

The international linkage of economic policy in Lower Mekong Region  
- Four country CGE approach -

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Summary

Thailand, Vietnam, Cambodia and Lao PDR belong to Lower Mekong Region. Though each country stays in different development stage each other, these countries have strong economic relationships. So the development policy must be different country by country. An implication of policy in one country may be crucial to other country. In addition, these countries will be much more integrated via ASEAN FTA. Under such situation, it is of importance to reconsider the development strategies of each country. In this paper, we will construct four country international CGE model, and evaluate the policy implication of each country's industry and/or development policies.

## 1. INTRODUCTION

Lao PDR is located in a central part of Indochina peninsula, faces Yunnan in China, Myanmar, Thailand, Cambodia and Viet Nam, and is landlocked by these countries. The population is about 5,500 thousand, the area of this small country is 237 thousands km<sup>2</sup>. Population density is low, 23 person /km<sup>2</sup>. About 80% of this country is mountainous areas. Population growth rate is high and the average life expectancy is short. It is at the first stage of economic development. According to World Bank's WDI, annual per capita GDP in Laos is about 400 US dollars. The daily calorie supply estimated by FAO is around 2300 kcal, which is almost the same level as Sub Sahara region. Lao has been ranked as one of the poorest countries among Less Developed Countries.

Electricity generation, textile, wood and wood products are main industries for exportation. In recent years, some of the mineral resources are under development. On the other hand, many consumption goods as well as capital goods are imported since Laos has few industries for these products. The constant international trade imbalance and government financial deficit are remarkable characteristics in Laos. The deficit is difficult to be financed by domestic saving, and has been financed by donation and loan from foreign governments.

It is a common observation that a country in transition from less developed country to developed country

is changing its industrial structure from agriculture to manufacture dependent structure. But the industrialization in Laos might not be easier. It is realistic to utilize rich natural resource such as water for Lao's economic development. Electricity generation, traditional handcrafts, tourism and mining seem to be promising sectors for economic development.

The purposes of this study are to estimate Input-Output table and Social Accounting Matrix for development planning of Laos and to consider the possibility of the economic development through natural resource utilization. Though input-output table and SAM are very important tools for making development plan, these data are not estimated in Laos. After estimating these tables, two case studies are conducted. One of these is an evaluation of economy wide effect of one unit exportation of electricity, crops, wood products and textile. The other is the evaluation of land productivity increase through paddy field irrigation. Though we employ simple SAM multiplier analysis, it provides us with first order approximation of these effects.

## 2. DATA AND METHOD

Laotian government does not publish input-output table and Social Accounting Matrix. Therefore, we are required to estimate them. The methods for analysis are skyline analysis and SAM multiplier analysis. Since the methods for analysis are familiar, we concentrate on the detailed SAM estimating procedure in this section.

**Table 1 Typical macro Social Accounting matrix**

	1	2	3	4	5	6	7	8	9
	Activity	Commodity	Factors	Firm	Household	Government	Capital	ROW	Total
1	Activity	Sales							Domestic Production
2	Commodity	Intermediate			Private Consumption	Gov't Consumption	Investment	Export	Market Supply
3	Factors	Value Added							Factor Income
4	Firm		Capital Income			Transfer			Firm Income
5	Household		Labour Income	Divident		Transfer		Remittance	HH Income
6	Government	Indirect Tax	Tariffs	Corporate Tax	Income Tax			Foreign Grants	Gov't Revenue
7	Capital			Corporate Savings	HH Savings	Gov't Savings		F.D.I.	Total Savings
8	ROW		Import	Factor Income paid to ROW			Investment to ROW		Foreign Exchange Outlays
9	Total	Production Cost	Absorption	V.A.	Firm Expenditure	HH Expenditure	Gov't Expenditure	Total Investment	Foreign Exchange earning

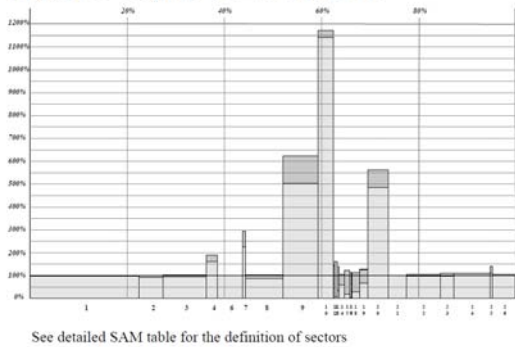
Social Accounting Matrix is a square matrix that records all of the transactions conducted in a certain period between production sectors, agents, and economic institutions. Typical SAM is shown in **Figure 1**. Each cell in the SAM represents expenditure

by the column account to the row account. Let us consider, for example, household sector. This institutional sector gets income from labor supply, dividend from share holding, government transfer and remittance from abroad. Household row in the SAM represents these various income sources of the household sector. After deducing income tax from the income, household sector allocates their disposable income into two parts: savings and consumption. Total consumption expenditure is allocated to each commodity. The expenditure flow is represented by Household column in the SAM.

Input-output tables are traditionally used for development planning, since it provides production sectors in detail. It captures only the transaction of good and services, and does not include enough institutional details to provide a framework for considering the full impact of policy on the economy.



Figure 3 Skyline of Laos at 2001



Findings from this figure are as follows:

- agricultural and service sectors are almost self sufficient with little export and import
- other crops (including coffee), textile and its products, wood and wood products, and electricity generation earn much foreign exchange by its exportation, but the share of these sectors are not so large
- domestic production of heavy and chemical industries cannot fulfill the domestic final demand and much import is required in these sectors.

In order to evaluate the Laotian industrial structure, we need to compare with different years or different countries. Laotian industrial structure is compared to the experience of Thailand. Because of the space, we omit the skyline charts. But we know from the charts that agriculture and food manufacturing had a large share and were exporting sectors, while manufacturing sector had small share and was importing sectors at the first stage of the economic development (high sufficiency ration in agriculture and low in manufacture). As Thai's economy grows, the share in agriculture and food manufacturing are declining, while the share in manufacturing sector (including capital good) is increasing. Textile sector becomes exporting sector. The process of structural change in industry is a typical pattern of economic development.

