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Laos' World Trade Organization Accession and Poverty Reduction

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The Impact of Laos' Accession to the World Trade Organization

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Abstract

World Trade Organization (WTO) accession produces tangible benefits but also has costs, especially for transitional economies and Least Developed Countries (LDC) like Laos. Despite the benefits and costs of WTO accession, there are very few quantitative studies on Laos' accession to the WTO. Therefore, the main objective of this paper is to attempt to quantify the economy-wide impact and poverty of Laos' WTO accession. We employ a standard GTAP model for this analysis. The simulation results show that Laos will gain from accession to the WTO, but these gains are quite small. The real GDP will increase about 0.5% and welfare (equivalent variation) will increase by about US$ 8 million. On the other hand, the trade deficit will increase and output in some sectors will be reduced. Therefore, it is difficult to conclude that Laos will gains benefits from WTO accession. The micro-simulation using the household survey indicates that the change in household welfare due to the tariff reduction is heterogeneous. The winners from the tariff reduction are households which live in Vientiane capital, and are the non-poor in the urban area. The losers from this policy change are the households which do not belong to the above categories, and their household income drops and their poverty rates increase slightly. The policy implication is that social safety nets for the possible losers are necessary in the future when the trade liberalization policy is implemented. Since this study focuses only the impact of the tariff reduction, the obtained impact might under- or over-estimate all of the impact of the WTO accession.

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Introduction

The Lao Government (GOL) has designated trade liberalization as one of the most important keys to economic growth and poverty reduction (GoL, 2004). Laos joined the ASEAN[2] Free Trade Area (AFTA) by 1998 and applied for World Trade Organization (WTO) membership in 1997. Laos is expected to join the (WTO) by 2010.[3] In order to access the WTO, Laos has had to reform trade policies such as removing tariff and non-tariff barriers and has had to extend the coverage of trade and investment rules. WTO accession is likely to improve economic indicators such as price, output, employment, trade volume, and household income, and change trade partners.[4] However, Laos is a Least Developed Country (LDC) [5] which has experienced transitional economy periods and faces twin fiscal and trade deficits; a significant economic development gap exists between Laos and most other WTO members. By reducing tariffs, import prices will decrease, and imports will therefore increase. As a result, Laos will incur bigger trade and budget deficits, and domestic Small and Medium Enterprises (SMEs) will be negatively affected.[6]

Despite the positive and negative impacts of Laos' WTO accession, there are very few studies on this issue.[7] In a qualitative analysis, Anderson (1998) examined the implications of WTO accession for Laos' agricultural and rural development; this study found that the net benefits of WTO accession are

[2] Laos and Mynma have joined Association of Southeast Asia Nation (ASEAN) in 1997. Now ASEAN has 10 members.
[3] According to economists in Ministry of Industrial and Commerce and the press in 2006.
[4] According to Winter (2004), who summarized previous studies on the relationship between trade and growth, trade improves growth due mainly to increased productivity, including improved policies and institutions. There are some characteristics of Laos specifically, which should be taken into account.
[5] According to UNDP(2007/2008), in term of human development index, Laos was ranked as 130th out of 177 countries. GDP per capita of US$580 in 2007 (World Bank, 2008). 34 percent of the population live below the poverty line (NSC, 2003).
[6] As most of the SMEs in Laos lack competitiveness, the WTO accession might prove challenging for them. For a more detailed discussion on the impact of trade liberalization on SMEs see Kyophilavong (2008).
[7] For a more detailed quantitative analysis of the impact of AFTA on the Lao economy, see Kyophilavong, 2004; 2007a.

overwhelmingly positive. Akkharath (2003) also conducted a qualitative study which showed that WTO accession will bring not only many opportunities but also various challenges. But to date, the impact of WTO accession on the Lao economy has not been assessed using the Computable General Equilibrium (CGE) approach. As a result, the impact of Laos' WTO accession on national wide-economy and poverty is not well-understood from a quantitative perspective. Therefore, this study's first main objective is to attempt to quantify the impact of Laos' WTO accession on national wide-economy and poverty using the standard Global Trade Analysis Project (GTAP) model.

Laos has achieved economic growth in the past decade and the incidence of poverty fell from 45 percent to 39 percent between 1992-93 and 1997-98. However, poverty is still high, and inequality has increased (NSC, 2003). A number of interrelated factors determine whether trade liberalization has positive or negative consequences on income distribution and poverty. In this study, we focus on two mechanisms. The first mechanism takes place in the factor market and effects on household income. A second mechanism takes place in the commodity market and affects household expenditure patterns. The specific effects of trade liberalization vary from country to country, and so the exact impact of trade liberalization on poverty and income distribution is not clear in the context of Laos. Thus, in the second party of this paper, we analyze the impact on the income distribution and povety using Lao househoeld survey.

Macroeconomic Condition

Since introducing the New Economic Mechanism (NEM) in 1986[8], Laos has been in transition from a centrally planned economy to a more market-oriented economy. As a result, except during the Asia Financial Crisis of the 1990s, Laos has been achieving high rates of economic growth with low inflation. Table 1 shows that key macroeconomic indicators from 1990 to 2006. The average

[8] After establishing the Lao People's Democratic Republic in 1975, it adopted a planned economy following socialist countries until 1986.

economic growth was about 6.53 % during 2001-2006, which increased from 6.18 % during 1996-2000[9]. The average inflation rate was maintained at one digit during 2001-2006, which is a significant decline from the average rate of 57 % during 1996-2000. The exchange rate was also stable during 2001-2006. Laos has an agriculture-based economy; in a total GDP of 2.8 US$ billion in 2005, the agriculture sector accounted for 44% of GDP, the industry sector for 30% and the service sector for 26% (World Bank, 2008). However, since 2003, the industry sector has grown more than 10%, which has caused the agricultural share of GDP to decline.

Even though Laos has been maintaining high economic growth with low inflation and a stable exchange rate, it still has serious macroeconomic issues to overcome. Firstly, Laos is basically facing chronic twin deficits in both government spending and international trade. The average ratio of budget deficit to GDP was 4.4% during 2001-2006.The average ratio of trade account balance deficit to GDP was 9.24 % during the same period. These deficits are mainly financed by Official Development Assistant (ODA), Foreign Direct Investment (FDI), and remittances. The fiscal issue is particularly serious in Laos. If the budget deficit continues to expand, it will cause an accelerating inflation rate and devaluation of the kip (Lao currency), and could lead to economic instability like during the period of the Asian Financial Crisis (Okonjo et al, 1999). Secondly, there is a huge gap between saving and investment. The saving rate is low because of low average incomes—GDP per capita was about US$580 in 2007 (World Bank, 2008)—and because financial sectors are underdeveloped. The banking sectors are occupied by the state commercial banks, which are unable to perform full banking functions.[10] Thirdly, Laos is also facing a high burden of external debts. The external debt accumulation was more than 60 % of GDP in 2007. If Laos becomes too dependent upon foreign finance, especially to meet its

[9] The engine of growth during this period is from capital inflows of foreign direct investment (FDI) in mining and hydropower sectors and mining exports. For a more detailed discussion on the impact of FDI in the mining and hydro sectors on the Lao economy, see Kyophilavong and Toyoda (2008).
[10] More details of financial issues in Laos are discussed in Kyophilavong (2008).

debt obligations, this could cause a foreign debt crisis and might lead to macroeconomic instability. Therefore, there is debate about the impact of WTO accession on the macroeconomic conditions in Laos.

