-	0.008
16. Agricultural Machinery	-	-	-	-	-	0.116	-	-	-	-
17. Other Manufacturing	0.007	-	0.005	0.022	0.002	0.102	-	-	-	0.008
18. Electricity, Water Work and Public Utilities	0.006	-	0.007	0.024	0.001	0.119	-	-0.001	-	0.008
19. Construction and Trade	-	-	0.009	0.048	-	-	-	-	-	0.009
20. Service Transportation and Communication	0.006	-0.002	0.008	0.023	0.002	0.108	-	-0.001	-	0.008

Commodity C	Intermediate input to activity A (Simulation 4.9, (%Δ))									
	ACT01	ACT02	ACT03	ACT04	ACT05	ACT06	ACT07	ACT08	ACT09	ACT10
1. Paddy and Maize	-5.899	-	-5.182	-	-4.128	-4.690	-	-	-	-0.341
2. Cassava, Beans and Nuts	-	-4.035	-5.193	-	-	-4.695	-	-	-	-0.341
3. Vegetables, Sugarcane and Fruits	-	-	-5.188	-	-4.120	-4.685	-	-	-	-0.341
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-
5. Other Crops	-5.899	-4.035	-5.191	-5.339	-4.121	-4.668	-7.189	1.300	-	-0.341
6. Livestock	-	-	-	-	-	-4.689	-	-	-	-0.341
7. Forestry	-6.122	-4.878	-5.143	-	-4.027	-4.684	-7.186	1.299	-0.404	-0.341
8. Fishery	-	-	-	-	-	-4.687	-	1.298	-	-0.341
9. Mining and Quarrying	-	-	-4.955	-	-4.108	-4.681	-	1.153	-0.407	-0.344
10. Food Manufacturing	-	-	-5.222	-5.556	-3.955	-4.688	-7.407	1.298	-	-0.341
11. Textile Industry	-5.904	-4.009	-5.211	-5.339	-4.122	-4.646	-7.177	1.295	-0.399	-0.366
12. Paper Industries and Printing	-	-	-5.203	-	-4.132	-4.708	-7.076	1.325	-0.412	-0.340
13. Rubber Chemical and Petroleum Industries	-5.899	-4.036	-5.191	-5.338	-4.122	-4.689	-7.188	1.297	-0.407	-0.341
14. Non Metallic Products	-6.107	-3.226	-5.172	-5.352	-4.122	-4.558	-7.190	1.282	-0.426	-0.339
15. Metal Product and Machinery	-5.899	-4.031	-5.191	-5.339	-4.122	-4.686	-7.188	1.297	-0.407	-0.341
16. Agricultural Machinery	-5.902	-4.048	-5.194	-5.343	-4.123	-4.672	-7.185	1.295	-0.285	-0.408
17. Other Manufacturing	-5.775	-4.038	-5.195	-5.354	-4.121	-4.693	-7.184	1.304	-0.406	-0.322
18. Electricity, Water Work and Public Utilities	-6.083	-4.167	-5.197	-	-4.124	-4.686	-7.158	1.306	-0.407	-0.339
19. Construction and Trade	-5.825	-4.294	-5.281	-5.625	-4.201	-4.663	-7.209	1.291	-0.409	-0.318
20. Service Transportation and Communication	-5.900	-4.033	-5.192	-5.338	-4.121	-4.691	-7.190	1.297	-0.407	-0.341