Comparing to Thai's experience, characteristics of Laotian industrial structure are the high share sectors (agriculture) has almost no export, share of exporting sector is small (about 20%), and resource based export such as mining and electricity are mainly contributed to Lao economy. It is important idea to improve agriculture as exporting sector if the international commodity market situation permits (for example, maize for feed).

## 2) SAM multiplier analysis

According to the skyline analysis, the foreign exchange earning by export is remarkable in "other crops (including coffee)", "wood and wood products", "textile and its products" and "electricity generation". In addition, from the viewpoint of foreign exchange acquisition, the effect of grant from foreign countries as well as foreign borrowing is significant. Therefore, in the SAM multiplier analysis, we evaluate the impact on various industries and economic institutions (endogenous sectors) with one unit increase in the exogenous sector (exporting sectors). In order to compare input-output multipliers, we show both multipliers in the

same table.

Table 4 Multipliers and evaluation of Land Productivity Increase

	Total Value (bill. Kips)	Multipliers										5% increase in Land productivity for rice production	
		IO multipliers					SAM multipliers					dOutput (bil. Kip)	%
		One unit of increase in					One unit of increase in						
Other Crops EXP	Textile EXP	Wood and Wood products EXP	Electricity EXP	Grant	Other Crops EXP	Textile EXP	Wood and Wood products EXP	Electricity EXP	Grant				
1 Grain	6,218	0.06	0.02	0.01	0.00	0.00	1.89	1.34	1.11	1.45	1.56	311	3.0
2 Vegetables and Fruits	1,524	0.00	0.00	0.00	0.00	0.00	0.45	0.32	0.36	0.38	0.38	38	2.5
3 Livestock	2,511	0.00	0.02	0.00	0.00	0.00	0.73	0.54	0.44	0.58	0.63	67	2.7
4 Other crops	623	1.09	0.06	0.01	0.00	0.00	1.18	0.13	0.06	0.07	0.08	18	2.9
5 Forestry	80	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.05	0.00	0.00	3	3.2
6 Fishery	1,455	0.00	0.00	0.00	0.00	0.00	0.43	0.31	0.26	0.34	0.36	37	2.5
7 Mining and Quarrying	164	0.00	0.01	0.01	0.15	0.01	0.01	0.01	0.01	0.16	0.01	5	3.1
8 Food Manufacturing, Beverages and Tobacco	2,427	0.00	0.01	0.01	0.01	0.01	0.71	0.52	0.44	0.57	0.61	121	3.0
9 Textile and its products	2,167	0.00	1.58	0.01	0.01	0.01	0.08	1.63	0.06	0.06	0.07	68	3.1
10 Wood and wood products	874	0.00	0.00	1.29	0.00	0.00	0.02	0.01	1.30	0.01	0.02	28	3.2
11 Paper products and publishing	153	0.00	0.02	0.04	0.01	0.01	0.03	0.03	0.05	0.03	0.04	5	3.1
12 Chemical Industries	1,438	0.10	0.18	0.20	0.27	0.34	0.35	0.34	0.46	0.25	40	2.8	
13 Rubber and Plastic products	278	0.00	0.02	0.08	0.01	0.06	0.06	0.11	0.05	0.06	8	2.8	
14 Non-metallic mineral products	416	0.00	0.00	0.01	0.00	0.10	0.07	0.07	0.08	0.13	11	2.7	
15 Basic metal and metal products	666	0.03	0.02	0.16	0.02	0.16	0.11	0.24	0.12	0.16	19	2.8	
16 Industrial Machinery	923	0.02	0.02	0.08	0.02	0.21	0.16	0.20	0.17	0.26	25	2.8	
17 Electrical Machinery	28	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	1	2.7	
18 Motor Vehicles and transportation equipments	1,200	0.01	0.02	0.10	0.06	0.39	0.22	0.26	0.28	0.32	32	2.7	
19 Other Manufacturing	747	0.00	0.10	0.02	0.01	0.15	0.21	0.11	0.13	0.19	21	2.8	
20 Electricity and Water Works	1,180	0.00	0.04	0.06	1.26	0.03	0.06	0.08	1.28	0.04	37	3.1	
21 Construction	1,046	0.00	0.00	0.00	0.00	0.24	0.17	0.15	0.19	0.33	28	2.7	
22 Whole and retail	1,954	0.01	0.04	0.08	0.01	0.44	0.35	0.34	0.36	0.59	53	2.7	
23 Restraints and Hotels	768	0.01	0.01	0.04	0.02	0.30	0.15	0.16	0.17	0.20	20	2.6	
24 Transportation and Communications	2,061	0.02	0.04	0.14	0.05	0.52	0.40	0.45	0.45	0.54	55	2.7	
25 Banking	159	0.00	0.01	0.02	0.03	0.03	0.03	0.04	0.05	0.03	4	2.8	
26 Other Services	1,312	0.00	0.02	0.03	0.03	0.36	0.21	0.19	0.24	0.55	37	2.8	
27 Wages and Salaries	3,393					1.00	0.74	0.62	0.68	0.92	76	2.3	
28 Other V.A.	12,169					3.67	2.59	2.16	3.01	2.95	315	2.6	
29 Household	14,148					4.24	3.03	2.53	3.34	3.53	355	2.5	
30 Enterprise	12,169					3.67	2.59	2.16	3.01	2.95	315	2.6	
31 Government	3,169					0.61	0.44	0.38	0.50	1.52	90	2.3	
32 ROW	4,396					0.00	0.08	0.01	0.00	0.06	141	2.7	
33 Capital	4,927					1.12	0.81	0.68	0.90	1.58	133	2.7	
34 Total	86,753										2,518	2.7	
35 Ind total	32,371	1.37	2.23	2.47	1.97	8.36	7.38	6.78	7.67	7.42	1,092	2.7	