Table 1 Key macroeconomicindicators

Macroeconomic indicators	**2001-2006**	**1996-2000**	**1990-1995**
Population (million. person)*	5.46	4.86	4.40
Population growth (%)	2.12	2.06	2.52
GDP (current million US$) **	2,416	1,618	1,276
GDP growth (%)	6.53	6.18	6.46
GDP per capita (constant 2000 US$) **	379	307	248
GDP per capita growth (%)	4.04	3.68	3.80
Reserve Money (M2) (million US$)*	450,981	270,728	148,280
Money supply (M2) (%)*	21.14	65.99	30.92
In flation -CPI (%)	9.73	57.00	15.27
Trade Deficit (million. US$)***	-219.91	-263.21	-174.92
Trade Deficit /GDP (%)	-9.24	-16.06	-13.14
Foreign reserve (million. US$)***	220	127	48
External debt (million US$) *	2,640	2,410	1,965
External debt /GDP (%)	115	152	161
Buget Deficit (including grants)(million US$)	-104	-58	-100
Buget Deficit /GDP (%)	-4.42	-3.60	-7.61
Buget Deficit (exclude grants)(million US$)	-149	-121	-145
Buget Deficit /GDP (%)	-6.29	-7.58	-11.21
Exchange Rate (kip/US$) Official Rate***	10,163	4,094	727

Sources:
* Asian Development Bank (ADB), *Key Indicators for Asia and the Pacific 2008 www.adb.org/statistics*
** World Bank,*World Development Indicators CD-ROM (2005) and*
*** International Monetary Fund, *International Financial Statistics CD-ROM August 2008*

Laos and the WTO

Under the planned economy, international trade had been controlled by government. At that time, Laos' main trading partners were socialist countries. However, Laos shifted from a planned economy to a market economy in 1986. Trade liberalization has been one of the pillars of economic reforms in Laos (Martin, 2001); the tariff rate changes are shown in table 2. In November, 2004, Laos was granted Normal Trade Relations status by the United States. Moreover,

as mentioned above, Laos plans to join the WTO by 2010. Laos applied for WTO membership in 1997.

Until 2008 Laos had made good progress towards becoming a WTO member.[11] The Lao delegation discussed bilateral trade agreements with a number of WTO member states. They were also successful in reaching an agreement with the EU on open market access for goods. In addition, the service sector in Laos will be negotiated at the next meeting. However, many areas still require improvement such as laws related to trade including standards, intellectual property rights, customs and enterprises.These actions indicate that Laos is keen to participate more fully in the global economy in the near future. Both challenges and opportunities remain in order for Laos to gain the benefits of WTO membership.

Table 2. Initial Ad Valorem tariff rate (%)

Sector	Oceania	East Asia	Southeast Asia	South Asia	North America	Latin America	EU	Sub-Saharan Africa	Rest of World	Total
Grains and crops	3.96	27.93	22.61	0	0	0	4.97	26.43	2.7	88.6
Livestock and meat products	0	0	16.1	0	0	0	17.34	0	0	33.44
Mining and extraction	0	2.57	3.13	0	0	0	4.72	0.74	0	11.15
Processed food	14.94	34.53	19.22	0	18.08	0	15.27	0	11.05	113.1
Textiles and clothing	9.66	9.33	6.6	9.13	0	2.39	9.67	0	8.81	55.58
Light manufacturing	9.98	25.37	15.53	5.16	24.16	2.1	17.83	4.5	9.74	114.4
Heavy manufacturing	5.21	7.47	6.93	6.09	5.84	7.17	7.03	4.88	8.03	58.65
Utilities and construction	0	0	0	0	0	0	0	0	0	0
Transportation and communication	0	0	0	0	0	0	0	0	0	0
Other services	0	0	0	0	0	0	0	0	0	0
Total	43.76	107.2	90.11	20.38	48.09	11.65	76.81	36.54	40.33	474.9

Source: GTAP database.

Trade Structure

[11] For more detailed information see www.moic.gov.la

Laos is facing chronic trade deficits. However, trade deficits have been narrowing since 2003 due to the increase in the export of mineral.[12] As seen in Table 1, the average trade deficit to GDP was 9.24 % during 2001-2006, a decline from 16.06 % during 1999-2000. The average export growth during 2001-2006 was 20.4 %, an increase from 1.7 % during 1996-2000. On the other hand, the average growth of imports was 14.10 % during 2001-2006 (table 1).

Table 3. Export by County in the world and the ASEAN countries (share, %)

Export	2001-2006		1996-2000		1990-1995	
	Value (1000US$)	share (%)	Value (1000US$)	share (%)	Value (1000US$)	share (%)
ASEAN	1,731,493	56.3	304,358	25.6	350,454	43
EU	937,474	30.5	534,506	44.9	204,614	25.1
ASIA	301,482	9.8	250,224	21	205,152	25.2
US	54,421	1.8	89,334	7.5	45,880	5.6
Oceania	27,056	0.9	1,441	0.1	263	0
Other	25,687	0.8	11,000	0.9	7,856	1
Total word	3,077,613	100	1,190,864	100	814,218	100
Thailand	1,127,454	65.1	287,440	94.4	334,529	95.5
Vietnam	529,853	30.6	-	-	-	-
Singapore	3,873	0.2	14,551	4.8	14,327	4.1
Malaysia	63,022	3.6	153	0.1	1,138	0.3
Cambodia	529	0	36	0	-	-
Indonesia	6,668	0.4	2,160	0.7	459	0.1
Philippine	83	0	19	0	-	-
Brunei	10	0	-	-	-	-
Total ASEAN	1,731,493	100	304,358	100	350,454	100

Source: Compile from COMTRADE data in the WITS database.

[12] Increasing mining exports are the main cause of the narrowing trade deficit. One of the largest mining projects in Laos is the Sepon Mining Project; for more details of the project see http://www.ozminerals.com/Operations/Mining-Operations/Sepon-Gold.html.