Commodity C	Intermediate input to activity A (Simulation 4.9, (%Δ))									
	ACT11	ACT12	ACT13	ACT14	ACT15	ACT16	ACT17	ACT18	ACT19	ACT20
1. Paddy and Maize	-	0.143	-0.420	-	-	-	0.093	-	-	-0.057
2. Cassava, Beans and Nuts	-	-	-0.432	-	-	-		-	-	-0.056
3. Vegetables, Sugarcane and Fruits	-	-	-0.335	-	-	-		-	-	-0.056
4. Rubber and Latex	-	-	-0.418	-	-	-		-	-	-
5. Other Crops	0.761	0.146	-0.418	-	-	-	0.118	0.926	0.109	-0.056
6. Livestock	0.759	-	-0.417	-	-	-	0.094	-	-	-0.053
7. Forestry	0.709	0.137	-0.418	0.155	0.143	-	0.092	-	0.197	-0.057
8. Fishery	-	-	-0.418	0.481	-	-	0.086	-	-	-0.055
9. Mining and Quarrying	0.820	0.141	-0.418	0.153	0.153	-	0.091	0.976	0.125	-0.056
10. Food Manufacturing	0.759	0.148	-0.418	0.150	0.197	-	0.093	-	0.117	-0.056
11. Textile Industry	0.761	0.149	-0.418	0.157	0.154	-	0.092	0.977	0.153	-0.056
12. Paper Industries and Printing	0.762	0.146	-0.418	0.153	0.154	-8.556	0.092	0.982	0.130	-0.056
13. Rubber Chemical and Petroleum Industries	0.761	0.146	-0.418	0.153	0.153	-8.745	0.092	0.976	0.124	-0.056
14. Non Metallic Products	0.730	-	-0.418	0.153	0.153	-8.721	0.093	0.983	0.123	-0.054
15. Metal Product and Machinery	0.762	0.147	-0.418	0.154	0.153	-8.733	0.092	0.976	0.123	-0.056
16. Agricultural Machinery	-	-	-	-	-	-8.731	-	-	-	-0.119
17. Other Manufacturing	0.761	0.149	-0.419	0.154	0.153	-8.793	0.092	0.962	0.122	-0.055
18. Electricity, Water Work and Public Utilities	0.761	0.147	-0.418	0.154	0.154	-8.728	0.093	0.976	0.127	-0.056
19. Construction and Trade	0.763	0.151	-0.416	0.193	0.152	-8.000	0.085	0.975	0.100	-0.055
20. Service Transportation and Communication	0.761	0.146	-0.418	0.154	0.154	-8.738	0.092	0.976	0.120	-0.056

Source: Model Simulations 4 and 4.1 – 4.9

Note: 1/ base year values equal to as in Appendix P.5

S.7 Percentage change of quantity of investment demand for commodity c ($QINV_c$) from results of Simulations 4 and 4.1 – 4.9 compared with base year

Sectors	Base[1/] year	SIM 4 (%Δ)	SIM 4.1 (%Δ)	SIM 4.2 (%Δ)	SIM 4.3 (%Δ)	SIM 4.4 (%Δ)	SIM 4.5 (%Δ)	SIM 4.6 (%Δ)	SIM 4.7 (%Δ)	SIM 4.8 (%Δ)	SIM 4.9 (%Δ)
1. Paddy and Maize	-	-	-	-	-	-	-	-	-	-	-
2. Cassava, Beans and Nuts	-	-	-	-	-	-	-	-	-	-	-
3. Vegetables, Sugarcane and Fruits	-	-	-	-	-	-	-	-	-	-	-
4. Rubber and Latex	-	-	-	-	-	-	-	-	-	-	-
5. Other Crops	-	-	-	-	-	-	-	-	-	-	-
6. Livestock	834.90	1.07	1.11	0.98	1.09	1.16	0.99	1.14	1.09	1.09	1.10
7. Forestry	-	-	-	-	-	-	-	-	-	-	-
8. Fishery	-	-	-	-	-	-	-	-	-	-	-
9. Mining and Quarrying	73.70	-	0.14	-	-	0.14	-	0.14	-	-	-
10. Food Manufacturing	-	-	-	-	-	-	-	-	-	-	-
11. Textile Industry	1,000.00	-0.02	0.03	-0.10	0.01	0.07	-0.09	0.06	-	0.01	0.01
12. Paper Industries and Printing	-	-	-	-	-	-	-	-	-	-	-
13. Rubber Chemical and Petroleum Industries	2,999.80	-0.02	0.03	-0.09	0.02	0.08	-0.09	0.07	0.01	0.01	0.02
14. Non Metallic Products	3,815.00	-0.02	0.03	-0.09	0.02	0.08	-0.09	0.07	0.01	0.01	0.02
15. Metal Product and Machinery	446,988.10	-0.02	0.03	-0.09	0.02	0.08	-0.09	0.06	0.01	0.01	0.02
16. Agricultural Machinery	4,822.60	-0.02	0.03	-0.09	0.02	0.08	-0.09	0.06	0.01	0.01	0.02
17. Other Manufacturing	65,564.50	-0.02	0.03	-0.09	0.02	0.08	-0.09	0.06	0.01	0.01	0.02
18. Electricity, Water Work and Public Utilities	-	-	-	-	-	-	-	-	-	-	-
19. Construction and Trade	598,576.10	-0.02	0.03	-0.09	0.02	0.08	-0.09	0.06	0.01	0.01	0.02
20. Service Transportation and communication	864.30	-0.01	0.03	-0.09	0.02	0.08	-0.08	0.07	0.01	0.01	0.02