Source: Estimated by the author

Table 4 presents SAM multipliers. Input-output multipliers are in general smaller than SAM multipliers, and close to zero except for the

multipliers of their own sectors. Industry sum of multipliers regarding to all industrial sectors (in the last row in the table) are distributed between 1.37 and 2.47. Influential sectors are Wood and its products and Textile and its products. Electricity is not so much influential to the industrial sectors. Other crops that include coffee have the least input output multiplier among exporting sectors. Input output multipliers of agricultural sectors are in general small, due to the inter industry structure of the commodity flow. Next, let us look at the SAM multipliers. Two characteristics are in order. First, the multipliers for industrial sectors are significantly greater than input output multipliers. Because SAM multipliers include the income linkage effect as well as inter industry linkage effect. Second, the multipliers regarding to the institutional sectors are greater in value than that of industrial sectors. It is important to abstract from this table that income linkage is stronger if the inter industry transaction is not so developed in the economy like Laos. This is true if we analyze a village economy where little industry exists. The order of impact on industrial sectors is different from the outcome of input output multipliers. Most influential export sector is the other crops and the next influential sector is the electricity. It is a little surprise, since the multipliers are not so small in spite of the very small amount of any inputs of this industry (see **Table 2**). Anyway, electricity is important for the Lao economy. Note also that the foreign grant is influential to the economy.

Grains in disaggregated SAM contain rice and maize. More than 90 % of it is rice. So we think of grains as rice. We evaluate the impact of 5% increase in land productivity for rice production. The rice yield is assumed to be increased 5% by technological improvement even without the increase in intermediate inputs of production. By this technological progress, the value added of the rice production increases, and it contributes the increase in the farm income. The farm income increase contributes, in turn, the increase of private final consumption and government revenue. The activity level of rice milling which is counted as a food manufacturing sector is also stimulated. Total effect of the land productivity increase is evaluated in the last two columns of the table. Productivity increase derives 2.7 percent growth in industry output, while it derives 2.3 to 2.6 increases in wage or other value added such as rent for paddy field. Thus, land productivity improvement is important for the economy.

### **3) Implication to the economic developments**

While manufacturing sectors are free from natural limitations, agricultural development is restricted by natural conditions and the natural resources. In order to breakout the limitation in agriculture, scientific agriculture is indispensable. In other word, technological progress is necessary for efficient use of scarce resources. Looking over the various process of economic development, we know it is necessary to develop the agricultural sector at first stage of economic development. The reasons are that agricultural sector is expected to expand the production for sufficient food supply, this sector supplies capital and labor for the industrialization, and that the development of this sector contributes the poverty reduction since the large share of population engages in agriculture.

Let us consider the case of Laos. It is clear from the above SAM multiplier analysis that the technological progress for land productivity increase raises the production of staple glutinous rice. We can say nothing from the SAM multiplier analysis whether agricultural sector can push out labor or not. To ascertain this point, another method such as computable general equilibrium model is required.

How about the coffee export? Though SAM multiplier is surely large, another consideration is necessary whether this is preferable for economy. The export of agricultural commodity is important for foreign exchange earning, but the international price fluctuation of primary commodities is also large (instability of international price). Export price declining may have negative influence on the economic growth (Prebisch and Singer Hypothesis). In addition, high SAM multiplier means that impact of a change in international price is magnified to the domestic economy. It is recommended to avoid export specialization of a few of specific

commodities and to reduce the price risk for exportation by increasing the variety of export commodities.

How about electricity export? Since LAOS is water resource abundant country, it has a comparative advantage for producing and export electricity (supply side condition). The neighbor countries who enjoy high economic growth rate show high demand for energy (demand side condition). In addition, hydraulic power generation is preferable in terms of the environment. If export is determined by a long period contract basis, export price is rather stable. Since dam construction for hydraulic power generation may lead to the environmental disruption of Laos, it should be careful to evaluate benefit and cost for dam construction. We must not underestimate environmental damage.

#### **4. SUMMARY AND CONCLUSION**

The purposes of this study were to estimate Input-Output table and Social Accounting Matrix for development planning of Laos and to consider the possibility of the economic development through natural resource utilization. Since Lao government does not estimate national income under System of National Account, it was hard to obtain required data. This means that our estimation is conducted under severe restrictions of data availability. Significant improvement will be expected when Laotian government conducts through economic surveys for estimating national income account. It is, however, the first attempt to estimate these statistics. Since these data are fundamental for quantitative consideration of economic development strategy, our effort is meaningful and empathized. Second, employing skyline analysis, we analyze the industrial structure of Laotian economy. Comparing with Thai's experience, we show a possibility of economic development by resource based exportation and by productivity improvement in agricultural sectors. Third, detailed SAM is constructed and SAM multipliers are evaluated and compared with input-output multipliers. This analysis shows the importance of income linkages as well as inter-industry linkages in Laos. Since SAM multiplier analysis is based on a simple linear general equilibrium setting, analysis by nonlinear computable general equilibrium model is our possible next step.

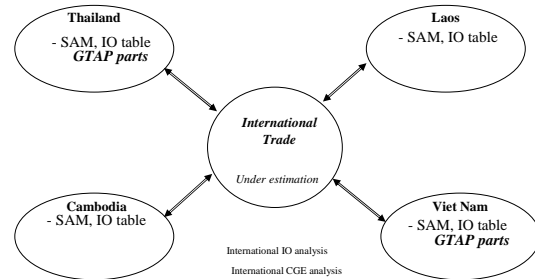
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## Sketch of our study: purpose

- To evaluate economic dependency within lower Mekong Countries
- To capture economic structure of LMC
- To construct numerical model (e.g. IO model, CGE model)
- To consider the relationship between Water Resource Endowment and economic development