Table 4. Import by County (share, %)

Import	2001-2006		1996-2000		1990-1995	
	value (1000US$)	Share (%)	value (1000US$)	Share (%)	value (1000US$)	Share (%)
1 ASEAN	4,281,062	77.4	2,087,341	79.3	1,173,624	68.5
2 Europe	278,011	5	191,122	7.3	113,934	6.6
3 ASIA	841,249	15.2	318,436	12.1	336,202	19.6
4 US	37,310	0.7	17,702	0.7	15,134	0.9
5 Oceania	79,704	1.4	14,412	0.5	74,070	4.3
6 Other	12,198	0.2	3,265	0.1	1,046	0.1
Total Word	5,529,533	100	2,632,278	100	1,714,100	100
1 Thailand	3,637,465	85	1,910,061	91.5	1,083,996	92.4
2 Vietnam	413,394	907	_	_	_	_
3 Singapore	192,536	405	158,817	7.6	82,739	7
4 Malaysia	20,956	0.5	8,828	0.4	3,665	0.3
5 Cambodia	4,632	0.1	3,184	0.2	_	_
6 Indonesia	10,289	0.2	5,959	0.3	3,224	0.3
7 Philippine	1,643	0	482	0	_	_
8 Brunei	147	0	10	0	_	_
Total ASEAN	4,281,062	100	2,087,341	100	1,173,624	100

Source: Compile from COMTRADE data in the WITS database.

ASEAN members are Laos' main trading partners; they account for 56.3 % of Lao exports and 77.40 % of imports. In ASEAN, Thailand claims the highest share of exports and imports. Thailand accounted for 65.1 % of total exports and 85 % of total imports during 2001-2006 (table 3, 4).

Table 5 shows the commodities in export in Laos from 1990 to 2006. Laos' main exports were Wood (31.44%), Apparel (28.55%) and Base metals and their products (15.31%) during 2001-2006. Base metals and their products have increased significantly during 2001-2006.

Laos imports various goods from other countries, from basic consumption goods to investment goods and fuel (table 6). The top three import commodities were Electrical and mechanical machine (19.08%), Oil and mineral products (18.63%), and Transport equipment (12.38%) during 2001-2006. Therefore, how WTO accession changes the terms of trade in Laos will be interesting to observe.

Table 5. Export by Commodity (share, %)

Commudity			2001-2006		1996-2000		1990-1995	
			Value (1000US$)	Share (%)	Value (1000US$)	Share (%)	Value (1000US$)	Share (%)
1	1-5	Animals & animal products	24,944	0.81	15,782	1.33	3,200	0.39
2	6-14	Vegetable products	162,192	5.27	85,476	7.18	40,182	4.94
3	15	Animal and Vegetable oils	27	0.00	61	0.01	20	0.00
4	16-24	Processed foods, drink & tobacco	18,883	0.61	7,936	0.67	3,056	0.38
5	25-27	Oil and mineral products	269,742	8.77	33,353	2.80	9,854	1.21
6	28-38	Chemical products	10,578	0.34	2,139	0.18	6,195	0.76
7	39-40	Plastics & rubber product	25,449	0.83	2,459	0.21	616	0.08
8	41-43	Skin, furs and their products	6,840	0.22	7,390	0.62	11,147	1.37
9	44-46	Wood	966,658	31.44	459,470	38.58	484,601	59.54
10	47-49	Wood products &paper	3,537	0.12	1,918	0.16	291	0.04
11.1	50-60	Textiles	7,145	0.23	2,991	0.25	829	0.10
11.2	61-63	Apparel	877,772	28.55	493,639	41.45	200,420	24.62
12	64-67	Shoes, hats, umbrellas, etc	43,627	1.42	35,325	2.97	1,165	0.14
13	68-70	Stone, ceramic & glass products	668	0.02	589	0.05	64	0.01
14	71	Jewelry & precious metal products	45,903	1.49	1,569	0.13	1,312	0.16
15	72-83	Base metals and their products	470,674	15.31	3,857	0.32	40,151	4.93
16	84-85	Electrical and mechanucal machines	31,956	1.04	6,749	0.57	3,120	0.38
17	86-89	Transport equipment	55,014	1.79	2,644	0.22	716	0.09
18	90-92	Photographic, precision instruments	1,134	0.04	350	0.03	937	0.12
19	93	Arms & munitions	23	0.00	8	0.00	2	0.00
20	94-96	Funiture &assorted products	13,207	0.43	17,774	1.49	2,016	0.25
21	97-98	Objets d' art	618	0.02	190	0.02	435	0.05
22	99	Other	35,370	1.15	8,326	0.70	3,749	0.46
Total			**3,071,962**	**100**	**1,189,997**	**100**	**814,077**	**100**

Source: Compile from COMTRADE data in the WITS database (see www.wits.worldbank.org)

Table 6. Import by Commodity (share, %)

Commudity			**2001-2006**		**1996-2000**		**1990-1995**	
			Value (1000US$)	Share (%)	Value (1000US$)	Share (%)	Value (1000US$)	Share (%)
1	1-5	Animals & animal products	61,357	1.11	25,195	0.96	25,980	1.52
2	6-14	Vegetable products	114,419	2.07	62,558	2.38	45,469	2.65
3	15	Animal and Vegetable oils	15,503	0.28	10,060	0.38	4,843	0.28
4	16-24	Processed foods, drink & tobacco	596,643	10.79	316,297	12.02	186,380	10.87
5	25-27	Oil and mineral products	1,030,291	18.63	317,093	12.05	169,041	9.86
6	28-38	Chemical products	300,015	5.43	122,397	4.65	106,326	6.20
7	39-40	Plastics & rubber product	206,129	3.73	93,058	3.53	68,640	4.00
8	41-43	Skin, furs and their products	5,692	0.10	3,046	0.12	1,744	0.10
9	44-46	Wood	7,460	0.13	3,351	0.13	1,857	0.11
10	47-49	Wood products &paper	65,459	1.18	31,082	1.18	15,449	0.90
11	50-60	Textiles	487,822	8.82	198,930	7.56	103,809	6.06
11	61-63	Apparel	68,894	1.25	23,691	0.90	23,748	1.39
12	64-67	Shoes, hats, umbrellas, etc	22,537	0.41	10,359	0.39	16,941	0.99
13	68-70	Stone, ceramic & glass products	141,162	2.55	86,397	3.28	40,498	2.36
14	71	Jewelry & precious metal products	68,731	1.24	15,878	0.60	67,015	3.91
15	72-83	Base metals and their products	394,482	7.13	165,011	6.27	100,379	5.86
16	84-85	Electrical and mechanucal machines	1,055,188	19.08	488,686	18.56	294,883	17.20
17	86-89	Transport equipment	684,292	12.38	572,809	21.76	387,199	22.59
18	90-92	Photographic, precision instruments	48,838	0.88	35,342	1.34	16,009	0.93
19	93	Arms & munitions	1,066	0.02	59	0.00	786	0.05
20	94-96	Funiture &assorted products	51,043	0.92	25,666	0.97	17,240	1.01
21	97-98	Objets d' art	598	0.01	71	0.00	112	0.01
22	99	Other	110,801	2.00	32,655	1.24	21,183	1.24
Total			**5,529,386**	**100**	**2,632,368**	**100**	**1,714,100**	**100**

Source: Compile from COMTRADE data in the WITS database (see www.wits.worldbank.org)