Source: Model Simulations 4 and 4.1 – 4.9

Note: 1/ Million baht

S.8 Percentage change on other economic variables in the model from results of Simulations 4 and 4.1 – 4.9 compared with base year

Sectors	Base year	SIM 4 (%Δ)	SIM 4.1 (%Δ)	SIM 4.2 (%Δ)	SIM 4.3 (%Δ)	SIM 4.4 (%Δ)	SIM 4.5 (%Δ)	SIM 4.6 (%Δ)	SIM 4.7 (%Δ)	SIM 4.8 (%Δ)	SIM 4.9 (%Δ)
1. Average price of											
1.1 Labour	5.3	-	-	-	-	-	-	-	-	-	-1.89
1.2 Capital	14.9	-	-	-	-	-	-	-	-	-	-
2. supply of factor f (											
2.1 Labour[2/]	30,444,700	-	-	-	-	-	-	-	-	-	-
2.2 Capital[1/]	16,661,940	0.31	0.06	0.01	0.08	0.03	0.03	0.04	0.004	0.05	0.31
3. Government	627,868.80	-0.18	-0.23	0.01	0.11	-0.03	0.005	-0.05	-0.02	-0.005	-0.19
4. Enterprise Saving (	332,604.00	-0.61	-0.13	-0.10	-0.03	-0.03	-0.19	-0.05	0.02	0.04	-0.58
5. Foreign savings (	264,045.50	-	-	-	-	-	-	-	-	-	-
6. Foreign exchange rate	1.00	-0.30	-0.10	-	-0.10	-	-0.10	-	-	-	-0.30
7. Dummy variable (*WALRAS*) (Zero at equilibrium)[3/]	1.867051E-9	1.935588E-9	1.935588E-9	2.702095E-9	-2.07919E-9	1.093926E-7	-1.85574E-9	3.273192E-8	-2.66082E-8	7.426365E-9	1.177256E-9

Source: Model Simulations 4 and 4.1 – 4.9

Note: 1/ Million baht

2/ Persons

3/ Actual values

Appendix T

Main results of Simulations 1 – 4

T.1 The summary of percentage changes from base year of the main policy simulations of share parameter of factor input (α_{fa}) in the production functions

Sector	SIM 1 (%Δ)		SIM 2 (%Δ)		SIM 3 (%Δ)		SIM 4 (%Δ)	
	Lab[1/]	Cap[2/]	Lab[1/]	Cap[2/]	Lab[1/]	Cap[2/]	Lab[1/]	Cap[2/]
1. Paddy and Maize	-7.87	4.85	-	-	-	-	-7.87	4.85
2. Cassava, Beans and Nuts	-9.07	4.95	-	-	-	-	-9.07	4.95
3. Vegetables, Sugarcane and Fruits	-15.32	5.05	-	-	-	-	-15.32	5.05
4. Rubber and Latex	-17.97	4.98	-	-	-	-	-17.97	4.98
5. Other Crops	-17.11	5.05	-	-	-	-	-17.11	5.05
6. Livestock	-21.13	5.09	-	-	-	-	-21.13	5.09
7. Forestry	-8.72	5.06	-	-	-	-	-8.72	5.06
8. Fishery	-13.53	4.90	-	-	-	-	-13.53	4.90
9. Mining and Quarrying	-	-	-	-	-	-	-	-
10. Food Manufacturing	-	-	-	-	-	-	-	-
11. Textile Industry	-	-	-	-	-	-	-	-
12. Paper Industries and	-	-	-	-	-	-	-	-
13. Rubber Chemical and	-	-	-	-	-	-	-	-
14. Non Metallic Products	-	-	-	-	-	-	-	-
15. Metal Product and Machinery	-	-	-	-	-	-	-	-
16. Agricultural Machinery	-	-	-	-	-	-	-	-
17. Other Manufacturing	-	-	-	-	-	-	-	-
18. Electricity, Water Work and Public Utilities	-	-	-	-	-	-	-	-
19. Construction and Trade	-	-	-	-	-	-	-	-
20. Service Transportation and Communication	-	-	-	-	-	-	-	-

Source: Model Simulations 1 – 4

Note: 1/ = Labour,
2/ = Capital

T.2 The summary of percentage changes from base year of the main policy simulations on demand for input factor (QF)