## What have we done so far



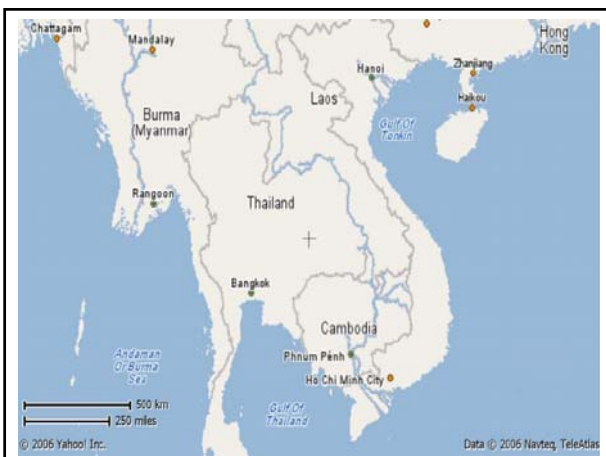
## Impact of 1% TFP growth in mnfcs on imports(% change)

Commodity/sector	Thailand	Vietnam
Rice	0.02	-0.03
Other Grains	0.03	0.18
Vegetables and Fruits	0.80	0.99
Raw Sugar	0.24	0.04
Livestock	0.98	0.18
Other Agriculture	0.81	0.51
Fishery	0.20	0.18
Forest	<b>0.57</b>	<b>7.37</b>
Mining	0.20	<b>1.21</b>
Food Products	0.08	0.05
Wood Products	0.57	1.37
Mnfc	0.20	0.19
Construction	-0.12	-0.34
Public Utility	<b>2.87</b>	<b>1.16</b>
Electricity	<b>10.13</b>	<b>0.96</b>
Service	0.41	0.75

Source) estimated using GTAP model

## Outline of the Presentation

- Background of our studies
- Overview of Laos
- Estimation of Social Accounting Matrix
- Skyline analysis
- IO and SAM multiplier analysis
- Implication for the development strategy



## Overview of Laos

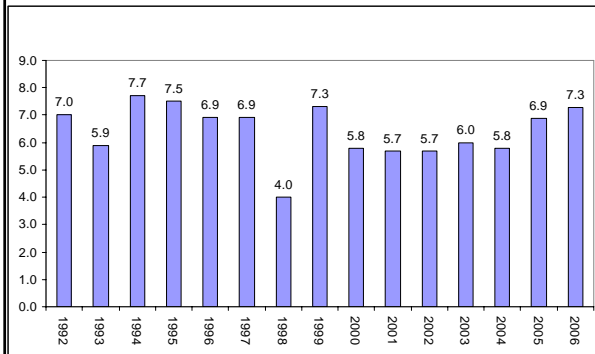
- Population, per capita GDP, inflation ratio
- Export and Import
- Capital inflow (FDI)
- Water Resource

## Basic Statistics for Laos

	Laos	Cambodia	Vietnam	Thailand
Population (thousands, as of 2000)	5,279	12,744	78,523	61,438
per capita GDP, (constant 2000 year US dollars, as of 2000)	329	287	397	1,998
Inflation rate, consumer prices (annual %, as of 2000)	25.1	-0.8	-1.7	1.6
Export (million dollars, as of 2000)	391	1,123	14,483	68,963
Import (million dollars, as of 2000)	690	1,424	15,637	61,924

Source: Population, GDP per capita, Inflation rate: WDI(WB) ; Export and Import: DOT(IMF).

## GDP Growth Rates (1992-2006)



Source: Statistical Yearbook, various issues, NSC, Lao, PDR

## Inflation: CPI and GDP deflator (annual %)

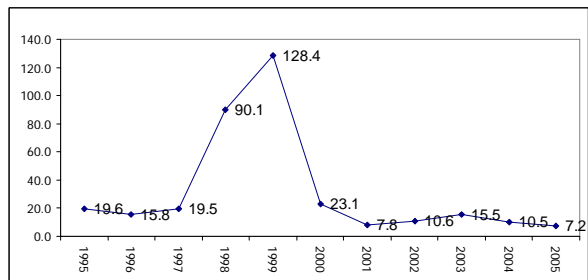
CPI	1998	1999	2000	2001	2002	2003	2004
Lao PDR	91.0	128.4	25.1	7.8	10.6	15.5	10.5
Cambodia	14.8	4.0	-0.8	-0.6	3.2	1.2	3.9
Vietnam	7.3	4.1	-1.7	-0.4	3.8	3.1	7.8
Thailand	8.1	0.3	1.6	1.6	0.6	1.8	2.8

GDP defl.	1998	1999	2000	2001	2002	2003	2004
Lao PDR	85.3	127.0	25.1	8.6	10.6	13.9	10.3
Cambodia	10.2	1.7	-3.1	0.0	2.3	1.1	5.3
Vietnam	8.8	5.7	3.4	1.9	3.9	6.7	7.9
Thailand	9.2	-4.0	1.3	2.1	0.8	1.6	3.3

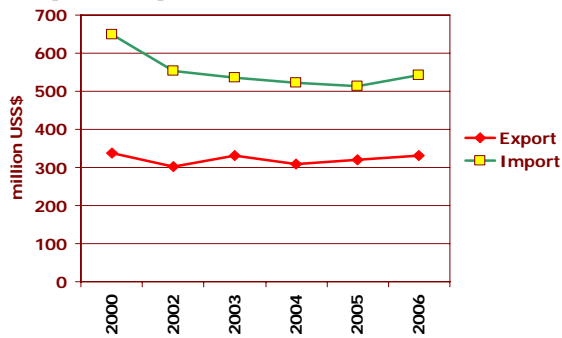
Source: IMF

## Inflation Rates: 1995-2006



Source: Statistical Yearbook, various issues, NSC, Lao, PDR

## Export and Import Value 2000-2006



Source: Statistical Yearbook, various issues, NSC, Lao, PDR

## Export by Sectors

	2002-2003	2003-2004	2004-2005	2005-2006
Wood and Wood Products	19.0	19.1	15.8	10.9
Rattan/Bamboo	0.8	0.3	0.4	0.0
Minerals	3.2	1.7	10.0	28.3
Gold	10.0	16.3	18.2	16.5
Forestry Products	1.6	0.9	0.9	1.6
Live animals& Products	0.6	1.1	0.7	0.1
Coffee	2.5	3.5	2.1	0.9
Other Agricultural products	3.1	3.5	4.3	7.2
Handicraft	3.5	0.5	0.6	0.0
Garment	24.7	26.5	23.6	23.2
Other Manufacturing Goods	2.0	2.9	2.5	1.5
Electricity	27.7	23.1	20.8	9.6
Others	1.2	0.7	0.1	0.1
Total	100.0	100.0	100.0	100.0

