Rethinking the Role of the Agricultural Sector in the Thai Economy and Its Income Distribution: A SAM Analysis

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August 2004

『国際開発研究フォーラム』27（2004. 8）
Forum of International Development Studies, 27（Aug. 2004）

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Abstract

The Agricultural sector has played a significant role in the Thai economy. It has been an engine of Thai industrial growth in the past. Its various kinds of good-quality agricultural produce and its strong comparative advantage are globally well-known. However, Thai agriculture has been devitalized since the 1980s and its population has been excluded from the country's rapid development and growth opportunities. The bias of government policies has been the main cause of the depressed agrarian conditions. This paper investigates potential for reviving the role of the agricultural sector in the Thai economy and improving its income distribution, using a Social Accounting Matrix (SAM) for analysis. It studies how stimulations of the Thai agricultural sector would affect the Thai economy and its income distribution compared to the manufacturing industrial sectors. Results from the policy simulations show clearly that agricultural and agricultural-processing sectors in Thailand have higher potential to increase domestic production through linkage or multiplier effects compared to that of manufacturing industrial sector. The agricultural and agricultural-processing sectors also have better potentials to generate more income to different households, to create better income distribution, and to induce more savings in the country.

I. Introduction

Agriculture has long been the backbone of the Thai economy, acting as the engine of industrial growth, bringing in a large amount of foreign exchange from its exports, providing the major source of income for more than half of the country's population, and representing the rural livelihood. However, all it received back from the government and the thriving economy was suppression and deprivation. There are still many serious problems unsolved in the Thai agricultural sector, namely, pervasive poverty, lack of inputs and capital, low technology, low productivity, low income, depressed interests, high tenancy and landlessness, and price fluctuation. The bias of government policies has been the main cause of the depressed agrarian conditions. According to the theory of structural change and two-sector model, every society seeking to industrialize with minimal dependence on foreign capital has no choice but to exploit resources from agriculture in the early stages of development. In this sense, Thailand is no exception if it also wants to promote its industry. The problem lies in the highly unbalanced character of the process by which agriculture has been used to

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permanently subsidize urban commercial-industrial interests and industrialization with little concern for the future of agriculture. Farmers have long been experts at surviving on their own because no government solved chronic problems, ranging from debt to land holding, in a systematic way. Moreover, much of the expenditure on agriculture focused on activities, like dam construction and road-building, which were designed to promote commercialization and greater production for export, rather than on activities that would directly uplift rural incomes, like subsidies for small producers, land reform, and support for smallholder technological innovation. Although Thailand has a huge comparative advantage in agriculture, without investing back a huge amount of capital into this sector it cannot be reinvigorated. Lack of investment makes agriculture weaker and leaves farmers ever poorer. A substantial part of government revenues should have been recycled back to the agricultural sector to counter the negative impacts of policies biased against agriculture. Fortunately but ironically, since the East Asian economic crises burst in 1997, agriculture's role became more important in the eyes of the Thai government, and the government has become aware of the potential of this sector for the first time in Thailand's history. Many projects and policies have been implemented to upgrade the sector and the quality of life of the rural people. Thai agriculture still has high potential to grow and become stronger, and therefore the role of the government to revive and promote it is very much desired. Since Thai agriculture still continues to encounter many challenges under this unpredictable, dynamic world economy, more careful policies and strategies must be carried out without delay.

This paper investigates potential for reviving the role of the agricultural sector in the Thai economy and improving its income distribution, using a Social Accounting Matrix (SAM) for analysis, then compares the agricultural sector to the manufacturing industrial sector. It analyzes how the agricultural and agricultural-processing sectors could contribute to the country's growth if they received more economic stimulations from the government or abroad, such as more investment, more export demands, and more income transfers to the households, which are considered exogenous inputs. The research aims to show how economic stimulations to agricultural sectors would affect the total production of the whole economy, generate income to different levels of households, affect income distribution, generate government revenues, induce savings, and affect the country's imports.

The paper is organized as follows. Section II discusses the condition of Thai agriculture. Section III provides the theoretical frameworks for the analysis and explains the research methodology. The framework includes the input-output framework, the Social Accounting Matrix, and the SAM multipliers. The analyses and simulation results are drawn in section IV. The last section presents the conclusion.

II. The Condition of Thai Agriculture

Thailand's agriculture has two contrasting images. The first is as a rich, well-watered, inexhaustible land, an image captured since the reign of King Ramkhamhaeng of Sukhothai era in the thirteenth

Table 1 Crop Exports in Year 2000（Selected Countries）

Products	Rice		Cassava（flour, tapioca, dried, starch）		Natural Rubber		Sugar（raw, centrifugal, refined）		Fruits and Vegetables	
Country	Metric Ton	Value（1000$）	Metric Ton	Value（1000$）	Metric Ton	Value（1000$）	Metric Ton	Value（1000$）	Metric Ton	Value（1000$）
World	23,162,904	6,459,824	15,753,836	472,295	5,700,817	3,875,785	34,968,680	8,016,289	114,085,244	67,777,921
Thailand	6,140,314	1,638,134	13,438,091	351,014	2,541,994	1,519,011	4,240,748	643,888	4,932,324	1,210,155
Australia	621,666	229,424	…	…	1,104	2,055	152,604	38,791	1,736,415	854,292
Brazil	26,380	6,505	56,666	4,072	180	320	6,692,200	1,199,425	1,942,179	1,525,012
China, Hong Kong, Macao	3,077,332	582,109	294,384	23,006	37,355	31,273	487,049	96,932	5,972,195	4,047,831
France	66,154	42,729	2,012	636	13,883	14,101	3,208,705	1,187,456	5,446,340	3,119,081
India	1,532,598	655,457	5,232	397	4,005	3,222	349,063	96,238	1,188,039	952,888
Indonesia	1,189	306	444,226	13,678	1,379,987	889,302	1,900	1,977	666,002	300,553
Italy	666,336	309,547	655	186	13,548	13,734	397,245	113,766	6,166,364	4,059,474
Japan	42,148	13,610	112	72	357	2,214	3,184	1,428	29,079	81,221
Korea, Rep	58	317	117	58	955	1,312	329,800	71,672	105,055	334,581
Malaysia	117	46	5,820	821	845,708	748,616	33,806	27,700	284,100	195,771
Mexico	323	292	443	128	1,435	1,870	305,507	50,828	4,884,704	3,270,010
Pakistan	2,016,273	533,314	…	…	…	…	20,330	4,768	454,169	126,314
Philippines	224	115	1,615	731	30,685	14,293	138,869	51,999	2,346,405	652,776
United States	2,736,462	835,996	31,145	2,019	38,044	58,749	101,150	39,883	9,465,810	7,954,295
Vietnam	3,477,000	667,349	337,642	12,100	273,000	166,022	70,030	450	265,259	267,931
Thailand's Percentage to the World	26.51	25.36	85.30	74.32	44.59	39.19	12.13	8.03	4.32	1.79

Source: Author, using data from the Food and Agriculture Organization of the United Nations（FAO）Statistical Database

century. Thai agriculture has never failed to preserve the country's food security. It is, has been, and continues to be a major source of rural income and undividable part of rural livelihood. It provided great revenues to the country from commodities exports. It was a major source of the industrial sector's inputs during the industrialization process. Its comparative advantage to other countries' agriculture has made Thailand able to preserve its long standing status of net food exporter. As shown in Table 1, Thailand was number one exporter of rice, cassava, and natural rubber in 2000. Its export volumes accounted for 26 percent of the world's export volumes for rice, 85 percent for cassava, and 44 percent for natural rubber. It was among the top exporters of sugar (12 percent), and fruits and vegetables (4 percent). The success of Thai agriculture has been shown by the country's diversified agriculture taking advantage of world demand for a wide range of commodities, starting with cassava, kenaf, maize, and sugarcane in the 1960s and 1970s, moving on to soybeans, oil palm, and coffee in the 1980s, and in the 1990s pioneering in the production and export of prawns, frozen fowl, fruits, and flowers (Bello 1998: 133).

The other image of Thai agriculture is, however, as a poor, unproductive sector which is losing its competitiveness to other sectors in the country. As shown in Table 2, Thai agriculture contributed only around 10 percent to the GDP in 2000. This represents a decline from 38 percent in 1951, 27 percent in 1970 and 20 percent in 1980, while the contribution of industry rose from 17 percent in 1951 to 41 percent in 2000. Meanwhile, employment in the agricultural sector fell from 71 percent in 1980 to 51 percent in 1998, as shown in table 3. This discrepancy between fall in contribution to GDP and fall in share of employment reflects the low level of labor productivity in Thai agriculture. The figures can be compared with other Asian developing countries, where unlike in Thailand, shares of agriculture to GDP dropped in about the same proportion as respective the drops of employment in agriculture.