Sector	SIM 1 (%Δ)		SIM 2 (%Δ)		SIM 3 (%Δ)		SIM 4 (%Δ)	
	Lab[1/]	Cap[2/]	Lab[1/]	Cap[2/]	Lab[1/]	Cap[2/]	Lab[1/]	Cap[2/]
1. Paddy and Maize	1.51	-	-1.83	5.00	0.05	-	0.25	5.00
2. Cassava, Beans and Nuts	10.11	-	-5.27	5.00	0.12	-	6.24	5.00
3. Vegetables, Sugarcane and Fruits	-2.42	-	1.14	5.00	0.11	-	-0.94	5.00
4. Rubber and Latex	-8.87	-	4.61	5.00	0.04	-	-4.62	5.00
5. Other Crops	5.66	-	-2.22	5.00	0.30	-	3.57	5.00
6. Livestock	-7.58	-	4.18	5.00	-0.04	-	-3.82	5.00
7. Forestry	-6.09	-	1.91	5.00	0.22	-	-3.83	5.00
8. Fishery	0.90	-	2.76	5.00	0.10	-	3.63	5.00
9. Mining and Quarrying	-2.39	-	1.28	-	-0.03	-	-1.19	-
10. Food Manufacturing	-1.73	-	0.62	-	0.02	-	-0.97	-
11. Textile Industry	2.91	-	-0.98	-	-0.06	-	1.74	-
12. Paper Industries and	1.44	-	-0.53	-	-0.04	-	0.77	-
13. Rubber Chemical and	-2.07	-	0.88	-	-0.01	-	-1.24	-
14. Non Metallic Products	0.55	-	0.30	-	-0.14	-	0.29	-
15. Metal Product and Machinery	0.80	-	-0.22	-	-0.10	-	0.32	-
16. Agricultural Machinery	-	-	10.03	-	2.11	-	-	-
17. Other Manufacturing	0.46	-	-0.10	-	-0.05	-	0.20	-
18. Electricity, Water Work and Public Utilities	3.38	-	-1.12	-	-0.17	-	1.69	-
19. Construction and Trade	1.07	-	-0.34	-	-0.06	-	0.51	-
20. Service Transportation and Communication	-0.11	-	0.15	-	-0.05	-	-0.14	-

Source: Model Simulations 1 – 4

Note: 1/ = Labour,

2/ = Capital

T.3 The summary of percentage changes from base year of the main policy simulations on the capital-labour ratio (K/L)

Sector	SIM 1 (%Δ)	SIM 2 (%Δ)	SIM 3 (%Δ)	SIM 4 (%Δ)
1. Paddy and Maize	-1.49	6.95	-0.05	4.74
2. Cassava, Beans and Nuts	-9.19	10.84	-0.12	-1.17
3. Vegetables, Sugarcane and Fruits	2.48	3.82	-0.11	5.99
4. Rubber and Latex	9.73	0.37	-0.04	10.08
5. Other Crops	-5.36	7.39	-0.30	1.38
6. Livestock	8.21	0.79	0.04	9.18
7. Forestry	6.48	3.03	-0.22	9.18
8. Fishery	-0.90	2.17	-0.10	1.32
9. Mining and Quarrying	2.45	-1.27	0.03	1.21
10. Food Manufacturing	1.76	-0.61	-0.02	0.98
11. Textile Industry	-2.82	0.99	0.06	-1.71
12. Paper Industries and Printing	-1.42	0.53	0.04	-0.76
13. Rubber Chemical and Petroleum Industries	2.11	-0.87	0.01	1.26
14. Non Metallic Products	-0.54	-0.30	0.14	-0.29
15. Metal Product and Machinery	-0.80	0.22	0.10	-0.32
16. Agricultural Machinery	25.90	-9.12	-2.06	16.02
17. Other Manufacturing	-0.46	0.10	0.05	-0.20
18. Electricity, Water Work and Public Utilities	-3.27	1.13	0.17	-1.67
19. Construction and Trade	-1.06	0.34	0.06	-0.50
20. Service Transportation and Communication	0.11	-0.15	0.05	0.14

Source: Model Simulations 1 – 4

T.4 The summary of percentage changes from base year of the main policy simulations on activity (QA), quantity of domestic output (QX), quantity of export (QE), output c sold domestically (QD), quantity of import (QM) and composite commodity (QQ)