Source: NSC, Ministry of Finance



## Inflow FDI and long term loans (mil.\$US)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
<b>Laos</b>														
Net FDI	6	7	8	30	59	95	160	91	46	0	34	24	25	19
Net long term loans	146	101	49	54	43	75	170	130	78	61	59	77	60	75
<b>Cambodia</b>														
Net FDI			33	54	69	151	284	203	121	232	148	149	145	84
Net long term loans				5	55	81	73	36	52	33	72	91	146	155
<b>Vietnam</b>														
Net FDI	16	229	385	523	742	1400	1500	1800	1200	1412	1298	1300	1400	1450
Net long term loans	-86	6	387	-117	71	412	367	669	719	43	336	399	36	1127
<b>Thailand</b>														
Net FDI	2444	2014	2113	1804	1366	2068	2336	3746	6941	6103	3366	3892	953	1949
Net long term loans	1605	3091	1897	3204	3930	6309	10237	6096	364	-3408	-4923	-7070	-7288	-6097

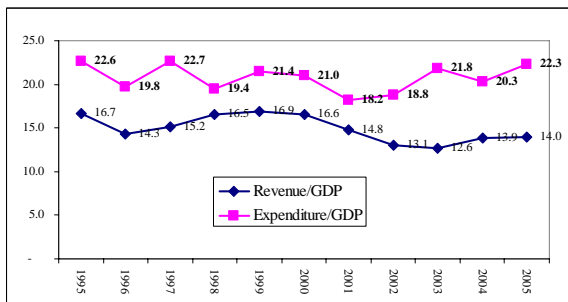
Data source: Global Development Finance 2000, 2006

## FDI by Sectors

	2004		2005		2006	
	Projects	Value Share(%)	Projects	Value Share(%)	Projects	Value Share(%)
Electricity Generation	0	11.0	10	83.5	13	63.8
Agriculture	19	14.2	21	1.4	39	17.0
Mining	24	58.5	39	7.5	26	2.7
Industry and Handicraft	37	6.6	19	1.2	31	4.6
Trading	19	3.6	11	0.6	17	3.2
Construction	7	1.9	3	0.1	3	4.8
Service	23	3.3	20	1.7	21	0.4
Hotel and Restaurant	8	1.3	10	1.1	9	1.2
Telecom	3	5.1	0	0.0	6	0.0
Wood Industry	8	1.7	8	0.5	3	0.0
Banking	1	1.9	0	0.4	0	0.0
Garment	3	0.6	1	0.0	5	0.1
Consultancies	4	0.4	1	0.0	4	0.1
<b>Total</b>	<b>151</b>	<b>100.0</b>	<b>143</b>	<b>100.0</b>	<b>171</b>	<b>100.0</b>

Source: Committee of Planning and Investment

## Government Revenue and Expenditure



Source: Annual Report, Bank of Lao, various issues

## Water Resources in the MRB

Country/Region	Catchment			Average flow (m <sup>3</sup> /sec)	Flow contribution (%)
	Area (km <sup>2</sup> )	Share/Country (%)	Share/Basin (%)		
Yunnan	165,000	38	21	2410	16
Myanmar	24,000	4	3	300	2
Lao, PDR	202,000	97	25	5270	35
Thailand	184,000	36	23	2560	17
Cambodia	155,000	86	20	2860	19
Viet Nam	65,000	20	8	1660	11
<b>Total</b>	<b>795,000</b>	<b>100</b>	<b>100</b>	<b>15060</b>	<b>100</b>

Source: MRC

## Overview of Laos: summing up

- landlocked by Yunnan in China, Myanmar, Thailand, Cambodia and Viet Nam
- annual per capita GDP in Laos is less than 400 US dollars
- population is about 5.5 million
- 80% of it is mountainous areas/ total area 236,800km<sup>2</sup>/population density is 23 person/km<sup>2</sup>.
- electricity, garment, wood and its products have comparative advantage
- some of the mineral resources are under development, in recent years
- only a few agricultural and wood products are exported
- imports various kinds of goods (domestic supply of consumption and capital goods are poor)
- constant financial deficit and international trade deficit are remarkable
- deficits are difficult to finance by domestic saving, and has been financed by donation and loan from foreign governments
- difficult to invite and improve exporting industries by FDI
- it is realistic to utilize rich natural resource such as water in order to maximize the growth rate

## Estimating SAM

- SAM is a square matrix that records transactions between production sectors, agents, and economic institutions at any desired level of disaggregation
- IO table is a special subset of SAM that describes the production structure of the economy, i.e., transaction of good and services between production sectors.
- Lao Government does not publish SAM, IO table.