Table 2 Gross Domestic Product at 1988 Prices by Industrial Origin (percent)

Year	Agriculture	Industry	Manufacturing (included in Industry)	Services
1951	38	17	14	45
1960	31	20	14	49
1970	27	24	17	49
1980	20	30	23	50
1990	13	38	28	49
1995	11	41	31	48
2000	10	41	32	49

Source: Author, using data from Thailand's National Economic and Social Development Board (NESDB).

The figures in Table 3 show a very contradictory picture of Thailand's development in the past decades as the country has tried very hard to become a newly industrializing economy (NIE), while more than half of the population are still engaged in the agricultural sector and more than three quarters still live in rural areas. It is obvious that though agriculture's contribution to GDP in

Thailand has dropped dramatically, the country has failed to push more workers out of agriculture and channel them to industrial or service sectors, as should take place during the industrialization process. This phenomenon would not be a problem if the majority of Thailand's population still in the agricultural sector and living in the countryside had a better standard of living and welfare. However, lower standard of living and neglect of rural interests have been a common story in Thailand's countryside for more than a century.[1]

Table 3 Gross National Income Per Capita, Employment in Agriculture, Percentage of Agricultural Value Added to GDP, and Percentage of Rural Population (selected countries)[2]

Country	Gross National Income Per Capita	Employment in Agriculture		Agriculture Value Added		Rural Population	
	$	% of total labor force		% of GDP		% of total population	
Year	2000	1980	1998	1970	1999	1980	2000
Thailand	2,000	71	51	26	10	83	78
Bangladesh	370	73	63	44	25	86	76
Cambodia	260	76	..	..	51	88	84
China	840	69	47	35	18	80	68
India	450	70	..	46	28	77	72
Indonesia	570	56	45	45	19	78	59
Japan	35,620	10	5	6	2	24	21
Korea, Rep	8,910	34	12	26	5	43	18
Lao PRD	290	80	..	..	53	87	77
Malaysia	3,380	37	19	29	11	58	43
Philippines	1,040	52	40	30	18	63	41
Vietnam	390	73	71	..	25	81	76
Average World	5,170	51	..	..	5	60	53
Average of Lower Middle Income Countries	1,130	58	45	31	14	69	58
Average of East Asia and Pacific Countries	1,060	66	46	33	14	78	65

Sources: Data of Gross National Income per Capita and Rural Population is from World Bank's 2002 World Development Indicators, p.18-20, 134-136. Data of Employment in Agriculture and Agriculture Value Added is from World Bank's 2001 World Development Indicators, p. 28-30.

The poor, unproductive image of Thai agriculture, therefore, is due to pervasive poverty in the sector. Corresponding to the livelihood of the rural poor, Thai agriculture suffers from lack of capital, low technology, and depressed interests. This aspect is a strong characteristic of the Northeastern region where land is unfertile, capital and technology inputs are missing, and rural poverty is pervasive. Other regions have also increasingly faced the problem of pervasive rural poverty, mostly due to lack of opportunities. Rural areas have been left far behind by the city and highly inequitable access to income from agricultural growth is a persistent problem. This makes for a contradiction between Thailand's status as a very strong agricultural economy and the continuing low living standards of the millions of agricultural population.

Other evidence of the contradictory development in Thailand is the precipitous gaps in income between farmers and the group of urban professional and technical workers (including administrators

and academics). In 1998 the average monthly income per household of farm operators mainly owning land, farm operators mainly renting land, and farm workers were only 24.50 percent, 26.52 percent, and 16.03 percent of that of the group of urban professional and technical workers, respectively. In 2002, the gaps were widened to 26.0 percent, 29.36 percent, and 16.10 percent, respectively.[3]

The Thai agricultural sector has been depressed by the biased government policies subordinating the countryside to the city due to the ingrained social values of feudalism and hierarchy. After the Second World War, Thailand's development policy has focused on promotion of industrialization. The policies have essentially sacrificed the interests of the rural people, who are numerous but politically powerless smallholders, to the interests of an urban coalition dominated by extremely powerful commercial, bureaucratic, and military elites. Examples of biased policies are the Rice Premium; biased industrial policies to favor selected interests with special ties to the bureaucracy; the water allocation bias[4]; and the suppression of Farmer's Federation of Thailand（FFT）in the 1970s.

The Rice Premium, an *ad valorem* or variable tax based on the value of a commodity on rice exports, imposed by the Thai government from 1955 to 1985, is considered the most prominent instrument for the subordination of the countryside. The government began to tax the rice economy before regularizing it as the rice premium, and had imposed a monopoly on rice exports and set up machinery to buy supplies at low prices since the end of World War II. The rice premium, which was changed at irregular intervals, sometimes reached 30 percent of the world market price.[5] By tightly controlling the flow of the marketable surplus to the world market, the premium had the effect of insulating the domestic market from international rice price movements and consistently depressing the domestic price of rice. This was a mechanism for protecting the urban consumer against shortages caused by excessive exports in times of high international prices. It avoided the administrative complexity and political difficulties of introducing a large land tax or any similar direct tax on the peasant. The result was that rice producers were deprived of substantial income, this being transferred instead in the form of lower food costs to urban employers and workers.

Since the mid-1980s onward, the Thai governments have, from time to time, paid attention to the strategy of turning Thailand into a "Newly Agro-Industrializing Country." The government envisioned a central role for export agriculture via the consolidation of the country's comparative advantage in traditional export crops and increases in comparative advantage in new agro-industrial exports, such as canned food, frozen prawns and broiler chickens. However, this strategy has encountered many obstacles. First, the fertile land for cultivation had been bought up by land speculators during the rapid expansion of industry which left many farmers tenants or agricultural workers. Second, the intensification of industrialization around Bangkok area had pushed up labor costs in the city. This encouraged more and more laborers to settle permanently in Bangkok rather than the more traditional pattern of seasonal migration, and it is difficult for the agro-industrial enterprises to attract specific agricultural inputs from the farms or to introduce a contract farming

system. Third, the contract farming systems were often unfair contracts with many farmers falling into debt with the company from purchases of seeds, fertilizers, and other inputs. Fourth, there were technological constraints as the government was ill-equipped to be the R&D coordinator and technological innovator, and the private sector was not willing to invest in this kind of public goods. Fifth, Thailand's export agriculture became increasingly threatened by developments in world trade and the intense competition.

Recently, particularly since the East Asian economic crises of 1997, the agenda of agricultural development and the quality of growth have received increased attention from the public and academic community. The country's past development strategy based on promoting industrialization and capitalism lost its credibility as many questioned whether this strategy was still a viable or sustainable way to promote the country's development. At that time, the agricultural sector and related industries, although wounded, helped cushion the blow of the crises by absorbing thousands of unemployed workers. Thus, during the economic turmoil, there was an outpouring of new ideas and discussion about economic and social development in the country. Many groups urged the government to solve the problems and try new strategies. The agricultural sector is reinvigorated as policies to develop this sector have been more frequently introduced, such as the King Bhumipol Adulyadej's *New Theory*[6]; Prime Minister Thaksin Shinawatra's three-year debt suspension for small farmers, one-million-baht funds for 70,000 villages, and the *One Tambon, One Product* project to help villagers develop local products for commercialization. However, utilizing the full potential of the sector remains one of the most daunting public policy challenges as promoting sustainable development, adding value to products and managing commodity price swings are all easier said than done. If policy makers still desire to push Thailand to become a newly agro-industrializing country, they have to dedicate more time and resources, and correctly solve the fundamental problems of Thai agriculture. Products with growth potential should receive government support to improve productivity and competitiveness in the world market.

III. Theoretical Frameworks for the Analysis and Research Methodology

Input-Output Framework, Social Accounting Matrix (SAM) and SAM Multipliers

Input-output (I-O) analysis was developed by Professor Wassily Leontief in the 1930s as a theoretical framework and an applied economic tool in a market economy. It displays sales and purchases relationship between different producers and consumers in an economy. It focuses on the interrelationships between sectors or industries in an economy with respect to the production and uses of their products and the products imported from abroad. The I-O analysis assumes that (1) the inputs used in producing a product are related to the industry output by a linear and fixed coefficient production function, at least in the short run, so each industry uses a fixed input ratio for the production of its output; (2) each industry produces only one homogenous commodity and there is no

substitution among the different inputs; (3) production in every industry is subject to constant returns to scale; (4) there is excess in production capacity in all sectors, and increasing demand can always be met by higher output with no price increase. In other words, sectoral production is completely demand-driven. Since these assumptions are likely to be unrealistic, I-O models are more useful as guidelines to potential induced linkage, and as indicators of likely supply bottlenecks that may occur in a growing economy, than as predictive models (Sadoulet 1995: 287).

