

*Lao People's Democratic Republic*¹

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1. Introduction

This document describes the steps behind the creation of the first Input-Output (I-O) table of Lao People's Democratic Republic for the Global Trade Analysis Project (GTAP). The GTAP I-O table for Lao People's Democratic Republic is based on the 2002 Input-Output table built by Menon and Warr (2006). This document is divided in 4 sections. The next section explains the data and its characteristics. Section 3 describes the process of building the GTAP ready database, outlining some of the assumptions made about the structure of the source data so it can be consistent with GTAP format, including sectoral splits to match GTAP specification.

2. Source Data

2.1. Data characteristics

The data used to construct the I-O table for Lao People's Democratic Republic in GTAP is based on an I-O table constructed by Menon and Warr (2006), the first publicly available input-output table for Lao People's Democratic Republic. The 20 sector input-output table for Lao People's Democratic Republic has a commodity (product) by industry (activity) format, with units in millions of local currency (*Kip*) at basic prices for the year 2002. Each industry produces a single output, and the set of commodities therefore coincides with the set of industries. The Lao People's Democratic Republic I-O table contains 20 industries, listed in the appendix, table A.1. These include three agricultural industries: crops; livestock and poultry; forestry and logging. Nonagricultural industries include: mining and quarrying; seven manufacturing industries; and nine services and utilities industries.

The I-O table constructed by Menon and Warr (2006) is based on information from two sources. First, there is a 20 sector input-output table for Savannaket Province of Lao People's Democratic Republic, relating to the year 2003 (ADB 2005). This table was then adjusted by Menon and Warr using data from the Lao National Accounts for 2002. These authors compared the value added totals for the various sectors of the Savannaket table with those for Lao People's Democratic Republic, derived from the National Accounts. The Savannaket table was then amended using RAS to force the value added totals to match those for Lao People's Democratic Republic.

According to Menon and Warr, the resulting table had a structure which reflects the industry structure of Lao People's Democratic Republic, as reflected in its National Accounts, but within each industry the input-output technology reflects that of Savannaket Province. The method thus assumes that the input-output technology for each industry in Lao People's Democratic Republic is similar to that of Savannaket, even though the relative importance of

¹ Project funded by the Asian Development Bank Institute, under Infrastructure and Regional Cooperation. Thanks to Peter Warr for providing the original I-O data for Lao People's Democratic Republic.

these various industries in Lao People's Democratic Republic is quite different from that of Savannaket. However, Savannaket Province seems a suitable basis for this kind of exercise in that it is roughly intermediate within the provinces of Lao People's Democratic Republic in terms of its level of technology, neither the most nor the least advanced.

3. *I-O Table Construction*

The original data from Menon and Warr (2006) contains several matrices. However, some of this information is not needed for GTAP, such as some detailed household information, so we did not use or aggregated some of these data. The data used to construct the I-O table, were:

1. Intermediate Basic (Commodity by Industry and by source (domestic and imports))
2. Intermediate Margins (Commodity by Industry by source and by margin (transport and trade))
3. Intermediate Tax (Commodity by Industry and by source (domestic and imports))²
4. Investment Basic (Commodity by Industry and by source (domestic and imports))
5. Investment Margins (Commodity by Industry by source and by margin (transport and trade))
6. Investment Tax (Commodity by Industry and by source (domestic and imports))³
7. Households Basic (Commodity by source and by household type)
8. Households Margins (Commodity by source by margin (transport and trade) and by household type)
9. Households Tax (Commodity by source and by household type)⁴
10. Exports Basic (Commodity)⁵
11. Exports Tax (Commodity)
12. Government Basic (Commodity by source)⁶
13. Stocks (Commodity by source)⁷
14. Cost Matrix, which included value added components (Labor, Capital, Land and Production Tax)

3.1. *Use matrix, tax excluded (UF)*

To produce the UF matrix for GTAP, we did the following data manipulations:

1. Total Trade and Transport Intermediate Margins (both domestic and imports) were added by commodity to produce two vectors of trade and transport margins indexed by industry. These vectors were added to the corresponding sectors (Trade and Transport) of the Intermediate basic matrix in its domestic component. That is, trade and transport margins for imports were also added to trade and transport of domestic intermediate use. This procedure was done to balance sales and costs in the I-O matrix.
2. As described before, investment and household consumption in the original I-O table were in matrix form. However, for GTAP, we only needed a vector of Investment, and Household Consumption to include in final demand (both domestic and imports). To produce the vector of Investment, we added Investment Basic by industry to produce a

² Intermediate Taxes on imports are zero.

³ Investment Taxes on imports are zero.

⁴ Household Taxes on imports are zero.

⁵ Export Margins are zero.

⁶ Government taxes and margins, as well as government imports are zero.