### Social Accounting Matrix: Basic Framework

	1	2	3	4	5	6	7	8	9
	Activity	Commodity	Factors	Firm	Household	Government	Capital	ROW	Total
1	Activity	Sales							Domestic Production
2	Commodity	Intermediate			Private Consumption	Gov't Consumption	Investment	Export	Market Supply
3	Factors	Value Added							Factor Income
4	Firm		Capital Income			Transfer			Firm Income
5	Household		Labour Income	Dividend		Transfer		Remittance	HH Income
6	Government	Indirect Tax	Tariffs	Corporate Tax	Income Tax			Foreign Grants	Gov't Revenue
7	Capital			Corporate Savings	HH Savings	Gov't Savings		F.D.I.	Total Savings
8	ROW		Import	Factor Income paid to ROW			Investment to ROW		Foreign Exchange Outlays
9	Total	Production Cost	Absorption	V.A.	Firm Expenditure	HH Expenditure	Gov't Expenditure	Total Investment	Foreign Exchange earnings

### Macro SAM for Laos, 2001

Macro SAM for LAOS, FDR(2001)										(Unit: bn kips)
	Activities	Commodities	Factors	Firms	Households	Government	Capital	ROW	Total	
Activities	0	27,943	0	0	0	0	0	0	0	27,943
Commodities	12,241	0	0	0	11,348	1,134	4,927	2,861	0	32,512
Factors	15,561	0	0	0	0	0	0	0	0	15,561
Firms	0	0	12,169	0	0	0	0	0	0	12,169
Households	0	0	3,392	10,755	0	0	0	0	0	14,148
Government	141	179	0	1,413	368	0	0	1,068	0	3,109
Capital	0	0	0	0	2,431	2,035	0	462	0	4,927
ROW	0	4,390	0	0	0	0	0	0	0	4,390
Total	27,943	32,512	15,561	12,169	14,148	3,169	4,927	4,390	0	114,819

This is used for determining C.T.s in estimating IO table

### Estimated detailed SAM of Laos

- See distributed copies.
- Estimation procedure, omitted.
- Some part need to be re-estimated.

### Required Data for SAM Estimation

- Production Cost Structure for each good
- Output Value, Value added, Wage,...
- Private Consumption, Government Expenditure, Capital Formation, Trade
- Income Source of Household
- Tax Structure(Direct Tax, Indirect Tax, Subsidy,Corporate Tax, Tariff)
- Government Budget

### Some Analysis

- Input-Output Analysis
  - Skyline
  - IO multiplier
- SAM Analysis
  - SAM multiplier analysis (linear model)
  - CGE analysis (non-linear model)

### Input Output Analysis

- Basic Equation
  - (intermediate demand)+(Final demand)=(total output)
  - (intermediate cost)+(value added)=(total cost)

### IO model

$$AX + F + E - M = X$$

$A$  input output coefficient matrix  $A = (a_{ij})$

$X$  output vector

$F$  final demand

$E$  export vector

$M$  import vector



$$X = (I - A)^{-1}(F + E - M)$$

$$\Delta X = (I - A)^{-1}(\Delta F + \Delta E - \Delta M)$$

### IO model... continue

$$X = AX + (F + E - M)$$

Define

$$X^F = (I - A)^{-1}F \quad X^E = (I - A)^{-1}E \quad X^M = (I - A)^{-1}M$$

Output  $X$  is decomposed into  $X^F$ ,  $X^E$  and  $X^M$

$$X_i = X_i^F + X_i^E - X_i^M$$



$$\frac{X_i}{X_i^F} = 1 + \frac{X_i^E}{X_i^F} - \frac{X_i^M}{X_i^F} \quad (\text{total self sufficiency ratio})$$

### Explanation of skyline analysis

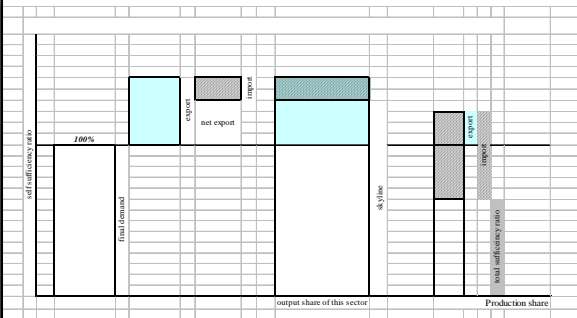
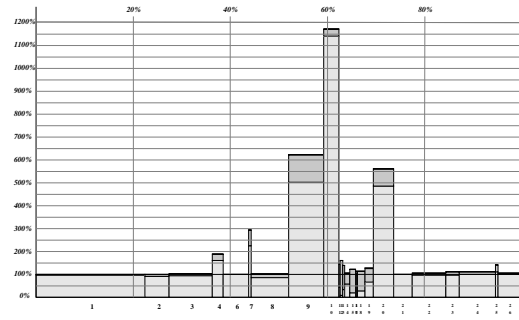


Figure 3 Skyline of Laos at 2001



See detailed SAM table for the definition of sectors

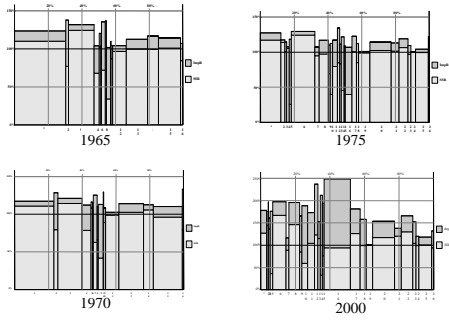
### Findings from the skyline

- agricultural and service sectors are almost self sufficient with little export and import
- other crops (including coffee), textile and its products, wood and wood products, and electricity earn much foreign exchange by its exportation, but the share of these sectors are not so large
- domestic production of heavy and chemical industries cannot fulfill the domestic final demand and much import is required in these sectors.