The key element for the I-O analysis is to obtain the inverse matrix. Mathematically, the vector of output x in the system of equation $Ax + f = x$ can be solved as $x = (I - A)^{-1} f$, where A is called the *input-output coefficient matrix*, I stands for *identity matrix*, which is a square matrix where all the diagonal elements are equal to 1 and all other elements are equal to zero, and f is the vector of final demands. $(I - A)^{-1}$ is the Leontief inverse which can be calculated with some difficulty. At present, spreadsheet computer software can easily invert a large size matrix.

The inverse matrix can be interpreted as a chain of interactions. The exogenous shock f gives impact to input requirement of any increase in output, or the coefficient matrix A, for the first round as Af, the second round as A^2f, the third round as A^3f, and the nth round as A^nf, so that the total impact is $(I + A + A^2 + ... + A^n) f$, which $I + A + A^2 + ... + A^n = (I - A)^{-1}$. Thus, sectoral outputs keep rising as a result of the higher intermediate-goods demand each round of effects generates. However, in each round output increases become smaller and smaller such that their total always has a limit (Sadoulet 1995: 286). Therefore, $(I - A)^{-1}$ is a multiplier which can be used to calculate overall changes in sectoral outputs which result from changes in final demands.

The inverse matrix $(I - A)^{-1}$ is fundamental to input-output analysis as it shows the full impact of an exogenous increase in net final demand on all industries. It is then possible to calculate what output levels would be required to meet various postulated levels of net final demand and consequently how output levels would be required to change to meet postulated changes in net final demand.

In chain reactions in input-output analysis, the first exogenous shock is assumed to be initiated by an exogenous increase in final demands, like an increase in export demand, or an increase in fixed capital formation. This assumption is made mainly for the sake of simplicity of exposition. Actually, the first shock can happen anywhere. It can be an increase in domestic production of intermediate consumption to replace imports, an increase in indirect taxes, a change in technology represented by changes in input structures, etc. (UN 1999: 8).

A SAM is a square matrix consisting of row and column accounts that represent the different sectors, agents, and institutions of an economy at the desired level of disaggregation. It is extended from the I-O table by adding factor accounts, institution accounts, capital accounts, and the rest of the world account. Each transaction or account in the SAM has its own row and column, and each cell represents an expenditure by the column account and an income to the row account. As each account

must balance, the corresponding row and column totals are equal. There are six types of accounts in the SAM: the activity accounts; the commodity accounts; the factor accounts (labor and capital); the current accounts of the domestic institutions, divided into households, firms, and the government; the capital accounts; and the rest of the world account.

SAM is a useful framework for preparing consistent, multi-sectoral economic data that integrates national income, input-output, flow-of-funds, and foreign trade statistics into a comprehensive and consistent dataset. It also provides a static image of a country's economic formation. In the analysis, the SAM will be used to assess the economy-wide effects of an increase in demand for one sector or in external transfer to an institution, in what is known as "multiplier analysis."

The SAM multipliers are used to simulate the outcome of production increase after setting an exogenous change. It can do further simulations on household income, government income, country's savings and linkages to the rest of the world. For example, in case of the input-output multipliers, suppose that the exports of rice and flour increase by 1 million baht, by how much does the sector's production increase? Which other sectors will increase their production? By how much will total production increase in the economy? In the case of the SAM multipliers, not only can we run simulations to find outcomes to address the above questions, but we can also see the multiplier effects outside the production sectors, such as effects on incomes of the different households (income effects across groups), impacts on the sum of total household income, effects on government incomes, effects on country's savings, and linkages to the rest of the world economy, such as the change in imports. By using both the input-output and SAM multipliers, we can compare the total production multipliers (the sum of the production impacts only) between both simulations. However, we cannot compare the effects between input-output and SAM multipliers on household incomes, government income, total saving, and linkages to the rest of the world, because the input-output multipliers do not provide outcome other than the impacts on production.

Extension of the input-output model to a SAM framework or SAM multipliers is performed by partitioning accounts into endogenous and exogenous accounts and assuming that the column coefficients of the endogenous accounts are all constant. An important issue then is to determine which accounts can be set exogenous and which can be set endogenous. Endogenous accounts are those for which changes in the level of expenditure directly follow any change in income, while exogenous accounts are those for which we assume that the expenditures are set independently of income. Standard practice is to pick, for the exogenous accounts, one or more among the government, capital, and rest of the world accounts, justifying the choice on the basis of macroeconomic theory and the objectives of the study (Sadoulet 1995: 288).

Sadoulet and De Janvry (1995) explain the SAM matrix in table 4 where x is the vector of total income or expenditure of the endogenous accounts, f is the vector sum of the expenditures of the exogenous accounts, l is the column vector of the income of the exogenous accounts, M is the square

Table 4 The SAM Matrix

	Endogenous Accounts (n)	Sum of exogenous Accounts (1)	Total
Endogenous accounts (n)	Mx	f	x
Exogenous accounts (m)	Bx	l	
Total	x		

Source: Sadoulet, E. and A. de Janvry. 1995. *Quantitative Development Policy Analysis* . Baltimore: John Hopkins University Press, p. 289.

matrix ($n \times n$) of coefficients of the endogenous accounts, and B is the rectangular matrix ($m \times n$) of the coefficients with exogenous accounts as rows (m) and endogenous accounts as columns (n).

If Δ represents the operator "change," one may define $(I - M)^{-1}$ as the matrix of multipliers or SAM multipliers, and Δf as the vector of shocks. Then, the vector of impacts is $\Delta x = (I - M)^{-1} \Delta f$, and the leakages is $\Delta l = B \Delta x$.

A shock, or a stimulation, is given by a change in elements of the exogenous accounts. The model solves for the equilibrium level of all the endogenous accounts. Multipliers, like their input-output analogues, are completely demand-driven. The coefficients in the rows of the exogenous accounts provide the "leakages." These leakages are, for example, the induced demand for imports, the induced government revenues, and the induced savings (Sadoulet 1995: 289). In other words, with an exogenous rest of the world account, simulations of changes in exports or in transfers to different households can be performed. With an exogenous capital account, shocks are mainly changes in investment. With an exogenous government account, changes in demand for administrative services and in transfers to value added or households can be simulated. In all cases, the multiplier model gives the impact on the structure of production, labor income, income of the various socioeconomic households, government revenues, savings, and imports (Sadoulet 1995: 289).

By using the SAM multipliers, the simulation is obtained by premultiplying the vector of the initial shock by the matrix M of multipliers to see the impact of an exogenous change, for example, an increase in export or transfer in one account or more. Each policy to be studied is therefore characterized by a vector of initial shock Δf. Its impact is measured by the resulting vector Δx. Therefore, $\Delta x = M \Delta f$.

Induced imports Δi resulting from the change in the production level can be obtained by premultiplying the vector of resulting change in the endogenous accounts (Δx) by the vector i' of import coefficients computed in A. Therefore, $\Delta i = i' \Delta x$. Likewise, the induced savings and government revenues can be computed as in the following equations. $\Delta s = s' \Delta x$ and $\Delta g = g' \Delta x$, when s' is the vector of saving coefficients and g' is the vector of government coefficients.

IV. Analyses and Simulation Results

IV.1. Data Arrangement

Since agriculture is a major sector in the Thai socio-economy, agricultural policies can affect all other sectors. For example, changes in agriculture's output supply, input demand, employment, and income generation in the rural areas can affect those of industrial and service sectors. Conversely, changes in other sectors may also affect production, employment, and income distribution in agriculture. This analysis aims to analyze this type of interaction among sectors and institutions, which require economy wide frameworks.

To pursue the analysis, a Social Accounting Matrix (SAM) of Thailand will be used for the policy simulations. It will be used to analyze the role of agriculture and manufacturing industry in Thailand and determine whether or not it is true that agriculture is passive, unproductive, and should not be promoted for economic development, as many policy makers believe. The analysis will study each sector's capacity to generate forward linkages or backward linkages, using the matrix of interindustry flows or the "input-output" matrix.