Sector	Simulation 1 (%Δ)						Simulation 2 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	-8.41	-3.30	-8.46	-2.65	4.14	-2.60	2.34	1.28	3.51	0.98	-1.71	0.96
2. Cassava, Beans and Nuts	-6.06	-4.48	-6.42	-3.87	1.45	-2.57	1.25	1.62	2.45	1.36	-0.79	0.83
3. Vegetables, Sugarcane and Fruits	-9.05	-2.53	-2.76	-2.51	1.66	-2.35	4.03	1.12	1.22	1.11	-0.58	1.05
4. Rubber and Latex	-9.79	-0.98	-3.42	-0.71	2.38	-0.71	4.92	0.45	1.55	0.30	-0.99	0.30
5. Other Crops	-7.45	-1.48	-0.09	-1.69	-12.13	-3.91	3.31	0.66	0.18	0.73	4.64	1.49
6. Livestock	-9.10	-1.40	-1.51	-1.39	-0.41	-1.37	4.84	0.69	0.75	0.68	0.22	0.67
7. Forestry	-10.80	-2.40	-2.57	-2.36	-1.57	-2.13	3.86	0.95	1.02	0.94	0.63	0.84
8. Fishery	-3.02	-0.65	6.67	-0.75	-0.65	-0.75	4.40	0.42	7.80	0.32	0.81	0.32
9. Mining and Quarrying	-0.84	-0.18	0.07	-0.20	-0.50	-0.28	0.45	0.12	0.03	0.13	0.24	0.16
10. Food Manufacturing	-0.60	-3.84	-4.03	-3.74	1.15	-2.73	0.21	1.85	1.92	1.80	-0.15	1.39
11. Textile Industry	1.23	0.54	0.57	0.53	-0.10	0.40	-0.42	-0.14	-0.16	-0.14	0.14	-0.08
12. Paper Industries and Printing	0.26	0.02	0.01	0.02	0.11	0.04	-0.10	0.01	0.01	0.01	0.02	0.01
13. Rubber Chemical and Petroleum Industries	-0.71	-0.96	-0.89	-0.98	-1.66	-1.18	0.30	0.50	0.48	0.51	0.82	0.61
14. Non Metallic Products	0.19	-0.07	-0.04	-0.10	-0.43	-0.17	0.10	0.10	0.09	0.12	0.29	0.15
15. Metal Product and Machinery	0.30	0.24	0.26	0.22	-0.18	-0.01	-0.08	-0.06	-0.07	-0.05	0.15	0.06
16. Agricultural Machinery	-11.61	-3.04	-3.16	-3.03	-9.35	-5.97	5.26	1.42	0.03	1.46	4.39	2.77
17. Other Manufacturing	0.17	-0.21	-0.21	-0.21	-0.21	-0.21	-0.04	0.11	0.11	0.12	0.17	0.14
18. Electricity, Water Work and Public Utilities	1.78	0.32	0.24	0.32	0.26	0.32	-0.60	-0.04	-0.11	-0.03	-0.04	-0.03
19. Construction and Trade	0.23	0.07	0.12	0.07	-0.04	0.07	-0.07	0.04	-0.09	0.04	0.09	0.04
20. Service Transportation and Communication	-0.07	-0.53	-0.55	-0.52	-0.32	-0.50	0.09	0.32	0.33	0.31	0.17	0.30