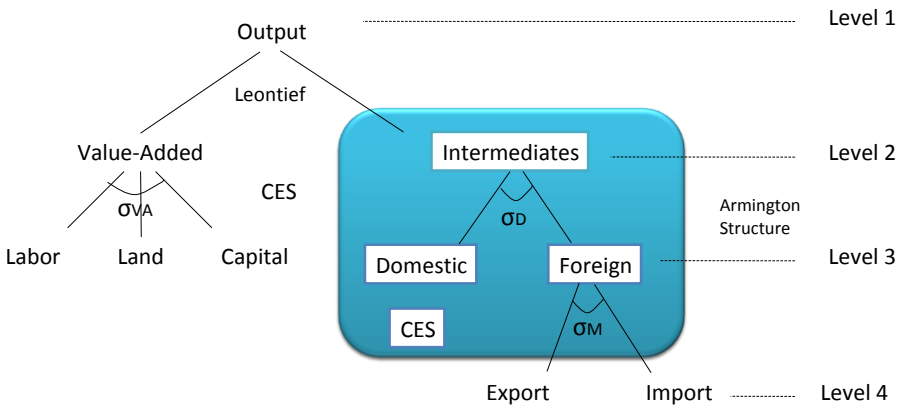
The GTAP Model and Database

The Global Trade Analysis Project (GTAP) model, a multi-region computable equilibrium (CGE) model, is one of the most popular models for analyzing the impact of trade policy. There are various advantages to the GTAP model. Firstly, since it is a multi-regional model of world production and trade, it can take into account the overall trade implications of Laos' WTO accession as well as third-party countries. Secondly, it contains a database for different sectors and thus can explore the trade implications for various sectors of interest.[13]

The GTAP model assumes perfectly competitive markets, where the zero profit condition holds, and that all the markets are cleared. The regional household allocates expenditures across three categories: private household, government, and savings. It derives income from the 'sale' of primary factors to the producers, which combines them with domestically produced and imported intermediate composites to produce final goods. These final goods are in turn sold both domestically to private households and the government, and exported to the rest of the world. Both government and private households also import final consumption goods from the rest of the world. A global bank intermediates between global savings and regional investments by assembling a portfolio of regional investment goods and selling shares in this portfolio to regional households in order to meet their savings demands. Finally, a global transport sector assembles regional exports of trade, transport and insurance services and produces a composite goods used to move merchandise trade among regions (Hertel and Tsigas, 1997). The production structure in the GTAP model is illustrated in Figure 1.

[13] For more details, see Hertel (1997). A graphical presentation of the GTAP model with particular emphasis on the accounting relationships is given by Brockmeier (1996).

Figure 1 Production structure in the GTAP model



Source: Hertel (1997)

Various studies have used the GTAP model to analyze the impact of trade policies. Tongzon (2001) used the standard GTAP model to assess the impact of China's WTO membership on the exports of East Asian developing economies. Anderson and Strutt (1999) used a GTAP model to investigate the impact of the Asian crisis and trade reforms on Indonesia. While many studies have used the CGE model for developing countries, there are very few studies using CGE model building for the Lao economy. Fukase and Martin (1999) built a simple CGE model to analyze the economic effect of joining the AFTA; their simulation results showed that AFTA accession is economically beneficial. Using the CGE modeling, Warr and Menon (2006) studied the effect of rural road improvements on poverty incidence in Laos. Their simulation results showed that there is considerable scope for reducing poverty incidence in Laos by reducing rural transport costs through improving the quality of rural roads. Warr (2006) built a two-sector, multi-household CGE model to analyze the impact of the hydropower dam Nam Theun 2 (NT2) His simulation results showed that the project had significant effects on poverty incidence, but if poor households do not share directly in the proceeds of the project, poverty incidence is likely to rise. Stone et. al (2009) used a GTAP model to investigate the impact of transport infrastructure

projects on socioeconomic characteristics in the Greater Mekong Subregion. liberalization in Laos. However, the newest version of the GTAP 7 database includes Laos' input-output table, which might provide significant contributions to empirical studies of this issue.

The latest version of the GTAP database, version 7, is used for this study. To facilitate our analysis on macroeconomic impacts, we have aggregated 57 sectors to 10 sectors and the 113 countries into 10 regions[14] but we used all 57 sectors of price and wage changes to measure the impact on household welfare. The breakdown of sectors and regions is shown in Table 7 and 8.

Table 7. Sectors of model

No	Commodity code	Comprising	Description
1	GrainsCrops	pdr wht gro v_f osd c_b pfb ocr pcr	Grains and Crops
2	MeatLstk	ctl oap rmk wol cmt omt	Livestock and Meat Products
3	Extraction	frs fsh coa oil gas omn	Mining and Extraction
4	ProcFood	vol mil sgr ofd b_t	Processed Food
5	TextWapp	tex wap	Textiles and Clothing
6	LightMnfc	lea lum ppp fmp mvh otn omf	Light Manufacturing
7	HeavyMnfc	p_c crp nmm i_s nfm ele ome	Heavy Manufacturing
8	Util_Cons	ely gdt wtr cns	Utilities and Construction
9	TransComm	trd otp wtp atp cmn	Transport and Communication
10	OthServices	ofi isr obs ros osg dwe	Other Services

Source: the authors compiled from GTAP database

[14] The GTAP model uses GEMPACK software for solving and simulation.

Table 8. Regions of model

No	Region code	Comprising	Region description
1	Oceania	AUS NZL XOC	Australia, New Zealand
2	EastAsia	CHN HKG JPN KOR TWN XEA	East Asia
3	SEAsia	KHM IDN MMR MYS PHL SGP THA VNM XSE	Southeast Asia
4	SouthAsia	BGD IND PAK LKA XSA	South Asia
5	NAmerica	CAN USA MEX XNA	North America
6	LatinAmer	ARG BOL BRA CHL COL ECU PRY PER URY VEN XSM CRI GTM NIC PAN XCA XCB	Latin America
7	EU_25	AUT BEL CYP CZE DNK EST FIN FRA DEU GRC HUN IRL ITA LVA LTU LUX MLT NLD POL PRT SVK SVN ESP SWE GBR	European Union 25
8	SSA	NGA SEN XWF XCF XAC ETH MDG MWI MUS MOZ TZA UGA ZMB ZWE XEC BWA ZAF XSC	Sub-Saharan Africa
9	LAOS	LAO	Laos
10	RestofWorld	CHE NOR XEF ALB BGR BLR HRV ROU RUS UKR XEE XER KAZ KGZ XSU ARM AZE GEO IRN TUR XWS EGY MAR TUN XNF	Rest of World

Source: the authors compiled from GTAP database.