The SAM used in this analysis is obtained from a discussion paper of the Trade and Macroeconomics Division, International Food Policy Research Institute (IFPRI), made by Jennifer Chung-I Li from the University of North Carolina at Chapel Hill and IFPRI which was published in July 2002. This SAM of Thailand from IFPRI is of year 1998 and is disaggregated enough to use for the analysis. There are a total of 78 accounts in this 1998 SAM of which 61 are in the productive sectors. However, before analysis can be conducted, some adjustments such as accounts grouping or data aggregating must be done. For details of how the 1998 SAM of Thailand was made, please see the original paper written by Jennifer Chung-I Li (2002).

The 1998 SAM of Thailand used for this simulation analysis is grouped into 21 accounts for productive sectors (activities and commodities), and the activities and commodities are combined together in order to reduce the size of the matrix. Therefore, the sum total for the combined activities and commodities in the column account is the total supply which includes domestic production and imports, and the sum total in the row account is the total demand which includes domestic production and exports.

There are a total of 41 accounts in this 1998 SAM of Thailand, which include: 21 productive sectors (activities and commodities combined); 3 factors of production (one labor category and two capital accounts: agricultural capital and non-agricultural capital); 3 types of household (agricultural household, non-agricultural household, and government-employed household); one account for private enterprise, and one for public enterprise; 9 accounts for the government, including accounts of taxes and subsidies; 2 accounts for capital including saving and investment, and inventory; and one account for the rest of the world. In other words, there are 29 endogenous accounts which include 21

productive sectors, 3 factors of production, 3 household types, and 2 enterprises, and there are 3 main exogenous accounts: one is the government which includes 9 sub-accounts of government taxes and subsidies; second is capital, and third is the rest of the world.

The 21 productive sectors include: paddy, other crops, vegetable and fruits, other raw agricultural products, livestock, fishing, forestry, mining[7], rice and flour, meat, canned food, other food, other agricultural products, beverage, tobacco, fuel[8], other manufacturing (industrial)[9], infrastructure[10], construction, trade and transportation[11], and services[12]. Since the analysis focuses mainly on the effects to agriculture, this 1998 SAM has 15 agriculture-related sub-sectors for detailed analysis. The remaining six productive sectors are those outside the agriculture-related sectors and will be analyzed only on a sectoral level.

The 1998 SAM obtained from IFPRI has only one aggregated labor factor and three disaggregated household types: agricultural, non-agricultural, and government-employed. However, the information is good enough for the analysis. The government-employed household is distinguished as same as the original SAM since it is considered an important household type with a quite significant number in employment (ranging from 7.5 to 9.5 percent of total labor force in 2001-2003 depends on quarters)[13]. They are also the household group, other than the non-agricultural households, who benefit from the lower food costs maintained by the governments in order to reduce the need to increase pay for civil servants. Moreover, government-employed households can represent a household group whose income is relatively neutral.

As the dataset for SAM multipliers for the simulation is from the year 1998, it is necessary to make sure that the simulations are not excessively altered by the East Asian economic crises in 1997. This sensitivity can be checked by looking at trends in industrial capacity utilization in Thailand before and after the crises. The rates were obtained from the Bank of Thailand and are shown in Table 5.

From the table, it is clear that the industrial capacity utilization rates before and after the crises

Table 5 Industrial Capacity Utilization by Product Group (Percent)

Capacity utilization	1995	1996	1997	1998	1999	2000	2001	2002[1]
Total	77.4	72.5	64.8	52.8	61.2	55.8	53.6	58.6
Total (exclude liquor)	76.3	71.4	63.2	50.3	56.3	59.4	56.1	59.8
Food	41.5	37.3	37.4	33.3	42.4	43.8	42.5	45.2
Beverage	82.3	83.0	79.1	77.2	101.9	32.6	36.7	45.1
Tobacco	75.2	84.2	75.8	60.4	54.4	53.7	52.1	54.2
Construction materials	97.3	78.7	72.9	44.6	49.8	50.1	52.3	59.3
Iron & steel products	64.2	65.2	50.6	35.9	39.6	47.0	50.0	62.3
Vehicles and equipments	81.4	67.6	48.5	23.4	35.6	40.1	44.5	51.3
Petroleum products	93.2	85.7	90.1	84.0	85.7	83.9	74.8	76.0
Electronic & electrical products	63.9	67.8	62.2	47.5	53.4	65.4	47.5	58.5
Others	80.0	77.7	66.1	68.9	72.9	75.4	77.0	72.2

Accounting for 44.5 percent of the 1995 manufacturing sector value added.
1. Average of January - September 2002
Source: Bank of Thailand

are very different in almost every sector. The trends had been decreasing since 1996 onward, but dropped dramatically in 1998 in the manufacturing sectors of construction materials, iron and steel products, vehicles and equipment, and electronics and electrical products. The capacity utilization in the agricultural-processing industries, which are food, beverage, and tobacco, also decreased but not as much as in the manufacturing sectors. The reason is that the agricultural-processing sectors were not affected by the crises as much as the manufacturing sectors, and some received advantages from increased export value due to the depreciation of the Thai baht.

However, in spite of the fact that the industrial capacity utilization rates in 1998 dropped dramatically compared to other years, this phenomenon is useful for the simulations to test the impact analysis. It can be explained in this way: the input-output and SAM multipliers analyses are static analyses which assume the sectoral production is completely demand-driven and only production quantity, not price, will change due to the excess production capacity in all sectors. The price will not change because increasing demand can always be met by higher output. Therefore, since there is no productivity relation involved in the input-output/SAM analyses, the decreased industrial capacity utilization in 1998 would not affect the simulations. Instead, the SAM of year 1998 is a good dataset to use in the simulations because during the crises there were many unutilized workers which made the adjustment in quantity greater than the price adjustment. In other words, price adjustment during the time of crises was very tight, so the situation meets the crucial assumption of input-output/SAM analyses that they are conducted in a static economy.

All number entries in the 1998 SAM are in 1998 current million Thai Baht.

IV.2. Interpreting Thailand's 1998 SAM Multipliers

Table 6 illustrates the matrix of multipliers computed from the 1998 SAM of Thailand. In SAM multipliers, government, capital, and rest of the world accounts are defined as exogenous. The outcomes of SAM multipliers shown in Table 6 can be interpreted by the following examples: interpretation of the ninth column in Table 6 indicates that an increase of one unit in exports of rice and flour induces an increase of production of 1.27 units in this sector, 0.79 units in the manufacturing sector, 0.45 units in the trade and transportation sector, 0.56 units in services sector, and 4.55 units in the whole economy. It also generates 1.14 units of household income. By contrast, an increase of one unit of manufacturing export (column 17 in Table 6) induces only 3.04 units in domestic production and 0.55 units in household income, although it generates 1.91 units in its own sector.

Columns 23 and 24 show the impact of stimulations to agricultural capital and non-agricultural capital, where investment could come either from the government or from the rest of the world. The simulations yield very different results for agricultural and non-agricultural capital. Simulation of one unit investment to agricultural capital gives 2.41 units in the whole economy compared to only 1.46 units from non-agricultural capital. One unit of investment generates 1.22 and 0.94 units of household