Sector	Simulation 3 (%Δ)						Simulation 4 (%Δ)					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*	*QA*	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	0.02	0.02	0.07	0.01	-0.04	0.01	-5.88	-2.02	-5.00	-1.63	2.20	-1.60
2. Cassava, Beans and Nuts	0.04	0.04	0.07	0.03	-0.03	0.02	-4.00	-2.66	-3.76	-2.31	0.67	-1.57
3. Vegetables, Sugarcane and Fruits	0.03	0.02	0.03	0.02	-0.04	0.02	-5.17	-1.45	-1.58	-1.44	0.95	-1.35
4. Rubber and Latex	0.01	-	0.06	-	-	-	-5.33	-0.58	-1.88	-0.43	1.19	-0.42
5. Other Crops	0.07	0.03	0.03	0.03	-	0.02	-4.08	-0.89	-	-1.02	-7.85	-2.44
6. Livestock	-0.01	-	0.01	-	-	-	-4.69	-0.71	-0.77	-0.71	-0.25	-0.70
7. Forestry	0.08	0.01	0.01	0.01	-	-	-7.13	-1.54	-1.65	-1.51	-1.02	-1.37
8. Fishery	0.03	-	7.36	-0.10	0.18	-0.10	1.32	-0.26	7.09	-0.36	-0.15	-0.36
9. Mining and Quarrying	-0.01	-0.02	-0.03	-0.02	-0.01	-0.02	-0.42	-0.14	-0.01	-0.15	-0.30	-0.19
10. Food Manufacturing	0.01	0.01	0.01	0.01	-0.02	-	-0.34	-2.01	-2.12	-1.95	0.81	-1.38
11. Textile Industry	-0.02	-0.02	-0.02	-0.02	-0.01	-0.02	0.74	0.32	0.34	0.31	-0.03	0.24
12. Paper Industries and Printing	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.14	-0.01	-0.02	-0.01	0.08	0.01
13. Rubber Chemical and Petroleum Industries	-	-0.01	-0.01	-0.01	-	-0.01	-0.42	-0.52	-0.49	-0.53	-0.88	-0.63
14. Non Metallic Products	-0.05	-0.03	-0.03	-0.03	-0.03	-0.03	0.10	-0.06	-0.05	-0.08	-0.27	-0.12
15. Metal Product and Machinery	-0.04	-0.03	-0.03	-0.03	-0.02	-0.03	0.12	0.09	0.10	0.08	-0.13	-0.04
16. Agricultural Machinery	1.12	0.29	-0.31	0.31	0.17	0.24	-7.65	-2.05	-2.25	-2.05	-5.06	-3.43
17. Other Manufacturing	-0.02	-0.02	-0.02	-0.02	-0.01	-0.02	0.08	-0.16	-0.17	-0.16	-0.12	-0.14
18. Electricity, Water Work and Public Utilities	-0.09	-0.04	-0.12	-0.04	-0.02	-0.04	0.90	0.15	0.07	0.15	0.12	0.15
19. Construction and Trade	-0.01	-0.03	-0.10	-0.03	-0.04	-0.03	0.11	-	-0.01	-	-0.04	-
20. Service Transportation and Communication	-0.03	-0.02	-0.02	-0.02	-	-0.01	-0.08	-0.28	-0.29	-0.28	-0.18	-0.26

Source: Model Simulations 1 – 4

T.5 The summary of percentage changes from base year of the main policy simulations on factor income (YF), enterprise income ($YENT$), household income (YH), and government income (YG)

Variables	Simulation 1 (%Δ)	Simulation 2 (%Δ)	Simulation 3 (%Δ)	Simulation 4 (%Δ)
Factor income (YF)				
Labour (L)	-0.84	0.41	-0.02	-0.48
Capital (K)	-0.82	0.43	-0.10	-0.44
Enterprise income ($YENT$)	-0.79	0.41	-0.01	-0.42
Household income (YH)	-0.82	0.41	-0.02	-0.45
Government income (YG)	-0.69	0.34	-0.07	-0.45

Source: Model Simulations 1 – 4

T.6 The summary of percentage changes from base year of the main policy simulations on price of activity (PA), producer price (PX), export price (PE), domestic price (PD), import price (PM), composite commodity price (PQ) and value added price (PVA)