Measurement of the Welfare Impacts

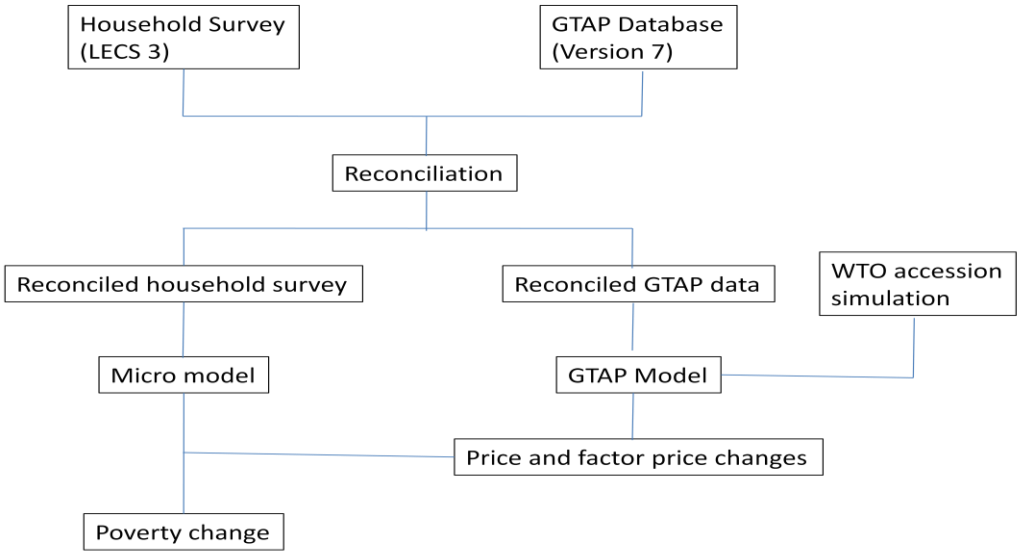
With a CGE mode, a number of approaches exist to analyze the income distribution. The traditional approach is the representative household method, where it is assumed the income or expenditures of households follow a certain functional form distribution (Adelman and Robinson, 1978; Dervis, de Melo and Robinson, 1991). The most up-to-date approach is the integrated-microsimulation- CGE model approach which combines the simulation from a CGE model with household level data. This approach has been implemented in various studies including Annabi et al. (2005) for Senegal, and Cororaton et al (2005) and Cororaton and Cockburn (2006) for the Philippines.

In the various types of the integrated- microsimulation- CGE model approach, this study will use a “top-down approach” with micro accounting to estimate the impact of Laos’ WTO accession on poverty and income distribution (Nicata, 2005; Chen and Ravallion, 2004; Ravallion and Lokshin, 2008). There are two steps for estimating the effect of trade liberalization on household welfare. Firstly,

we estimate producers and consumers price changes and factor production price changes from Lao GTAP model. Secondly, the price changes from the GTAP model are used with Lao household expenditure survey to estimate household welfare changes (figure 2).

The household welfare change is calculated using the formula in Chen and Ravallion (2004) and Ravallion and Lokshin (2008). In their approach, household welfare changes from trade liberalization occur through four factors in income: revenues, consumptions, inputs and wages as in Equation (3) in Chen and Ravallion (2004). A increase in consumer, produce, and factor production prices raise welfare through revenues and wages and decreases it through consumptions and inputs. These changes for particular food and non-food items alter household welfare which is based on the share of the revenue of these items. For example, the changes of international demand for particular goods affect household incomes which depend on the proportion to their marketed production of goods.

Figure 2: Methodology framework



Source: authors adopted from Ivanic (2006)

Data Matching

This study used data from the third Lao Expenditure and Consumption Survey (LECS 3) in 2002/2003. LECS 3 has 8092 samples which consist of 1604 urban households (20%) and 6488 rural households (80%).

1. Consumption and production

We used GTAP Database version 7 which consists of 57 sectors to this study, and factors product included land, capital, skilled labor and un-skilled labor. We matched consumption and production from LECS 3 to GTAP database. In LECS 3 there were 357 categories for consumption and 117 categories for production.

Since the agricultural section in LECS 3 did not contain the value of sales and cost of the agricultural products, we cannot use the data from this section. However, the diary section of LECS 3 records the monthly transaction of agricultural income and costs. So, we can obtain the information on agricultural income although it is possible that agricultural income is underestimated because the reference period is monthly and shorter in the diary section than the agricultural season in the agriculture section in LECS 3.

2. Labor

There are two types of labor in Lao GTAP model: skilled labor and un-skilled labor, so we categorize wage income in the household survey into skilled and un-skilled labor income in this study. We define wage income as that from skilled labor if wage earners have completed at least primary education, and as that from unskilled labor if wage earners have not completed primary education. Since each entry of wage income in LECS 3 has a person ID but does not have the information on the industry, the industry in which the person engaged for the longest days and hours is chosen as the industry of the wage income.

3. Household income

The change of per capita income is used as the welfare indicator in this study. Household income included the expenditure on own-produced agriculture products in addition to agriculture, non-agriculture business, and wage income, and since the share of the consumption from the own-produced agricultural products is very large in Laos and excluding this part from income underestimates actual income. New income in the simulation is calculated by adding the estimated welfare change to the income in the baseline as in Chen and Ravallion(2004).

4. Income poverty lines

Since official income poverty lines in LECS 3 are not established as far as we know, they should be obtained by this study. Since official per capita expenditure poverty lines in LECS 3 are established, the income poverty lines are obtained by taking the mean per capita expenditures each month for the poor households based on the expenditure poverty lines. The means are taken separately in eight areas (urban and rural areas in Vientian Capital, the north, central and south) and each month since the expenditure poverty lines in LECS 3 are calculated in the same way. Therefore, the income poverty rates using income poverty lines approximate the expenditure poverty rates in LECS 3.

Macro-simulation Designs

Laos will gain various benefits from WTO accession. Firstly, WTO accession will give Laos opportunities to improve the trade and investment environment. Secondly, WTO members would be more secure and less discriminatory in terms of market access for Lao exports. Thirdly, WTO accession will increase FDI in Laos[15].

[15] The benefits of WTO accession for Laos are discussed in more detail in Anderson (1998).

Despites the benefits of WTO accession, Laos will also experience costs. Firstly, as an LDC, Laos receives unilateral preferences from some 48 developed and developing countries. Laos has received duty-free, quota-free market access under the Everything But Arms (EBA) initiative from the EU, and the Generalized System of Preferences (GSP) from Australia, Belarus, Canada, Japan, New Zealand, Norway, Russia, Switzerland, and Turkey. Moreover, Laos is granted unilateral preferential treatment by the original ASEAN members under the ASEAN Integrated System of Preferences (AISP) and also gets Special and Preferential Treatment (SPT) from China and the Republic of Korea. This shows that Laos already has good market access opportunities, but under the WTO-Multilateral Trade System, these preferential tariffs will be eroded as in principle they are tariff barriers. Secondly, under the Agreement on Textiles and Clothing (ATC) and cheap labor, Lao garment exports were expanded to the EU and USA. If it joins the WTO, Laos will have to remove textile and clothing quotas and compete with large suppliers likes China, India and other countries. Thirdly, as some SMEs in Laos are small in scale and not competitive, WTO accession may have negative impact on their development. Fourthly, WTO accession may expand current budget and trade deficits, which might lead to macroeconomic instability.

Though WTO accession involves various costs and benefits, we focus on tariff cut for assess the impact of Laos' WTO accession. The base case scenario represents Laos without WTO accession, which is referred to as no shock in the model. The simulation scenario represents Laos' accession to the WTO through reduced tariff rates. We assume that with WTO accession Laos' final tariff rate commitment in agriculture, non-agriculture and service is the same as the Common Effective Preferential Tariff (CEPT) Scheme for AFTA. The simulation scenario cuts tariff rate in Laos to 2.5 % of all sectors except for service sectors from nine regions including Southeast Asia.