Table 6 Social Accounting Matrix Multipliers, Thailand, 1998

	1 Paddy	2 Other crops	3 Vegetable and fruits	4 Other raw agri pdt.	5 Livestock	6 Fishing	7 Forestry	8 Mining	9 Rice and flour	10 Meat	11 Canned food	12 Other food	13 Other agri pdt	14 Beverage	15 Tobacco
1 Paddy	1.09	0.05	0.05	0.05	0.14	0.05	0.02	0.02	0.61	0.11	0.04	0.07	0.06	0.03	0.03
2 Other crops	0.00	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
3 Vegetable and fruits	0.10	0.08	1.07	0.08	0.13	0.09	0.03	0.03	0.08	0.11	0.16	0.08	0.07	0.04	0.03
4 Other raw agri prod.	0.07	0.13	0.12	1.04	0.04	0.03	0.01	0.01	0.06	0.04	0.03	0.11	0.15	0.02	0.06
5 Livestock	0.05	0.04	0.04	0.04	1.12	0.05	0.02	0.01	0.05	0.82	0.03	0.08	0.03	0.02	0.02
6 Fishing	0.04	0.03	0.03	0.03	0.10	1.10	0.01	0.01	0.04	0.08	0.30	0.09	0.03	0.02	0.01
7 Forestry	0.00	0.00	0.00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
8 Mining	0.05	0.04	0.07	0.05	0.06	0.11	0.02	1.05	0.06	0.05	0.06	0.06	0.05	0.04	0.03
9 Rice and flour	0.11	0.09	0.08	0.09	0.26	0.11	0.04	0.03	1.27	0.20	0.07	0.14	0.13	0.06	0.06
10 Meat	0.05	0.04	0.04	0.04	0.04	0.04	0.02	0.01	0.04	1.04	0.03	0.03	0.03	0.02	0.02
11 Canned food	0.03	0.03	0.03	0.03	0.04	0.03	0.01	0.01	0.04	0.03	1.70	0.07	0.03	0.02	0.01
12 Other food	0.04	0.04	0.03	0.04	0.17	0.11	0.02	0.01	0.05	0.13	0.05	1.07	0.03	0.06	0.01
13 Other agri prod.	0.07	0.06	0.05	0.06	0.11	0.08	0.02	0.02	0.11	0.09	0.07	0.39	1.57	0.07	0.61
14 Beverage	0.09	0.08	0.07	0.08	0.08	0.08	0.03	0.03	0.08	0.07	0.06	0.05	0.06	1.05	0.03
15 Tobacco	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.01	1.01
16 Fuel	0.07	0.07	0.12	0.08	0.10	0.21	0.02	0.06	0.09	0.09	0.10	0.09	0.08	0.06	0.04
17 Other manufacturing	0.85	0.76	0.97	0.72	0.72	0.69	0.28	0.29	0.79	0.66	0.58	0.69	0.63	0.67	0.37
18 Infrastructure	0.05	0.04	0.05	0.04	0.07	0.05	0.02	0.02	0.08	0.06	0.04	0.07	0.06	0.04	0.03
19 Construction	0.05	0.06	0.06	0.04	0.09	0.04	0.02	0.03	0.06	0.07	0.04	0.05	0.05	0.03	0.03
20 Trade &Transportation	0.35	0.29	0.46	0.30	0.50	0.37	0.11	0.13	0.45	0.46	0.33	0.39	0.37	0.29	0.20
21 Services	0.54	0.43	0.48	0.44	0.53	0.48	0.18	0.24	0.56	0.50	0.39	0.43	0.45	0.34	0.22
22 Labor	0.81	0.43	0.34	0.44	0.58	0.40	0.14	0.16	0.64	0.55	0.39	0.39	0.47	0.29	0.22
23 Agri capital	0.37	0.54	0.40	0.54	0.31	0.59	0.27	0.02	0.24	0.24	0.22	0.15	0.13	0.04	0.05
24 Non-agri capital	0.47	0.39	0.51	0.39	0.56	0.48	0.15	0.41	0.59	0.61	0.56	0.57	0.68	0.47	0.33
25 Agri household	0.35	0.39	0.30	0.39	0.28	0.42	0.18	0.05	0.25	0.24	0.20	0.16	0.16	0.08	0.07
26 Govt-employed household	0.25	0.14	0.12	0.15	0.19	0.14	0.05	0.06	0.20	0.18	0.13	0.13	0.16	0.10	0.07
27 Non-agri household	0.73	0.48	0.48	0.48	0.64	0.51	0.17	0.30	0.68	0.64	0.52	0.53	0.63	0.41	0.30
28 Public enterprise	0.03	0.02	0.03	0.02	0.03	0.03	0.01	0.02	0.03	0.03	0.03	0.03	0.04	0.02	0.02
29 Private enterprise	0.30	0.33	0.32	0.33	0.31	0.38	0.15	0.15	0.29	0.30	0.27	0.25	0.28	0.18	0.13
Total Production	3.74	3.40	3.82	3.27	4.31	3.75	1.88	2.04	4.55	4.65	4.10	3.99	3.92	2.91	2.81
Total household income	1.33	1.01	0.90	1.02	1.10	1.06	0.40	0.41	1.14	1.06	0.86	0.82	0.95	0.59	0.44

Table 6 Social Accounting Matrix Multipliers, Thailand, 1998（continued）

	16 Fuel	17 Other manufac-turing	18 Infra-structure	19 Construc-tion	20 Trade & Transport-aion	21 Services	22 Labor	23 Agri capital	24 Non-agri capital	25 Agri household	26 Govt-employed household	27 Non-agri household	28 Public enterprise	29 Private enterprise
1 Paddy	0.02	0.02	0.03	0.03	0.03	0.04	0.06	0.06	0.03	0.10	0.06	0.05	0.00	0.00
2 Other crops	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
3 Vegetable and fruits	0.03	0.04	0.06	0.06	0.06	0.11	0.11	0.11	0.06	0.17	0.10	0.09	0.00	0.00
4 Other raw agri prod.	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.01	0.04	0.03	0.02	0.00	0.00
5 Livestock	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.03	0.09	0.05	0.05	0.00	0.00
6 Fishing	0.01	0.02	0.03	0.03	0.03	0.05	0.04	0.04	0.02	0.07	0.04	0.04	0.00	0.00
7 Forestry	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
8 Mining	0.52	0.05	0.23	0.09	0.08	0.04	0.04	0.04	0.02	0.06	0.04	0.04	0.00	0.00
9 Rice and flour	0.04	0.04	0.07	0.07	0.07	0.08	0.12	0.12	0.07	0.20	0.12	0.11	0.00	0.00
10 Meat	0.02	0.02	0.03	0.03	0.03	0.03	0.06	0.06	0.03	0.09	0.05	0.05	0.00	0.00
11 Canned food	0.01	0.02	0.02	0.03	0.03	0.06	0.04	0.03	0.02	0.05	0.04	0.04	0.00	0.00
12 Other food	0.01	0.02	0.03	0.03	0.03	0.03	0.05	0.05	0.03	0.08	0.05	0.04	0.00	0.00
13 Other agri prod.	0.03	0.04	0.04	0.04	0.04	0.06	0.07	0.07	0.04	0.11	0.07	0.07	0.00	0.00
14 Beverage	0.03	0.03	0.06	0.05	0.05	0.06	0.11	0.11	0.06	0.17	0.10	0.09	0.00	0.00
15 Tobacco	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.05	0.03	0.03	0.00	0.00
16 Fuel	1.14	0.06	0.17	0.08	0.15	0.07	0.07	0.06	0.04	0.10	0.07	0.06	0.00	0.00
17 Other manufacturing	0.30	1.91	0.54	1.02	0.52	0.61	0.75	0.72	0.40	1.16	0.73	0.65	0.00	0.00
18 Infrastructure	0.03	0.05	1.13	0.05	0.04	0.06	0.05	0.05	0.03	0.08	0.05	0.05	0.00	0.00
19 Construction	0.03	0.04	0.07	1.05	0.04	0.07	0.04	0.04	0.02	0.06	0.04	0.04	0.00	0.00
20 Trade&Transportation	0.14	0.30	0.26	0.45	1.32	0.30	0.34	0.28	0.19	0.44	0.35	0.31	0.00	0.00
21 Services	0.24	0.33	0.44	0.47	0.50	1.47	0.60	0.44	0.34	0.68	0.63	0.57	0.00	0.00
22 Labor	0.23	0.27	0.46	0.46	0.32	0.48	1.32	0.27	0.17	0.43	0.32	0.29	0.00	0.00
23 Agri capital	0.03	0.04	0.05	0.05	0.05	0.08	0.09	1.09	0.05	0.14	0.09	0.08	0.00	0.00
24 Non-agri capital	0.42	0.45	0.71	0.66	0.89	0.69	0.48	0.40	1.26	0.62	0.48	0.44	0.00	0.00
25 Agri household	0.06	0.07	0.12	0.12	0.11	0.14	0.25	0.69	0.10	1.17	0.11	0.10	0.00	0.00
26 Govt-employed household	0.08	0.09	0.15	0.15	0.12	0.16	0.40	0.11	0.08	0.14	1.11	0.10	0.00	0.00
27 Non-agri household	0.35	0.39	0.63	0.61	0.65	0.64	1.00	0.42	0.76	0.58	0.44	1.40	0.00	0.00
28 Public enterprise	0.02	0.02	0.04	0.04	0.05	0.04	0.03	0.02	0.07	0.03	0.03	0.02	1.00	0.00
29 Private enterprise	0.16	0.17	0.26	0.25	0.32	0.27	0.21	0.52	0.45	0.27	0.23	0.19	0.00	1.00
Total Production	2.64	3.04	3.27	3.65	3.08	3.23	2.68	2.41	1.46	3.82	2.67	2.40	0.00	0.00
Total household income	0.49	0.55	0.91	0.88	0.88	0.94	1.65	1.22	0.94	1.89	1.66	1.59	0.00	0.00

income from agricultural capital and non-agricultural capital, respectively.