Sector	Simulation 1 (%Δ)							Simulation 2 (%Δ)						
	PA	PX	PE	PD	PM	PQ	PVA	PA	PX	PE	PD	PM	PQ	PVA
1. Paddy and Maize	1.80	5.30	-0.50	6.00	-0.50	5.90	9.45	-	-2.00	0.20	-2.30	0.20	-2.30	-3.67
2. Cassava, Beans and Nuts	1.40	1.70	-0.50	2.40	-0.50	1.70	15.97	-	-0.70	0.20	-0.90	0.20	-0.70	-6.25
3. Vegetables, Sugarcane and Fruits	0.60	2.00	-0.50	2.10	-0.50	2.00	6.03	-	-0.80	0.20	-0.90	0.20	-0.80	-2.37
4. Rubber and Latex	-1.10	27.70	-0.50	31.20	-0.50	31.20	-	0.50	-	0.20	-	0.20	-	0.22
5. Other Crops	2.00	-	-0.50	-	-0.50	-	12.75	-	5.10	0.20	5.80	0.20	4.70	-5.03
6. Livestock	1.20	0.80	-0.50	0.80	-0.50	0.80	0.65	-	-0.40	0.20	-0.40	0.20	-0.40	-0.33
7. Forestry	-0.40	1.30	-0.50	1.70	-0.50	1.10	4.41	0.20	-0.50	0.20	-0.70	0.20	-0.40	-1.47
8. Fishery	0.90	-0.40	-0.50	-0.40	-0.50	-0.40	2.98	-	0.50	0.20	0.50	0.20	0.50	-1.19
9. Mining and Quarrying	-1.10	-3.00	-0.50	-3.10	-0.50	-2.40	-3.16	0.40	1.10	0.20	1.20	0.20	0.90	1.27
10. Food Manufacturing	0.50	1.50	-0.50	2.60	-0.50	2.00	-2.30	-	-0.60	0.20	-1.00	0.20	-0.80	0.66
11. Textile Industry	-0.70	-0.70	-0.50	-0.90	-0.50	-0.80	0.61	0.30	0.30	0.20	0.40	0.20	0.30	-
12. Paper Industries and Printing	-0.40	-0.40	-0.50	-0.40	-0.50	-0.40	-	0.20	0.20	0.20	0.20	0.20	0.20	-0.46
13. Rubber Chemical and Petroleum Industries	-0.40	-1.10	-0.50	-1.30	-0.50	-1.10	-2.72	0.20	0.50	0.20	0.50	0.20	0.40	0.68
14. Non Metallic Products	-1.00	-0.70	-0.50	-1.10	-0.50	-1.00	-0.74	0.50	0.30	0.20	0.50	0.20	0.40	0.74
15. Metal Product and Machinery	-0.70	-0.60	-0.50	-0.90	-0.50	-0.60	-0.47	0.30	0.30	0.20	0.40	0.20	0.30	0.47
16. Agricultural Machinery	-3.60	-8.90	-0.50	-9.20	-0.50	-5.30	-	1.60	4.00	0.20	4.10	0.20	2.30	4.76
17. Other Manufacturing	-0.60	-0.50	-0.50	-0.50	-0.50	-0.50	-0.69	0.30	0.20	0.20	0.20	0.20	0.20	0.46
18. Electricity, Water Work and Public Utilities	-0.70	-0.50	-0.50	-0.50	-0.50	-0.50	0.32	0.30	0.20	0.20	0.20	0.20	0.20	-0.32
19. Construction and Trade	-0.30	-1.40	-0.50	-1.40	-0.50	-1.40	-0.22	0.10	0.70	0.20	0.70	0.20	0.70	0.11
20. Service Transportation and Communication	-0.90	-0.30	-0.50	-0.20	-0.50	-0.30	-1.06	0.30	-	0.20	-	0.20	-	0.45

Sector	Simulation 3 (%Δ)							Simulation 4 (%Δ)						
	PA	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*	*PA*	*PX*	*PE*	*PD*	*PM*	*PQ*	*PVA*
1. Paddy and Maize	-	-0.10	0.10	-0.10	0.10	-0.10	-	1.00	2.90	-0.30	3.40	-0.30	3.30	5.77
2. Cassava, Beans and Nuts	-	-	0.10	-	0.10	-	-	0.80	0.90	-0.30	1.30	-0.30	0.90	10.07
3. Vegetables, Sugarcane and Fruits	-	-	0.10	-	0.10	-	0.22	0.30	1.10	-0.30	1.20	-0.30	1.20	3.88
4. Rubber and Latex	-	-0.60	0.10	-0.70	0.10	-0.70	-	-0.60	13.70	-0.30	15.50	-0.30	15.50	0.22
5. Other Crops	-0.10	-	0.10	-	0.10	-	-	0.90	-8.80	-0.30	-10.00	-0.30	-8.10	7.05
6. Livestock	-	-	0.10	-	0.10	-	-	0.70	0.30	-0.30	0.30	-0.30	0.30	0.33
7. Forestry	-	-	0.10	-	0.10	-	0.49	-0.20	0.90	-0.30	1.10	-0.30	0.70	2.94
8. Fishery	-	0.20	0.10	0.20	0.10	0.20	0.30	0.50	-0.10	-0.30	-0.10	-0.30	-0.10	1.79
9. Mining and Quarrying	-	0.10	0.10	0.10	0.10	0.10	-	-0.60	-1.60	-0.30	-1.60	-0.30	-1.30	-1.90
10. Food Manufacturing	-	-	0.10	-	0.10	-	-	0.20	0.90	-0.30	1.50	-0.30	1.10	-1.31
11. Textile Industry	-	-	0.10	-	0.10	-	-	-0.40	-0.40	-0.30	-0.50	-0.30	-0.40	0.61
12. Paper Industries and Printing	-	-	0.10	-	0.10	-	-	-0.20	-0.20	-0.30	-0.20	-0.30	-0.20	-
13. Rubber Chemical and Petroleum Industries	-	-	0.10	-	0.10	-	-	-0.30	-0.60	-0.30	-0.70	-0.30	-0.60	-1.36
14. Non Metallic Products	-	-	0.10	-	0.10	-	-	-0.50	-0.40	-0.30	-0.60	-0.30	-0.50	-0.37
15. Metal Product and Machinery	-	-	0.10	-	0.10	-	-	-0.40	-0.40	-0.30	-0.50	-0.30	-0.40	-0.47
16. Agricultural Machinery	-1.10	-4.10	0.10	-4.20	-3.90	-4.20	0.68	-3.20	-8.00	-0.30	-8.30	-0.30	-6.50	-7.48
17. Other Manufacturing	-	-	0.10	-	0.10	-	-	-0.30	-0.20	-0.30	-0.20	-0.30	-0.20	-0.46
18. Electricity, Water Work and Public Utilities	-	-	0.10	-	0.10	-	-	-0.40	-0.30	-0.30	-0.30	-0.30	-0.30	-
19. Construction and Trade	-	-	0.10	-	0.10	-	-	-0.20	-0.70	-0.30	-0.70	-0.30	-0.70	-0.22
20. Service Transportation and Communication	-	-	0.10	-	0.10	-	0.15	-0.50	-0.20	-0.30	-0.10	-0.30	-0.20	-0.61