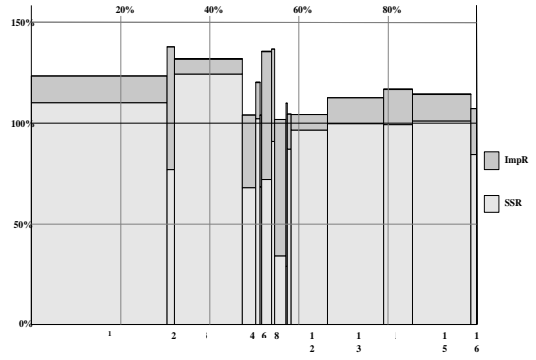
- Difficult to judge the Laos industrial structure only by one sheet of skyline
- Need to compare w/other year
- But we have no other Lao IO table
- As a second best, compare with Thai's experience

**Lets look at the time series skyline of Thai: 1965-2000**

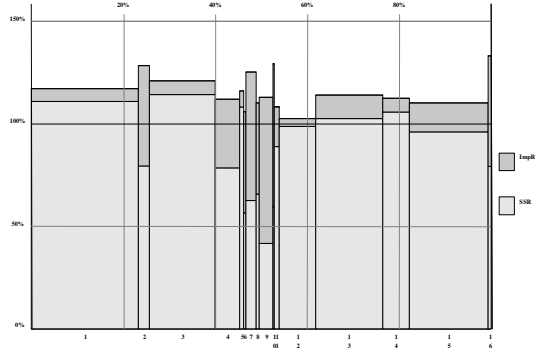
Figure 4 Skyline diagrams of Thailand



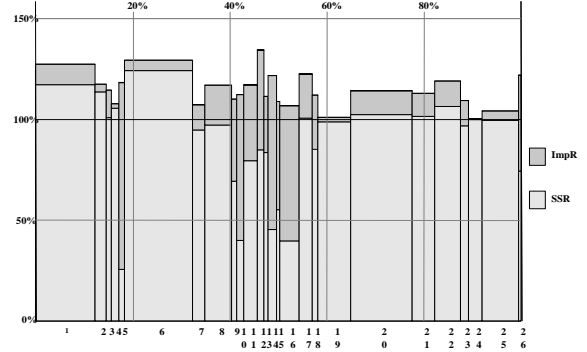
Skyline for Thailand, 1965



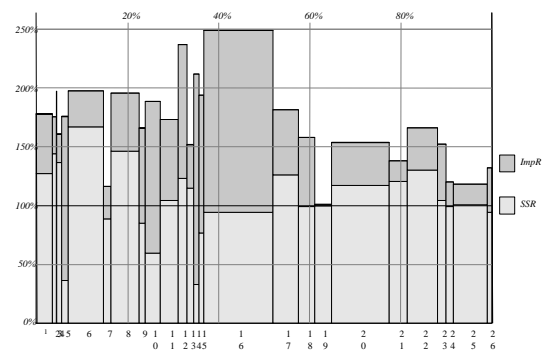
Skyline for Thailand, 1970



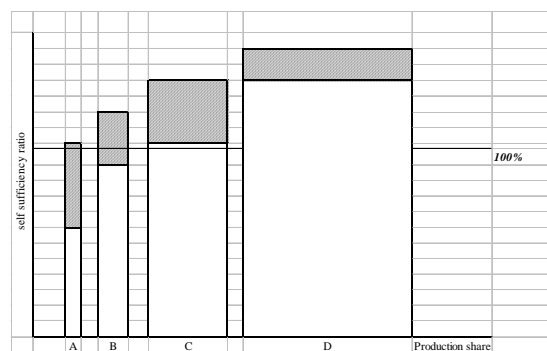
Skyline for Thailand, 1975



Skyline for Thailand, 2000



Typical Pattern of industrialization



First stage 1965-70

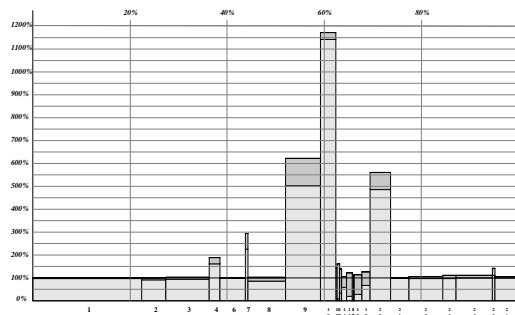
- Agriculture, Food manufacturing: **large share** and exporting sectors
- Manufacturing sector: small share and importing sectors (low sufficiency ratio)

Second stage

- Agriculture, Food manufacturing: share is declining, but still exporting sectors
  - Manufacturing sector (including capital good): share increasing, self sufficiency ratio is increasing
  - Textile: from importing sector to exporting sector
- Typical pattern of Economic development  
(Import -> import substitution -> export oriented)

## Back to Laos skyline again

Skyline of Laos at 2001



- Large share sectors (agriculture) has almost no export
- Share of exporting sector is about 20%
- Resource based export except for textile
- It is of great idea to improve agriculture as exporting sector if the international commodity market situation permits (for example, maize for feed)

## SAM multiplier analysis

- Sectors in SAM are partitioned into two parts: endogenous and exogenous accounts.
- The column coefficients of the endogenous accounts are assumed all to be constant.
- Endogenous accounts are those for which changes in the level of expenditure directly follow any change in income.
- The change in total income or expenditure of each endogenous account w.r.to a unity change in an entry of exogenous account vectors is called **SAM multiplier**.