Columns 25, 26, and 27 show the impact of income transfers to the three kinds of household, agricultural household, government-employed household, and non-agricultural household. The results are that the agricultural household induces the highest figure in the whole economy at 3.82 units, followed by 2.67 units from government-employed household, and 2.40 units from non-agricultural household. Agricultural households also generate the highest unit in total household income, 1.89, followed by 1.66 and 1.59 units from government-employed households and non-agricultural households, respectively.

IV.3. Policy Simulations

The analysis performed several simulations of impacts from an exogenous change, such as an increase in export demand, an increase in demand by government, an increase in investment by government or abroad, or an income transfer from government to households. The samples for computation of simulation A and B are shown in Table 7, and all the results of the simulations are shown in Table 8. For example, the result of simulation A (An increase of exports of all products and services together by 100 million baht. This increase is assumed to be distributed among all sectors in proportion to their initial exports.) shown at the end of column A in Table 7 (with total domestic production at 321.2, total household income at 70.1, government income at 3.2, total imports at 55.7, and total savings at 25.3) are also shown in Table 8 in row A. From the simulations, it is interesting to examine the impact on production, incomes, government's revenues, change in import, and total saving.

Table 7 Social Accounting Matrix Multipliers in Thailand: Policy Simulations

	Base values x (million Baht)	**Simulation A**: Increase of all products and services exports by 100 million baht Shock Δf (million Baht)	Impact Δx	Change $\Delta x/x$ (%)	**Simulation B**: Increase of other crops exports by 100 million baht Shock Δf (million Baht)	Impact Δx	Change $\Delta x/x$ (%)
1 Paddy	174,385	0.0	5.1	0.003	0.0	4.5	0.003
2 Other Crops	49,999	0.8	1.0	0.002	100.0	100.6	0.201
3 Vegetable and fruits	279,866	0.4	6.3	0.002	0.0	8.1	0.003
4 Other raw agri. pdt.	182,945	3.1	5.4	0.003	0.0	13.4	0.007
5 Livestock	133,033	0.2	3.2	0.002	0.0	4.1	0.003
6 Fishing	235,441	3.3	6.9	0.003	0.0	3.3	0.001
7 Forest	16,226	0.1	0.4	0.003	0.0	0.3	0.002
8 Mining	249,876	0.3	6.4	0.003	0.0	4.3	0.002
9 Rice and flour	339,747	3.9	10.5	0.003	0.0	9.2	0.003
10 Meat	113,550	0.0	2.5	0.002	0.0	4.2	0.004
11 Canned food	274,255	3.4	8.3	0.003	0.0	2.9	0.001
12 Other food	209,145	2.8	5.6	0.003	0.0	3.7	0.002
13 Other agri. pdt.	239,782	0.2	5.8	0.002	0.0	5.6	0.002
14 Beverage	212,408	0.3	4.8	0.002	0.0	7.8	0.004
15 Tobacco	70,306	0.1	1.6	0.002	0.0	2.3	0.003
16 Fuel	378,240	1.3	9.6	0.003	0.0	6.8	0.002
17 Other manufacturing	5,499,427	59.8	139.1	0.003	0.0	76.2	0.001
18 Infrastructure	232,572	0.4	5.5	0.002	0.0	4.4	0.002
19 Construction	490,824	0.0	4.3	0.001	0.0	5.7	0.001
20 Trade &Transportation	1,748,925	10.6	41.7	0.002	0.0	29.3	0.002
21 Services	2,389,488	8.9	47.1	0.002	0.0	43.3	0.002
22 Labor	1,460,656	0.0	32.8	0.002	0.0	43.0	0.003
23 Agri. capital	369,323	0.0	10.0	0.003	0.0	54.2	0.015
24 Non-agri. capital	2,332,976	0.0	52.8	0.002	0.0	39.4	0.002
25 Agri. household	534,327	0.0	12.3	0.002	0.0	39.2	0.007
26 Govt-employed hh.	497,127	0.0	11.0	0.002	0.0	14.3	0.003
27 Non-agri household	2,138,980	0.0	46.7	0.002	0.0	47.8	0.002
28 Public enterprise	124,496	0.0	2.8	0.002	0.0	2.1	0.002
29 Private enterprise	1,039,641	0.0	21.9	0.002	0.0	32.9	0.003
Total domestic production	22,017,964		321.2			339.8	
Total household income			70.1			101.3	
Government incomes Δg			3.2			2.4	
Total import Δi			55.7			52.3	
Total saving Δs			25.3			28.6	

Table 8 Policy Simulations with SAM Multipliers, Thailand, 1998

Policy Experiment			Total Production	Household Income	Government Income	Total Import	Total Saving
A	Exports	All products and services	321.2	70.1	3.2	55.7	25.3
B	or	Other Crops	339.8	101.3	2.4	52.3	28.6
C	Demand from	Vegetable and fruits	382.3	90.0	3.1	50.3	29.4
D	abroad	Other raw agri. products	327.4	102.3	2.4	52.7	28.7
E		Livestock	431.3	110.2	3.5	45.1	33.1
F		Fishing	374.8	106.4	3.1	45.2	31.9
G		Forest	188.4	39.9	1.3	76.4	11.4
H		Mining	203.9	40.9	3.2	63.8	17.2
I		Rice and Flour	454.7	113.8	3.7	43.7	34.0
J		Meat	464.7	106.1	3.6	45.2	33.6
K		Canned food	410.0	85.8	2.8	52.5	29.1
L		Other food	399.1	82.2	4.4	50.5	28.4
M		Other agri. products	391.9	95.2	3.2	45.8	33.3
N		Beverage	291.3	59.2	4.2	36.0	21.7
O		Tobacco	281.2	44.1	5.1	28.7	15.7
P		Fuel	264.2	49.3	3.6	45.8	18.9
Q		Other manufacturing	303.5	55.3	2.8	62.7	20.5
R	Demand or	Paddy	374.4	133.2	2.8	43.9	34.4
S	Investment	Infrastructure	327.2	90.5	5.7	41.9	32.8
T	(except Paddy)	Construction	364.9	88.0	4.8	47.0	31.3
U	by Govt. or	Trade &Transportation	308.4	87.6	4.8	39.6	37.4
V	Exports	Services	322.9	93.6	3.6	45.1	32.9
W	Income	To Agri. Household	382.3	189.1	3.9	55.2	18.2
X	Transfers	To Govt. employed HH.	266.6	165.7	2.9	38.8	34.3
Y		To Non-agri. Household	240.5	159.3	2.6	34.7	44.2
Z		Redistribution rich to poor	136.9	28.6	1.3	19.7	-24.2
AA	Investment by	Agricultural Capital	240.5	121.5	2.5	44.8	34.6
AB	Govt. Transfers or	Non-agricultural Capital	145.7	94.0	1.6	30.6	48.6
	Investment by ROW						

IV.3.1. Examples of Policy Experiments

Policy Experiment A. Consider an increase of export of all products and services together by 100 million baht. This increase in external demand is assumed to be distributed among all sectors in proportion to their initial exports.

The result in Table 8 shows that with an increase of export of all products and services together by 100 million baht, would induce 321.2 million baht in the whole economy, generate 70.1 million baht in total household income, generate 3.2 million baht in total government income, induce 55.7 million baht in total imports, and generate 25.3 million baht in total savings.

Policy Experiment I and Q. Consider an increase of only rice and flour exports by 100 million baht (experiment I) The result (see table 8) shows that it would induce 454.7 million baht in domestic production, generate 113.8 million baht in total household income, generate 3.7 million baht in government income, induce 43.7 million baht in imports, and generate 34 million baht in savings. By contrast, an increase of manufacturing exports (non-agricultural manufacturing export, experiment Q)

by the same amount induces only 303.5 million baht in the whole economy, far less than induced by rice and flour exports (experiment I).

In terms of total household income, the manufacturing export generates only about half of that of rice and flour export. For total saving, the manufacturing export induces only three-fifths of that of rice and flour exports. The manufacturing export induces more imports into the country than the rice and flour export. The rice and flour export generates more income to the government than the manufacturing export. Since the manufacturing export induces more import, it may generate less income to the domestic production and thus reduces the government's tax base.

Policy Experiment R. Since Thailand does not export paddy directly but exports it after processing into rice and flour, the simulation for paddy has to be only in the increasing demand by the government (exogenous factor to change the shock (*f*)). The shock cannot be from the increasing investment by the government since paddy itself is not an investment good. Consider a policy of increasing paddy demand by the government by 100 million baht. The result shows that it would induce 374.4 million baht in domestic production, generate 133.2 million baht in total household income, generate 2.8 million baht in government income, induce 43.9 million baht in total imports, and generate 34.4 million baht in total savings.