Source: Model Simulations 1 – 4

T.7 The summary of percentage changes from base year of the main policy simulations on macroeconomic indicators

Macroeconomic Variables	SIM 1 (%Δ)	SIM 2 (%Δ)	SIM 3 (%Δ)	SIM 4 (%Δ)
Private Consumption (*PRVCON*)	-0.82	0.41	-0.02	-0.45
Government Consumption (*GOVCON*)	-0.31	0.08	0.005	-0.19
Investment (*INVEST*)	-1.04	0.57	-0.06	-0.61
Export (*EXP*)	-0.96	0.48	-0.02	-0.54
Import (*IMP*)	-0.98	0.49	-0.02	-0.55
Gross Domestic Product (*GDP*)	-0.80	0.41	-0.02	-0.46

Source: Model Simulations 1 – 4

Appendix U

Base year value of output in the model (100 million of baht)

Sector	Base year value of output					
	QA	*QX*	*QE*	*QD*	*QM*	*QQ*
1. Paddy and Maize	1,918.07	1,684.38	196.08	1,488.30	11.55	1,499.85
2. Cassava, Beans and Nuts	411.19	367.70	89.17	278.53	91.46	369.99
3. Vegetables, Sugarcane and Fruits	1,356.72	1,678.55	100.27	1,578.28	63.02	1,641.31
4. Rubber and Latex	823.03	708.64	80.25	628.39	0.50	628.89
5. Other Crops	1,505.31	1,210.10	151.78	1,058.32	263.31	1,321.63
6. Livestock	1,216.68	1,224.10	78.65	1,145.45	20.95	1,166.40
7. Forestry	258.43	241.17	46.03	195.14	83.13	278.26
8. Fishery	1,492.95	1,534.46	28.57	1,505.89	12.99	1,518.89
9. Mining and Quarrying	7,620.55	6,123.50	277.64	5,845.86	2,198.24	8,044.10
10. Food Manufacturing	6,229.27	8,924.24	3,178.99	5,745.25	1,506.08	7,251.33
11. Textile Industry	4,955.99	6,440.79	2,327.20	4,113.59	1,061.05	5,174.64
12. Paper Industries	2,407.59	2,409.52	440.82	1,968.70	560.27	2,528.97
13. Rubber Chemical and Petroleum Industries	16,970.45	16,029.66	3,614.65	12,415.01	5,250.96	17,665.97
14. Non Metallic Products	1,938.65	1,470.47	820.88	649.60	156.43	806.03
15. Metal Product and Machinery	24,201.83	26,245.72	1,4354.77	11,890.95	15,157.05	27,048.00
16. Agricultural Machinery	124.23	114.69	3.51	111.18	92.14	203.32
17. Other Manufacturing	3,548.23	4,717.26	2,655.53	2,061.73	2,154.03	4,215.76
18. Electricity, Water Work and Public Utilities	5,123.99	4,683.98	138.14	4,545.84	102.46	4,648.30
19. Construction and Trade	10,772.13	6,848.42	110.06	6,738.36	2.25	6,740.61
20. Service Transportation and Communication	17,167.56	17,385.47	2,408.80	14,976.67	2,213.22	17,189.89

Source: Author’s calculation