Simulation Results from GTAP model

Following are the simulation results showing the impact of Laos' WTO accession.

Impact on macroeconomic variables

Laos will gain minor benefits from WTO accession. WTO accession has positive impact on increasing real GDP, but the percent change is small: about 0.5% (table 9). In addition, WTO accession increases equivalent variation (EV) about 1 $US million. The increased EV comes mostly from the allocative efficiency effect,[16] specifically in *Processed Food*, *Light Manufacturing* and *Grains and Crops* (table 9). The main reason WTO accession has such a slight positive impact is that the economy of Laos is small and tariff rates are already low.

Table 9. Impact on macroeconomic variables

Macroeconomic variables	Impact of WTO accession
Real GDP (%)	0.53
Equavalient Variation	0.96
Export volumes (%)	5.65
Import volumes (%)	7.91
Trade balance (US$ million)	-42.70
Terms of trade (%)	-0.97

Source: Authors' simulation from GTAP model.

Impact on industry output

Only the output of *Textiles and clothing, Utilities and construction, Transportation and communication* and *other services* increase from WTO accession. Other sectors face declining output. Therefore, most of the output of Lao products might decline due to WTO accession (table 10).

[16] There are basically 4 major sources for any welfare change: allocative efficiency effect, endowment effect, technology effect and terms of trade effect (Huff and Hertel, 2000; Hanslow, 2000; Adams, 2005).

Table 10. Impact on industry output

Sector	Impact on industry output (%)
Grains and crops	-0.41
Livestock and meat products	-0.07
Mining and extraction	-0.31
Processed food	-4.74
Textiles and clothing	5.63
Light manufacturing	-1.81
Heavy manufacturing	-3.27
Utilities and construction	4.85
Transportation and communication	0.52
Other services	1.01

Source: Authors' simulation from GTAP model.

Impact of trade balance

Only two sectors, *Mining and extraction* and *Textiles and clothing,* show a trade surplus from WTO accession. The net gain from *Mining and extraction* is 3 million US$ and from *Textiles and clothing* is 5 million US$. Laos experiences losses in other sectors; the losses in *Processed food* are especially high, accounting for about 30 US million. As the simulation results show that Laos will face losses in the agriculture and food sectors, this has a potentially significant influence on the food security of Laos. Therefore, it is important for policy markers carefully consider the impact of WTO accession on food security (table 11).

Table 11. Impact on trade balance

Sector	Impact on trade balance (US$ million)
Grains and crops	-5.13
Livestock and meat products	-0.65
Mining and extraction	3.14
Processed food	-30.87
Textiles and clothing	5.66
Light manufacturing	-6.75
Heavy manufacturing	-14.18
Utilities and construction	0.78
Transportation and communication	0.48
Other services	4.85

Source: Authors' simulation from GTAP model.

Impact on exports and imports

As expected, WTO accession leads to increase export and import volumes. The exports of *Textiles and clothing* and *Light manufacturing* increase about 8% and *Heavy manufacturing* by about 7%. Other sectors show much smaller increases: *Grains and crops* increase by about 0.5%, *Livestock and meat products by* about 2% and *Mining and extraction* by about 2 % (table 12).

On the other hand, imports in many sectors increase. In some sectors, this increase is significant: imports *Grains and crops* and *Livestock and meat products* increase about 30%, and *Processed food* increases about 20%. Imports of *Textiles and clothing*, *Light manufacturing* and *Heavy manufacturing* also increase, but the but percentage change is much smaller: imports in *Light manufacturing* increases about 10%, *Textiles and clothing* about 8%, and *Heavy manufacturing* about 3% (table 13).

Table 12. Impact on export volumes

Sector	Impact on export volumes (%)
Grains and crops	0.58
Livestock and meat products	1.87
Mining and extraction	2.17
Processed food	0.2
Textiles and clothing	8.82
Light manufacturing	8.53
Heavy manufacturing	6.78
Utilities and construction	9.61
Transportation and communication	0.62
Other services	5.16

Source: Authors' simulation from GTAP model.

Table 13. Impact on import volumes

Sector	Impact on import volumes (US$ million)
Grains and crops	36.15
Livestock and meat products	33.4
Mining and extraction	-7.32
Processed food	23.86
Textiles and clothing	7.79
Light manufacturing	10.19
Heavy manufacturing	3.58
Utilities and construction	-4.43
Transportation and communication	-0.63
Other services	-2.72

Source: Authors' simulation from GTAP model.

Impact of demand for labor

Demand for most *Unskilled labor* declines from WTO accession, except in *Textiles and clothing, Utilities and construction*, *Transportation and communication,* and *other services*. The demand for labor in*Textiles and clothing* and *Utilities and construction* increase by about 5%. However, demand for *Unskilled labor* in *Livestock and meat products*, *Mining and extraction*, *Processed food*, *Textiles and clothing*, *Light manufacturing*, and *Heavy manufacturing* decline.

Out of six sectors, the demand for *Skilled labor* in *Textiles and clothing* and *Utilities and construction* also declines 4%. The simulation results show that except in *Textiles and clothing* and *Utilities and construction,* demand for unskilled and skill labor will decline, causing unemployment problems in some sectors (table 14). More details of result of output, terms of trade, export, import, demand of skilled and un-skilled labors in 57 sectors see Table A1.

Table 14. Impact on demand for primary factors of production (%)

Sector	Land	Unskill labor	Skill labor	Capital	Natural Resource
Grains and crops	-0.1	-0.7	-0.9	-0.7	0.0
Livestock and meat products	0.4	-0.5	-0.9	-0.7	0.0
Mining and extraction	0.1	-0.4	-0.5	-0.4	0.0
Processed food	-1.0	-4.4	-5.4	-4.8	0.0
Textiles and clothing	3.8	6.0	4.9	5.5	0.0
Light manufacturing	0.5	-1.5	-2.6	-1.9	0.0
Heavy manufacturing	-0.2	-2.9	-4.0	-3.4	0.0
Utilities and construction	3.4	5.3	4.1	4.8	0.0
Transportation and communication	1.6	1.0	-0.5	0.4	0.0
Other services	1.8	1.6	0.4	1.1	0.0

Source: Authors' simulation from GTAP model.