Policy Experiments W, X, Y and Z. These policy experiments simulate income transfer of 100 million baht to agricultural households, government-employed households, non-agricultural households, and income redistribution from the rich to the poor. The differential impacts (see Table 8) show that the income transfer to agricultural households (experiment W) yields most benefits to the whole economy, to the total household income, and to the government incomes. However, the transfer of income to agricultural households induces more imports to the country and generates less total savings than the transfers to government-employed and non-agricultural households (experiment X and Y). For the policy experiment Z, an income redistribution of 100 million baht from non-agricultural households and government-employed households, considered as the rich, to agricultural households, considered as the poor, gives very negative outcome on total savings and induces fewer units of total production, total household income, government incomes, and imports. However, it must be noted that in simulation Z, the source of money to finance agricultural households is already known, that is, from the non-agricultural households and government-employed households, unlike in simulations W, X and Y. Therefore, even though the simulation outcomes of Z were less than those of W, X and Y, they are still positive numbers, except for the outcome of total savings. If the total production of simulation W is deducted by the amount of initial financing assumed to derive from the budget for non-agricultural households in simulation Y (382.3 − 240.5 = 141.8), we can compare the new total production of simulation W (141.8) to that of simulation Z (136.9). Since 141.8 is very close to 136.9, we have to admit that, when financed by other sectors, income transfer to agricultural households to induce total production is not significantly better than income redistribution. However,

if the income transfer is financed by the new increasing budget of the government, the induced total production (382.3) will not have to be deducted.

The negative total saving in simulation Z occurs because the income from the rich, who have a high saving rate, has to be transferred to the poor, who have a low saving rate, and therefore, the total savings decline. If the government were to apply the policy of income redistribution from the rich to the poor as in simulation Z, in the long run it would create a bigger saving-investment gap, and the country would need more foreign savings to finance this gap. Therefore, the negative outcome in total savings is highly undesirable.

Policy Experiments AA and AB. Consider the government invests capital fund into agricultural capital (experiment AA) and into non-agricultural capital (experiment AB), or else consider transfers or investment from the rest of the world to agricultural capital and to non-agricultural capital by 100 million baht. The results show that the investment into agricultural capital yields more benefits to the whole economy, to the total household income, and to the government incomes. However, the transfer to agricultural capital induces more imports to the country and generates less total saving than the transfer to non-agricultural capital.

IV.3.2 Simulation Results

From the policy experiments and the results shown in Table 8, it is obvious that, compared to the manufacturing industrial sector, agricultural and agricultural-processing sectors in Thailand have high potential to increase domestic production through linkage or multiplier effects. The agricultural and agricultural-processing sectors also have better potentials to generate more income to different households, to create better income distribution, and to induce more savings in the country. Moreover, these help to support the argument that the Thai agricultural sector has long been an engine of economic growth as it may have boosted the economy through its multiplier effect. On the other hand, the government's biased policies to subordinate agriculture for the urban industrial sector may have hindered the economic growth and country's income distribution.

The sector that induces highest production in the economy if it receives economic stimulations, such as an increase in export demand, an increase in demand by government, an increase in investment by government or from abroad, or an income transfer from government to households, is meat production, followed by rice and flour, and livestock. The sector that induces the least is forestry, followed by mining, and fuel.

The sector that generates highest income to the different households in total if it receives economic stimulations is paddy, followed by rice and flour, and livestock. The sector that generates the least income is forestry, followed by mining, tobacco, and fuel. From 1998 SAM calculation, the ratio of labor in its value added of the paddy sector was 65 percent, that of rice and flour sector was 39.7 percent, and that of livestock sector was 55.8 percent. The ratio of labor in its value added of the forestry

sector was 13.5 percent, that of mining sector was 12.1 percent, that of tobacco sector was 0.6 percent, and that of fuel sector was 21.7 percent. Sectors that create better income distribution (income generation to agricultural households close or equal to income generation to non-agricultural households, and are relatively in high value (see Table 6)) are fishing, other crops, and other raw agricultural products. Economic stimulations into agricultural capital would generate better income distribution among agricultural and non-agricultural households. Economic stimulations into mining, beverage, tobacco, fuel, manufacturing, infrastructure, construction, trade and transportation, and service sectors would worsen the income distribution among different households as non-agricultural households would benefit the most.

The sector that induces highest total saving in the economy if it receives economic stimulations is trade and transport, followed by paddy, rice and flour, meat, and other agricultural products. The sector that induces lowest savings into the economy is forestry, followed by mining, tobacco, and fuel. However, economic stimulations into agricultural households would induce low savings in the country, but economic stimulations into non-agricultural capital and non-agricultural households would induce high savings in the country. This is because the agricultural households are basically poor and lack savings. From 1998 SAM calculation, the ratio of agricultural household's saving to the country's total saving was -3.7 percent, while that of the government-employed household was 2.5 percent, and that of the non-agricultural household was 25.9 percent. Therefore, if the agricultural households received some transfers from the government, the money would be used for consumption rather than for investment, which would generate less multiplier effects. This reason relates and helps to refine the result of experiment W that the transfer of income to agricultural households induces more imports to the country than the transfers to government-employed and non-agricultural households (experiment X and Y). Since the agricultural population in Thailand is large, with 51 percent of the total labor force engaged in agriculture in 1998, agricultural households then consume products (and they consume more than they can save) not only from their own sector but from non-agricultural and services sectors which have high import ratios to their sector output. From 1998 SAM calculation, the manufacturing sector's import ratios to its sector output was 35 percent, and the service sector's import ratios to its sector output was 11.7 percent, while that of the agricultural and agricultural processing sectors together was 5.6 percent. Therefore, the huge consumption from the agricultural households can induce more imports to the country through this multiplier effect.

For inducing government income, the agricultural and agricultural-processing sectors have less potential than the infrastructure, construction, trade and transportation, beverage, and tobacco sectors due to the fact that the tax rates on the agricultural sector are quite low and there are also many tax exemption policies being applied in the sector (as to avoid the administrative complexity and political difficulties of introducing a large land tax or any similar direct tax on the peasant). The government's revenue from the agricultural sector comes mostly from the import tariffs since Thailand, to some

extent, still protects its agricultural domestic market. Induced government income from the manufacturing sector is also quite low. This may be due to the fact that it receives many kinds of tax exemptions or privileges from the Thai government's Board of Investment (BOI) to promote industrialization in the country. From 1998 SAM calculation, the average import tariff rate on agricultural and agricultural processing sectors together was 4.4 percent, while that on the manufacturing sector was 3.5 percent. Moreover, the ratio of tax in value added of the agricultural and agricultural processing sectors together was only 0.9 percent, and that of the manufacturing sector was 4.9 percent. Since other sectors use a lot of products from agricultural and manufacturing sectors as their intermediate inputs, government receives lesser tax from these two sectors due to the multiplier effect. In addition, since the manufacturing sector induces more import (35 percent to its sector output in 1998), it may generate lesser income to the domestic production and thus reduces the government's tax base. On the contrary, it is no surprise to see that from the simulation results in Table 8, the sectors which generate highest income to the government are infrastructure and tobacco. The construction sector ranked the same as the trade and transport sector, generating quite high income to the government. These are because, for the infrastructure sector, most enterprises were state-owned or partly owned by the government in 1998. (In 2002, many state-owned enterprises started their gradual transformation into privately-owned enterprises). For the tobacco sector, the government has always imposed heavy taxes. From 1998 SAM calculation, the ratio of tax in beverage and tobacco's value added was as high as 98.5 percent, and the average import tariff rate on tobacco sector was 10.8 percent. For the trade and transportation sector, most of the transportation companies are either run by the government or pay a high premium to stay in the oligopoly market, and the ratio of value added in its production was as high as 60 percent from 1998 SAM calculation. For the construction sector, there is no clear explanation, but the induced government revenue may be generated from taxing its labor as the ratio of labor in its value added was as high as 51 percent from 1998 SAM calculation.

For linkages to the rest of the world or effects to imports, the economic stimulations into forestry, mining and manufacturing sectors would induce more import demands in the country. This is unsurprising as Thailand has continually increased its timber imports since the 1989 ban on logging in natural forests. From 1998 SAM calculation, the import ratio to domestic output of the forestry sector was as high as 155.2 percent, and that of the mining sector was 82.7 percent. There is also no doubt why the manufacturing sector induces more import demands, as it has many imported contents in its input materials, and the import ratio to domestic output of this sector was 35 percent from the 1998 SAM calculation. By contrast, the economic stimulations into tobacco, beverage and trade and transport sectors would induce lower import demands in the economy. This may be caused by the low import ratio to output these sectors have (6.2 percent for tobacco sector, 4.7 percent for beverage sector, and 4.2 percent for trade and transportation sector).