⁷ Stocks for imports are zero.

column vector indexed by commodity. For Household consumption, we did not need the household information, so we added the Household Basic matrix by household to produce a column vector indexed by commodity. Government, Stocks and Exports, both were indexed by commodity and by source, so we did not need to modify these data.

3. As well as in the intermediate matrix, we added Trade and Transport margins in Investment and Household consumption into the corresponding “Trade” and “Transport” sector (note that this is only for domestic use). For investment, we estimated the total value of Investment Margins by type of margin (trade and transport) by adding the Investment Margins matrix by commodity, industry and source. For Household Consumption, we added the Households Margins matrix by commodity, source and household type, two produce two total values of trade and transport margins. These total values of Trade and Transport margins for both Investment and Household consumption were added to the Trade and Transport sectors.

For the Value Added portion of UF, we did not need to modify the original data, since it was in the ORANIG factors (labour, capital and land) required by GTAP.

3.2. Use matrix, tax inclusive (UP)

To estimate the Use matrix, tax inclusive (UP) we added the Intermediate Tax matrix to the intermediate portion of the UF matrix. Same as in the UF matrix, we estimated a vector of taxes for both Investment and Household consumption, and added them to those components in the UF matrix. It is worth noting that there were no intermediate, investment or household taxes on imports. For exports, we added export taxes.

3.3. Output (OP) and imports, duty free (MF)

To obtain a vector of output of sector i non-commodity net indirect tax included (vector “OP” in GTAP notation), we added together the sum of domestic and imports intermediate use, value added, and other production taxes. Finally, to produce a vector of imports by commodities with import duties excluded (vector “MF” in GTAP notation) we removed import duties from the vector of total imports by commodity (tax excluded).

3.4. Commodity splits

One of GTAP’s requirements for I-O tables is to have a minimum of 30 sectors. For this reason, we split agricultural sectors to match GTAP sectors. Table A.2 contains the initial sectoral split of both “Crops” and “Livestock” sectors into 13 sectors. To split these sectors, we used production data from FAO, price data from Rao (1993), and cost shares from Cambodia’s I-O table in GTAP.

For production, we used two types of data: Production data (in tonnes) and data from FAO’s Food and Balance Sheets (in tonnes), from 2000-2003, the years for which the I-O data for Lao People’s Democratic Republic was. Food and Balance Sheets contain information of supply and use of food products. For supply, they provide information on local production, imports, change in stocks and exports. For use, they provide information of commodity use as feed, seed, food manufacturing, food, waste and other uses.

We combined these data with international prices from Rao (1993, table 5.3) to estimate values in millions of 1990 international dollars. This information provides a consistent source of price data that enables us to estimate agricultural value shares (Table 1). In this case, we only

estimate value for supply data (Table 1), since the sectoral cost structure and use data is taken from Cambodia's I-O table (Table 2). We compared production data from both FAO data sources, and adjusted the data for plant based fibers (cotton) in Table 1 from zero to 0.4% to denote that there was local plant based fibers production in 2000-2003. We then subtracted proportionally what we added to "plant based fibers" from the shares of all other crop sectors, according to their share in total value.

To split crops and livestock sectors across (sales split) we used local production shares for the domestic part of the UF and UP matrices, and import shares to split the import portion of those matrices. We used stock and export shares from Table 1 to split both stocks and exports in the domestic portion of UF and UP (the import portion has zero values for both change in stocks and exports). For values that denote crops use by crops and by livestock and livestock use by crops and by livestock, we combined production shares with cost shares from Cambodia (Table 2).

To split crops and livestock vertically across all other sectors, we used the cost shares from Cambodia (not shown here). However, after splitting the agricultural sectors, sales and costs did not balance, given the data manipulation. To assure that balance between sales and costs was maintained, we use a partial RAS procedure, which balanced sales and costs, without affecting import use in final demand in the UF and UP matrices.

Table 1. Value Shares for Crops and Livestock Sectors in Lao People's Democratic Republic (2000-2003)

Sector	Local Production	Imports	Stock variation	Export value
<u>Crops</u>				
Rice	54.2 ¹	32.8	100	0.0
Wheat	0.0	8.2	0	0.0
Other cereals	2.8	11.4	0	2.0
Fruits and vegetables	33.0	7.8	0	1.1
Oil seeds	1.8	0	0	2.0
Plant based fibers	0.4 ¹	0	0	0.0
Sugar crops	1.0	0	0	0.0
Other crops	6.9	39.7	0	94.9
Total	100	100	100	100
<u>Livestock</u>				
Bovine cattle	33.1	0.0	0	0.0
Pigs, poultry; eggs	27.7	0.3	0	21.2
Raw milk	0.6	40.8	100	0.0
Wool	0.0	0.0	0	0.0
Fishing	38.5	58.9	0	78.8
Total	100	100	100	100

¹ Modified to be consistent with Production data

Source: Author own estimation based on FAO Food and Balance Sheets (2000-2003)

Sectoral split to map the 31 Lao People's Democratic Republic sectors to the 57 GSC2 sectors was performed at the GTAP Center, using the cost structure of their "GTAP Representative Table" (chapters 13, Dimaranan and McDougall, 2002). Table A.3 contains the sectoral concordance between GTAP sectors and the 31 disaggregated Lao People's Democratic

Republic sectors. Figure A.1 provides a summary diagram of the procedures applied to the source data to bring it into the GTAP format.