Welfare Impacts of the WTO Accession

Using the simulated price and output changes based on the GTAP model, the prediction of the welfare change and poverty are created using Lao household survey (LECS). Table 15 summarizes the results of the micro-simulation. The first panel in the table shows the median change in the welfare for households with the tariff reduction in terms of rural/urban, regions, and poverty status in the

baseline economy. The third and fourth columns indicate the estimated per capita welfare changes and the percentage of the welfare change in base income, respectively. The former implies the absolute size of the welfare

Table 15. Summary statistics on esimated welfare impacts

1. Median welfare change			
		Per capita (kip)	Percentage in income
National		-1019.4	-1.1
Rural		-1138.1	-1.4
Urban		2388.3	0.9
Region			
Vientiane Capital		4044.2	1.1
North		-1177.5	-1.4
Central		-978.8	-1.0
South		-1087.3	-1.2
Expenditure poverty in Base			
Non-poor		-1034.5	-0.7
Poor		-1018.6	-1.6
rural non-poor		-1357.2	-1.0
rural poor		-1045.4	-1.7
urban non-poor		3279.0	1.0
urban poor		-70.4	0.0
2. Gini index as percentage			
	Baseline	Simulated	Change
Total	0.488	0.496	0.01
rural	0.436	0.444	0.01
urban	0.414	0.420	0.01
Region:			
Vientiane Capital	0.387	0.393	0.01
North	0.458	0.466	0.01
Central	0.466	0.474	0.01
South	0.458	0.465	0.01
3. Poverty impacts (headcount index, percentage)			
	Baseline	Simulated	Change
National:	30.7	31.2	0.48
rural	28.9	29.6	0.78
urban	37.0	36.4	-0.53
Region:			
Vientiane Capital	37.2	36.8	-0.39
North	30.6	31.4	0.81
Central	30.7	31.1	0.40
South	27.2	27.7	0.58
Sources: Authors' computations based on the GTAP model and LECS 3.			

change, and the latter does the relative size. As seen in the table, the welfare change in the entire country is negative 1019.4 kips and 1.1 percent decline of

base income.[17] However, the direction of the welfare change in the rural is opposite of that in the urban (-1138.1 and 1.4 percent increase from base income for the rural and 2388.3 and 0.9 percent decline for the urban). These results indicate that the welfare changes by the tariff reduction to households are heterogeneous. Additionally, the welfare changes are estimated over regions and poverty status in the baseline economy. As seen in the panel, households in Vientiane capital benefits from the tariff cut, but households in the rest of the regions become worse off. In addition, both poor and non-poor households are negatively affected on average. But the urban non-poor are positively affected, the urban poor are neutral, and households in the rural areas suffer and more for the poor in the rural areas as shown in the table. Therefore, the welfare change due to the tariff reduction in the entire economy is negative, but that differ across rural/urban, regions, and initial poverty status.

The second panel in the table shows the change in inequality of the economy due to the tariff reduction using the Gini index. We found that almost no change in the inequality due to the policy change as seen in the panel. The Gini indexes increased slightly from the baseline to simulation, but they are negligible.

The last panel in Table 15 shows the impacts to the poverty. The poverty rate in the entire country increases slightly due to the policy change, but the changes are heterogeneous across rural/urban and regions. As seen in the table, the poverty headcount rate increased by 0.48 percentage point from 30.7. However, the poverty rate Increases by 0.78 percentage point in the rural and decreases by 0.53 in the urban. Finally, the poverty rates decrease in Vientiane capital and increase in the rest of the regions. These changes in the poverty rates are

[17] The direction of the welfare change in the entire country in this micro-estimation is opposite of that in the macro-simulation from the GTAP model. This difference occurs since the former uses the first-order change in income as a welfare indicator due to only the changes in consumer and producer and production factor prices, and the latter uses the equivalent variation as a welfare indicator which additionally takes the changes of the quantity in production, consumption and production factor input into account. Therefore, the two numbers are not directly comparable.

consistent with those in the welfare changes as discussed in the previous paragraph although the size of the changes is not significant.

As discussed in this section, the impacts of the tariff reduction on welfare are heterogeneous, and are positive for the households in the urban, Vientiane capital, and the urban non-poor, but negative for the rest of the households. Thus, the trade liberalization makes winners and losers within the country. The impacts on inequality are negligible. But the impacts on poverty are small and have the same trend as the welfare change.

Conclusion

This paper has attempted to quantify the impact of Lao's WTO accession using a standard GTAP model. From the simulation results, we can conclude that the benefits from WTO accession are quite small; the real GDP will increase only about 0.5% and household welfare (EV) will increase by 1 million US$. In addition, except from *Textiles and clothing* and *Utilities and construction,* the output of most Lao products will fall; many sectors will experience trade deficits; and the demand for skilled and unskilled labor will fall. Therefore, we can conclude that overall Laos will gain minor benefits from WTO accession.

The micro-simulation using the household survey indicates that the change in household welfares due to the tariff reduction is not homogenous but heterogeneous. The winners from the tariff cut are households which live in the urban areas, Vientiane capital, and are the non-poor in the urban area as shown the above. The losers from this policy changes are the households which do not belong to the above categories, and their household income drops and the poverty rates increase. The magnitudes of the changes are not so large with this simulation, but if more drastic liberalization policies are implemented, the magnitude of the changes could be much larger. Therefore, we should be cautious to implement the liberalization policies in Laos since the changes could

make losers in the rural areas in which 77 percent of the population resides. The policy implication is that social safety nets for the possible losers are necessary when the trade liberalization policy is implemented in future.

This study is characterized by several weaknesses for GTAP simulation. First, it uses a static GTAP model, which does not reflect the real impact of Laos' WTO accession. Second, trade liberalization bestows various benefits such as improvement of trade facility and business climate, but this simulation focuses only on tariff cuts, and so the impact of WTO accession might be underestimated.

Moreover, this top-down approach has several weaknesses as follows. First, there are no behavior response linking between macro and micro accounting model which is major criticism of this approach (Bourguignon, Bussolo and Silav, 2008). This approach is first-round effects which are a good approximation of total welfare effects when prices and wage changes are small and markets are competitive. Price and wage changes are not marginal and markets are not perfectly competitive. Therefore, behavioral response cannot be ignored. Secondly, this approach focuses on the short-term welfare impact of trade policy changes. This approach does not capture the dynamic effect from trade policy changes through labor market adjustment and technical innovation (Ravallion and Lokshin, 2008). Thirdly, this approach does not capture feedback of externalities from trade policy changes on productivity and utility. For instance, increase pollution from trade policy changes has inverse impact on productivity of firm and decreasing utility of households (Xie and Saltzman, 2000). Fourthly, this approach assumes that price and wage changes from trade policy are the same in both rural and urban areas. Is fact, infrastructure, market access and geographic condition are different by each location. Therefore, price and wage change from trade policy changes are not necessary the same in urban and rural areas (Winter, McCulloch and McKay, 2004; Nicita, 2005). Despite these weaknesses this approach can usefully analyze the welfare impact from

economic policy and provide beneficial policy implications for compensating losers from policy changes.