Most simulations do not touch on how to finance the transfers or investment made by the government, nor do they guarantee that there will be an increase in export or a transfer from abroad. The money input to a sector in the simulation can be derived from either the new increasing government budget from the year before, or it can be drawn from budget reallocation from one sector to another sector. In the latter case, it may create problems of what is the proper budget reallocation strategy, or conflicts between different ministries or departments. Since one of the limitations of the I-O/SAM analyses is that the simulations are likely to be unrealistic, I-O/SAM models are not used as predictive models or to examine the feasibility of simulation assumptions, such as whether it is easier to increase 100 million baht of agricultural export or to increase 100 million baht of non-agricultural export. Therefore, when planning for a project's budget or working on a project appraisal, more careful studies on cost-benefit analysis need to be conducted along with the assessment of the project's purpose. If a sector is financed by increase in exports or increase in demand from abroad, the problems of budget reallocation can be avoided.

V. Conclusion

In this paper, we have used the 1998 SAM of Thailand to investigate potential for reviving the role of the agricultural sector in the Thai economy and improving its income distribution. The results from the simulations prove that Thai agricultural and agricultural-processing sectors have better linkage or multiplier effects than Thai non-agricultural manufacturing sectors to: 1) induce more production in the economy; 2) generate more income to different households; 3) create better income distribution in the country; 4) induce more savings in Thailand. Moreover, it shows that although agriculture is almost always viewed as a less productive sector with low production multipliers, this SAM approach shows outcomes opposite to that perception. The linkage or multiplier effects of agricultural and agricultural-processing sectors in Thailand are better than those of the manufacturing sector. Furthermore, agricultural and agricultural-processing sectors induce a relatively more equitable distribution of income. These findings form an argument against those who ignore the importance of basing a development strategy on agriculture, in the erroneous belief that with scarce resources, investment should be concentrated on selected industrial sectors with high multipliers.

Notes

1 From the mid-nineteenth to the mid-twentieth century, the peasantry was introduced and was the foundation of Thailand's society and economy. As Phongpaichit and Baker (1995: 3) described, at the start of the nineteenth century, most of the area in Siam which was later settled was covered by jungle, scrub, and marsh. The agrarian population was small, and was bound by labor indenture to the nobility. The new peasantry broke through the boundaries of settlement and the bonds of social control to create a new rural society on a moving agrarian frontier. Rural Siam during this period was a frontier society with little interference by

overlords or the government, and needless to say, no welfare system. After the World War II, poverty was overwhelmingly a rural phenomenon. From when statistics were provided, in 1975/6, 36.1 percent of the rural population was living below the poverty line (12.5 percent for the urban population). In 1987/9, this fell to 29.4 percent, but was still high compared to that of the urban population (6.9 percent) (TDRI). Another source of statistics states that the percentage of poor in villages in 1992 was 29.7 percent (3.6 in municipal areas), 21.2 percent in 1994 (2.4 percent in municipal areas), and 14.9 percent in 1996 (1.6 percent in municipal areas) (NESDB 1999). The UNDP's Human Development Report of Thailand 1999 shows Human Development Index figures of 0.912 for Bangkok, 0.873 for central region, 0.897 for eastern region, 0.817 for western region, 0.655 for northeastern region, 0.717 for northern region, 0.766 for southern region, and 0.880 for the whole kingdom (UNDP 1999: 112).

2 Cambodia, Indonesia, Lao PRD, Malaysia, Philippines, and Vietnam are selected because they are ASEAN countries with similar climate, features of cultivation, and labor utilization. Bangladesh, China, and India are selected because they are Asia's developing countries which have quite strong agricultural sectors. Korea, Rep is selected because it is a newly industrializing economy whose path Thailand may follow. Japan is selected because it is considered Thailand's influential model of development with the same constitutional monarchy.

3 Author's own calculation using data from National Statistical Office. 1999. *Statistical Yearbook Thailand*. (46), and National Statistical Office. 2003. *Statistical Yearbook Thailand*. (Table 7.2).

4 In the early 1990s, owing to the short-sighted entrepreneurial and government approaches to the country's resources, Thailand was running out of water as water demand in agriculture, industry, and Bangkok was skyrocketing (Bello 1998: 166). Although most of the dam-water had traditionally been used for irrigation, especially for the second crop during the dry season, agriculture was now being squeezed by competing demands from other sectors and urban-industrial interests, like the Electricity Generating Authority of Thailand (EGAT), the Bangkok Metropolitan Water Authority (BMWA) (Christensen 1993), and golf courses. To accommodate urban demand, the Royal Irrigation Department in fact reversed its 40-year policy of encouraging farmers to plant a second rice crop during the dry season. This was highly threatening to farmers, who had become dependent on the second crop to make ends meet following the low rice price policies implemented by the government.

5 Wattana Sugunnasil. 1991. The State and Agrarian Policy in Thailand, 1960-80. *Ph.D. dissertation*. Wisconsin: University of Wisconsin at Madison. May 1991, p. 84. Cited in Bello (1998: 135).

6 His Majesty brought back and developed the old knowledge of integrated farming to apply in Thai agriculture once again. The *New Theory* points out ways to manage and increase agricultural production by applying mixed-crop and organic-crop agriculture for adequate household consumption, while surplus can be sold on the market. At the same time, it aims to improve rural livelihood, quality of life and the environment while increasing participation and cooperation among the villagers. It includes the meaning of self-sufficient and self-reliant. The King called it a *self-sufficient economy*. This strategy has been widely welcomed and adapted

by many farm households and rural people who found it very helpful, adaptable, and meaningful to their way of life.

7 Mining account comprises coal and lignite, crude petroleum and natural gas, and other mining.

8 Fuel account comprises gasoline, diesel, aviation fuel, and fuel oil.

9 Other manufacturing account comprises textiles, apparel, leather and footwear, wood products, furniture, paper, printing and publishing, basic chemicals, plastic and rubber, non-metal products, basic metals, fabric metals, machines, electrical manufacturing, transport equipment, and other industry.

10 Infrastructure account comprises electricity, gas distribution, and water.

11 Trade and transportation account comprises retail trade, land transportation, ocean transportation, inland water transportation, air transportation, and other transportation.

12 Services account comprises restaurants, hotels, communication, banking, insurance, real estate, business services, public administration, education, health care and medical, nonprofit organizations, recreation, repairs, and personal services.

13 Data from National Statistical Office's website. Report of the Labor Force Survey 2001-2003 (Table 4) (http://www.nso.go.th/eng/stat/lfs_e/lfse-tab4.xls).

References

Books and publications

Bello, Walden, et al.1998. *A Siamese Tragedy*. New York: Zed Books Ltd.

Christensen, Scott and Boon Long, Areeja. 1993. Better Water Management Needed. *The Nation*. 17 September 1993. Bangkok: The Nation.

Li, Jennifer Chung-I. 2002. *A 1998 Social Accounting Matrix (SAM) for Thailand: TMD Discussion Paper No. 95*. Washington DC: International Food Policy Research Institute.

NESDB (Thailand's National Economic and Social Development Board). 1999. Poverty and Inequality During the Economic Crisis in Thailand. *NESDB newsletter*. January 1999. Bangkok: NESDB.

Phongpaichit, Pasuk and Baker, Chris. 1995. *Thailand: Economy and Politics*. New York: Oxford University Press.

Sadoulet, E. and A. de Janvry. 1995. *Quantitative Development Policy Analysis*. Baltimore: John Hopkins University Press.

Sugunnasil, Wattana. 1991. The State and Agrarian Policy in Thailand, 1960-80. *Ph.D. dissertation*. Wisconsin: University of Wisconsin at Madison.

United Nations. 1999. *Handbook of Input-Output Table: Compilation and Analysis*. New York: United Nations.

United Nations Development Programme. 1999. *Human Development Report of Thailand 1999*. Bangkok: UNDP.

World Bank. 2001. World Development Indicators. Washington DC: World Bank.

World Bank. 2002. World Development Indicators. Washington DC: World Bank.

Websites

Bank of Thailand.
http://www.bot.or.th/bothomepage/databank/EconData/EconData_e.htm
Food and Agriculture Organization of the United Nations（FAO）. Statistical Database.
http://www.fao.org/waicent/portal/statistics_en.asp
NESDB（Thailand's National Economic and Social Development Board）
http://www.nesdb.go.th/econSocial/macro/macro.php
NSO（National Statistical Office）
http://www.nso.go.th
TDRI（Thailand Development Research Institute）
http://www.info.tdri.or.th