Table 4 Multipliers and evaluation of Land Productivity Increase

	Total Value (Mill \$Kgs)	Multipliers								% increase productivity
		I/O multipliers in				SAM multipliers in				
		Other Crop EXP	Textile EXP	Wood and Wood products EXP	Electricity EXP	Other Crop EXP	Textile EXP	Wood and Wood products EXP	Electricity EXP	
1	6,329	0.04	0.05	0.01	0.04	1.00	1.34	1.11	1.24	211
2	1,322	0.04	0.04	0.04	0.04	0.49	0.72	0.72	0.74	24
3	1,212	0.04	0.05	0.04	0.04	0.72	0.94	0.94	0.94	67
4	422	1.18	0.04	0.01	0.04	1.18	0.13	0.04	0.04	114
5	56	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	16
6	1,497	0.04	0.04	0.04	0.04	0.43	0.51	0.51	0.51	33
7	340	0.04	0.04	0.04	0.11	0.04	0.04	0.04	0.14	24
8	2,422	0.04	0.04	0.04	0.04	0.71	0.82	0.84	0.85	171
9	2,387	0.04	1.74	0.01	0.04	0.04	1.43	0.04	0.04	64
10	115	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	24
11	115	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	24
12	1,410	0.14	0.14	0.14	0.14	0.54	0.57	0.54	0.54	57
13	228	0.04	0.04	0.04	0.04	0.04	0.04	0.11	0.04	14
14	440	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.11	11
15	408	0.04	0.04	0.04	0.04	0.14	0.11	0.14	0.14	14
16	408	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	14
17	408	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	14
18	408	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	14
19	408	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	14
20	408	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	14
21	408	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	14
22	408	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	14
23	408	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	14
24	2,680	0.04	0.04	0.14	0.04	0.54	0.44	0.44	0.54	53
25	138	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	14
26	1,312	0.04	0.04	0.04	0.04	0.24	0.21	0.14	0.24	21
27	1,180	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	14
28	12,000	0.04	2.44	0.04	0.04	0.04	2.44	0.04	0.04	314
29	14,140	0.04	0.04	0.04	0.04	0.24	0.24	0.24	0.24	354
30	12,000	0.04	0.04	0.04	0.04	0.24	0.24	0.24	0.24	314
31	1,380	0.04	0.04	0.04	0.04	0.44	0.44	0.44	1.52	164
32	4,320	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	144
33	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
34	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
35	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
36	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
37	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
38	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
39	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
40	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
41	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
42	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
43	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
44	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
45	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
46	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
47	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
48	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
49	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144
50	1,112	0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.14	144

Source: Estimated by the authors

## Findings from IO multipliers

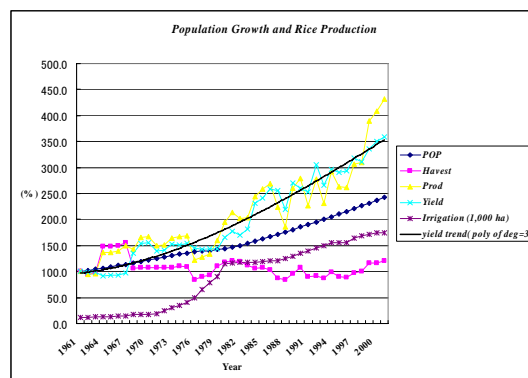
- IO multipliers are in general smaller than SAM multipliers, and close to zero except for the multipliers of their own sectors.
- Industry sum of multipliers regarding to all industrial sectors (in the last row in the table) are distributed between 1.37 and 2.47.
- Influential sectors are Wood and its products and Textile and its products.
- *Electricity is not so much influential to the industrial sectors.*
- Other crops that includes coffee has the least input output multiplier among exporting sectors.
- *Input output multipliers of agricultural sectors are in general small, due to the inter industry structure of the commodity flow.*

## Findings from SAM multiplier

- Multipliers for industrial sectors are greater than IO multipliers
- Second, the multipliers regarding to the institutional sectors are greater in value than that of industrial sectors.
- income linkage is stronger if the inter industry transaction is not so developed in the economy like Laos.
- Most influential export sector is the other crops and the next influential sector is the electricity.
- Electricity is important for the Lao economy. Note also that the foreign grant is influential to the economy.

## Yield increase: some background

- 1985: HYV Salakhaml 1-3-2 not so good
- 1993: TDK-1 4ton/ha under irrigation w/ fertilizer no photosensitivity harmful insect (*Nilaparvata lugens*) tolerance spreaded about 50% of varieties
- Irrigation investment stabilize yield fluctuation in rainy season production possibility in dry season



## Findings from SAM multiplier: Rice

- We evaluate the impact of 5% increase in land productivity for rice production.
- We assume this happen by the construction of irrigation: reduction of yield instability in wet season and production of rice in dry season. The rice yield is assumed to be increased 5% by technological improvement even without the increase in intermediate inputs of production.
- The activity level of rice milling which is counted as a food manufacturing sector is also stimulated.
- Productivity increase derives 2.7 percent growth in industry output, while it derives 2.3 to 2.6 increases in wage or other value added such as rent for paddy field.
- Land productivity improvement is of great important for the economy.
- One of the way to improve land productivity is to facilitate irrigation in two senses: *hard* and *soft*. The *hard* means the physical construction of the irrigation system, while the *soft* means the development of institutional system such as water use group. In order to have an efficient irrigation system, both of these are crucial.

## Implications for development

- While manufacturing sectors are free from natural limitations, agricultural development is restricted by natural conditions and the natural resources.
- To breakthrough the limitation, *scientific* agriculture such as selective breeding is indispensable.
- Technological progress is necessary for efficient use of scarce resources.
- it is necessary to develop the agricultural sector at first stage of economic development. Why?
  - (1) the sufficient supply of food is the first priority in the nation
  - (2) agricultural product is wage commodity and therefore is a cost for manufacturing. The lower, the better.
  - (3) Agricultural sector supplies labor and capital for the industrialization.

### Implications for development: coffee.

- How about the coffee export?
- Though SAM multiplier is surely large, another consideration is necessary whether this is preferable for economy.
- export of agricultural commodity is important for foreign exchange earning, but the international price fluctuation of primary commodities is also large
- export price declining may have negative influence on the economic growth (Prebisch and Singer Hypothesis).
- high SAM multiplier means that impact of a change in international price is magnified to the domestic economy.
- It is recommended to avoid export specialization of a few of specific commodities and to reduce the price risk for exportation by increasing the variety of export commodities.

### Implications for development: electricity.

- How about electricity export?
- Since LAOS is water resource abundant country, it has a comparative advantage for producing and export electricity (supply side condition).
- The neighbor countries who enjoy high economic growth rate show high demand for energy (demand side condition).
- hydraulic power generation is preferable in terms of the environment (GHG)
- If export is determined by a long period contract basis, export price is rather stable.
- It is often said that dam construction for hydraulic power generation surely lead to the environmental disruption of Laos. From a viewpoint of economics, it is the fact that we must pay a cost to obtain some benefit (Do not underestimate environmental damage).

Thank you very much for your attention!