Table 2. Value Shares of Intermediate Use (Domestic and Imports) from Cambodia

Domestic										Livestock					
Crops	pdr	wht	gro	v_f	osd	c_b	pfb	ocr	Total	ctl	oap	rmk	wol	fsh	Total
pdr	96.2	0.0	0.0	2.0	0.1	0.0	0.0	1.7	100	4.9	95.1	0.0	0.0	0.0	100
wht	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0
gro	0.8	0.0	98.6	0.2	0.0	0.1	0.0	0.3	100	20.8	77.8	0.0	0.0	1.4	100
v_f	1.1	0.0	0.1	92.8	0.3	0.0	0.1	5.6	100	4.4	94.9	0.0	0.0	0.7	100
osd	0.2	0.0	0.1	2.6	94.5	0.0	0.0	2.6	100	4.5	95.4	0.0	0.0	0.1	100
c_b	1.9	0.0	0.0	0.4	0.0	97.1	0.0	0.4	100	22.0	74.9	0.0	0.0	3.1	100
pfb	0.2	0.0	0.0	0.1	0.0	0.0	99.6	0.1	100	4.8	64.3	0.0	0.0	31.0	100
ocr	0.6	0.0	0.1	4.7	0.2	0.0	0.1	94.3	100	4.6	95.3	0.0	0.0	0.0	100
Livestock															
ctl	93.9	0.0	0.2	2.4	0.1	0.4	0.0	2.9	100	99.5	0.1	0.0	0.0	0.4	100
oap	40.2	0.0	1.4	7.0	1.2	2.5	0.3	47.4	100	0.0	99.9	0.0	0.0	0.1	100
rmk	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0
wol	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0
fsh	84.3	0.0	0.3	6.5	0.4	0.3	0.5	7.6	100	3.2	41.6	0.0	0.0	55.1	100

Imports										Livestock					
Crops	pdr	wht	gro	v_f	osd	c_b	pfb	ocr	Total	ctl	oap	rmk	wol	fsh	Total
pdr	96.2	0.0	0.0	2.0	0.1	0.0	0.0	1.7	100	4.9	95.1	0.0	0.0	0.0	100
wht	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0
gro	0.8	0.0	98.6	0.2	0.0	0.1	0.0	0.3	100	20.8	77.8	0.0	0.0	1.4	100
v_f	1.1	0.0	0.1	92.8	0.3	0.0	0.1	5.6	100	4.4	94.9	0.0	0.0	0.7	100
osd	0.2	0.0	0.1	2.6	94.5	0.0	0.0	2.6	100	4.5	95.4	0.0	0.0	0.1	100
c_b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0
pfb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0
ocr	0.6	0.0	0.1	4.7	0.2	0.0	0.1	94.3	100	4.6	95.3	0.0	0.0	0.0	100
Livestock															
ctl	41.7	0.0	0.0	8.3	0.0	0.0	0.0	50.0	100	0.0	99.8	0.0	0.0	0.2	100
oap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0
rmk	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0
wol	84.1	0.0	0.5	6.4	0.5	0.5	0.5	7.7	100	3.2	41.6	0.0	0.0	55.1	100
fsh	96.2	0.0	0.0	2.0	0.1	0.0	0.0	1.7	100	4.9	95.1	0.0	0.0	0.0	100

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Appendix

Table A.1. Sectors in Lao's I-O table

No.	Sector	Description
1	Crops	Crops
2	Livestock	Livestock, poultry and fishing
3	Forestry	Forestry and logging
4	Mining	Mining and quarrying
5	Food	Food, beverage and tobacco
6	Textiles	Textile, garment and leather products
7	Wood	Wood and paper products; printing and publishing
8	Chemical	Petroleum and chemical products
9	Mineral	Non-metallic mineral products
10	Metals	Metal prods, machinery, equipment, spare parts
11	Other Manufacturing	Other manufactured goods
12	Electricity and water	Electricity and water supply
13	Construction	Construction
14	Transportation	Transportation Services
15	Post and Telecommunication	Post and Telecommunication Services
16	Trade	Wholesale and retail trade
17	Banking	Banking, insurance, business services
18	Estate	Real estate & ownership of dwellings
19	Government	Public administration
20	Other Services	Personal, social & community services

Table A.2. Commodity Disaggregation of Lao's Sectors

No.	Disaggregated Sectors (31)	Original Sectors (20)	No.
1	Paddy rice (pdr)	Crops	1
2	Wheat (wht)	Crops	1
3	Other cereals (gro)	Crops	1
4	Fruits and vegetables (v_f)	Crops	1
5	Oil seeds (osd)	Crops	1
6	Sugar crops (c_b)	Crops	1
7	Plant based fibers (pfb)	Crops	1
8	Other crops (ocr)	Crops	1
9	Bovine cattle (ctl)	Livestock	2
10	Pigs and poultry; eggs (oap)	Livestock	2
11	Raw milk (rmk)	Livestock	2
12	Wool (wol)	Livestock	2
13	Fishing (fsh)	Livestock	2
14	Forestry	Forestry	3
15	Mining	Mining	4
16	Food	Food	5
17	Textiles	Textiles	6
18	Wood	Wood	7
19	Chemical	Chemical	8
20	Mineral	Mineral	9
21	Metals	Metals	10
22	Other Manufacturing	Other Manufacturing	11
23	Electricity and water	Electricity and water	12
24	Construction	Construction	13
25	Transportation	Transportation	14
26	Post and Telecommunication	Post and Telecommunication	15
27	Trade	Trade	16
28	Banking	Banking	17
29	Estate	Estate	18
30	Government	Government	19
31	Other Services	Other Services	20

Table A.3. Concordance between GTAP sectors and Lao's sectors

No.	GTAP Code	GTAP Sector	Lao Sector	No.
1	pdr	Paddy rice	Paddy rice	1
2	wht	Wheat	Wheat	2
3	gro	Cereal grains nec	Other cereals	3
4	v_f	Vegetables, fruit, nuts	Fruits and vegetables	4
5	osd	Oil seeds	Oil seeds	5
6	c_b	Sugar cane, sugar beet	Sugar crops	6
7	pfb	Plant-based fibers	Plant based fibers	7
8	ocr	Crops nec	Other crops	8
9	ctl	Cattle, sheep, goats, horses	Bovine cattle	9
10	oap	Animal products nec	Pigs and poultry; eggs	10
11	rmk	Raw milk	Raw milk	11
12	wol	Wool, silk-worm cocoons	Wool	12
13	for	Forestry	Forestry	14
14	fsh	Fishing	Fishing	13
15	col	Coal	Mining	15
16	oil	Oil	Mining	15
17	gas	Gas	Mining	15
18	omn	Minerals nec	Mining	15
19	cmt	Meat: cattle, sheep, goats, horse	Food	16
20	omt	Meat products nec	Food	16
21	vol	Vegetable oils and fats	Food	16
22	mil	Dairy products	Food	16
23	pcr	Processed rice	Food	16
24	sgr	Sugar	Food	16
25	ofd	Food products nec	Food	16
26	b_t	Beverages and tobacco products	Food	16
27	tex	Textiles	Textiles	17
28	wap	Wearing apparel	Textiles	17
29	lea	Leather products	Textiles	17
30	lum	Wood products	Wood	18
31	ppp	Paper products, publishing	Wood	18
32	p_c	Petroleum, coal products	Chemical	19
33	crp	Chemical, rubber, plastic prods	Chemical	19
34	nmm	Mineral products nec	Mineral	20
35	i_s	Ferrous metals	Metals	21
36	nfm	Metals nec	Metals	21
37	fmp	Metal products	Metals	21
38	mvh	Motor vehicles and parts	Metals	21
39	otn	Transport equipment nec	Metals	21
40	ele	Electronic equipment	Metals	21
41	ome	Machinery and equipment nec	Metals	21
42	omf	Manufactures nec	Other Manufacturing	22
43	ely	Electricity	Electricity and water	23
44	gdt	Gas manufacture, distribution	Electricity and water	23
45	wtr	Water	Electricity and water	23
46	cns	Construction	Construction	24
47	trd	Trade	Trade	27
48	otp	Transport nec	Transportation	25
49	wtp	Sea transport	Transportation	25

No.	GTAP Code	GTAP Sector	Lao Sector	No.
50	atp	Air transport	Transportation	25
51	cmn	Communication	Post and Telecommunication	26
52	ofi	Financial services nec	Banking	28
53	isr	Insurance	Banking	28
54	obs	Business services nec	Banking	28
55	ros	Recreation and other services	Other Services	31
56	osg	PubAdmin/Defence/Health/Educat	Government	30
57	dwe	Dwellings	Estate	29

Figure A.1. Process of creating the Lao's PDR I-O table for the GTAP Data Base