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Table A1. Impact of WTO accession by sectors

Sector	Output (%)	Trade balance ($US million)	Export (%)	Import (%)	Demand of Un-skilled labor (%)	Demand of skilled labor (%)
pdr	1.01	-0.45	-23.65	21.61	1.1	1.02
wht	2.1	0	15.88	-6.69	2.3	2.22
gro	-0.45	-0.1	-3.54	3.74	-0.52	-0.6
v_f	-1.53	-2.82	-3.77	27.16	-1.71	-1.79
osd	-1.26	-0.11	-6.39	33.01	-1.41	-1.49
c_b	0.34	0	-5.25	-4.64	0.35	0.28
pfb	-1.54	-0.06	-4.77	-4.68	-1.72	-1.79
ocr	-2.75	-0.78	-4.63	9.6	-3.05	-3.13
ctl	0.64	-0.13	-7.77	11.87	0.69	0.61
oap	0.59	-0.11	-2.96	7.58	0.63	0.55
rmk	1.08	0	18.59	-3.39	1.18	1.1
wol	10.88	0	31.26	-7.84	11.95	11.87
frs	-2.18	-1.15	-4.72	5.57	-2.36	-2.43
fsh	-0.06	-0.01	-3.46	9.86	-0.09	-0.15
coa	0.99	0.1	6.74	-0.18	11.96	11.89
oil	1.92	2.35	0.92	-10.93	20.81	20.75
gas	2.24	0.01	-76.62	-1.48	19.79	19.73
omn	2.02	-0.01	1.94	1.04	8.87	8.8
cmt	0.5	-0.14	-15.37	75.7	0.54	0.16
omt	-0.47	-0.87	-10.32	79.35	-0.43	-0.81
vol	-3.9	-0.33	-7.2	14.15	-3.86	-4.23
mil	-5.96	-0.34	-8.03	3.78	-5.92	-6.3
pcr	0.66	-0.71	-8.58	11.44	0.69	0.31
sgr	-13.41	-0.14	-1.78	1.84	-13.37	-13.75
ofd	-1.21	-7.59	-4.92	14.9	-1.17	-1.54
b_t	-4.54	-12.49	-2.78	20.15	-4.51	-4.89
tex	-0.3	-2.09	4.34	4.91	-0.27	-0.69
wap	2.21	2.17	3.07	9.94	2.24	1.82
lea	-6.25	-0.66	-4.12	9.65	-6.22	-6.64
lum	-2.78	-3.02	-2.29	14.08	-2.74	-3.17
ppp	-8.17	-0.46	-0.15	2.86	-8.14	-8.56
p_c	-2.81	-2.01	-1.45	10.56	-2.78	-3.2
crp	-1.37	-1.47	0.9	1.37	-1.37	-1.79
nmm	4.07	-1.61	1.24	3.12	4.1	3.68
i_s	-1.59	-1.8	-0.12	4.32	-1.59	-2.02
nfm	-2.23	-0.47	-0.3	3.27	-2.23	-2.66
fmp	0.37	-1.72	6.21	4.73	0.4	-0.02
mvh	-15.77	-2.41	50.98	4.27	-15.73	-16.15
otn	-25.44	0.93	52.09	-3.49	-25.4	-25.82
ele	-6.12	-1.69	20.54	3.75	-6.08	-6.5
ome	7.88	-5.24	19.6	3.95	7.92	7.5
omf	0.56	-0.43	7.89	13.25	0.59	0.17
ely	0.04	-0.01	-0.51	0.25	0.09	-0.33
gdt	-1.23	-0.24	-5.48	0.93	-1.17	-1.6
wtr	0.32	-0.01	-5.27	0.96	0.38	-0.04
cns	7.05	0.01	5.79	0.43	7.1	6.63
trd	1.06	-0.14	-2.61	0.39	1.12	0.55
otp	-0.43	-1.04	-2.41	2.16	-0.36	-0.93
wtp	1.55	0.15	1.72	0.02	1.62	1.06
atp	3.87	0.79	5.94	-1.91	3.95	3.38
cmn	0.77	-0.01	-1.17	-0.24	0.85	0.43
ofi	-0.07	-0.02	-6.29	0.32	-0.02	-0.45
isr	-1.4	-0.02	-4.52	0.49	-1.35	-1.78
obs	-0.54	-0.1	-6.23	0.38	-0.51	-0.93
ros	2.15	2.53	9.94	-2.52	2.23	1.81
osg	0.03	0.52	0.71	-0.54	0.29	-0.13
dwe	0	0	-2.42	-2.42	0.02	-0.4

Source: Authors' simulation from GTAP model.

Table A2. Household welfare change across 57 sectors

	sector	Rural			Urban		
		Revenue per capita (kip)	Change per capita (kip)	Percentage in income	Revenue per capita (kip)	Change per capita (kip)	Percentage in income
1	Paddy rice	-28280.8	448.8	-0.448	-24391.1	1040.4	-0.058
2	Wheat	-21.4	0.1	0.000	-41.9	0.2	0.000
3	Cereal grains nec	4002.0	87.5	0.012	-50.1	0.0	0.002
4	Vegetables, fruit, nuts	-9998.7	-126.5	-0.114	-16491.8	-218.4	-0.075
5	Oil seeds	-67.5	-1.1	-0.001	-60.4	-1.0	0.000
6	Sugar cane, sugar beet	-262.2	-2.9	-0.002	-651.8	-7.2	-0.002
7	Plant-based fibers	-109.4	-1.2	-0.001	-66.2	-0.8	0.000
8	Crops nec	3749.5	44.8	0.024	-32.0	7.3	0.004
9	Bovine cattle, sheep and goats,	6003.2	185.8	0.121	849.1	36.0	0.012
10	Animal products nec	-7264.8	-86.1	-0.074	-3343.4	-37.0	-0.014
11	Raw milk	3.0	-0.1	0.000	-61.9	1.5	0.000
12	Wool, silk-worm cocoons	0.0	0.0	0.000	0.0	0.0	0.000
13	Forestry	898.1	167.4	0.038	154.9	208.9	0.049
14	Fishing	-9163.5	-106.1	-0.098	-13483.8	-100.9	-0.013
15	Coal	0.0	1.3	0.001	70.3	16.0	0.002
16	Oil	0.0	0.0	0.000	0.0	0.0	0.000
17	Gas	0.0	0.0	0.000	0.0	0.0	0.000
18	Minerals nec	0.0	0.0	0.000	0.0	0.0	0.000
19	Bovine meat products	-4478.9	-95.8	-0.049	-11094.0	-237.4	-0.075
20	Meat products nec	-4558.5	-59.7	-0.036	-19263.1	-252.3	-0.076
21	Vegetable oils and fats	-76.1	-0.9	-0.001	-430.3	-5.3	-0.001
22	Dairy products	-121.7	-1.7	-0.001	-988.7	-13.7	-0.003
23	Processed rice	-952.2	-17.6	-0.012	-844.7	-15.6	-0.006
24	Sugar	-524.6	-1.9	-0.001	-2014.8	-7.5	-0.003
25	Food products nec	-7331.4	-66.1	-0.055	-21097.7	-57.1	-0.072
26	Beverages and tobacco products	-4141.1	-56.3	-0.031	-8230.9	-110.7	-0.029
27	Textiles	322.0	19.2	0.006	2112.6	142.3	0.023
28	Wearing apparel	-3171.0	26.2	0.009	-3382.9	1861.6	0.043
29	Leather products	-655.6	-4.2	-0.003	-1379.3	-8.8	-0.003
30	Wood products	-4712.4	64.8	-0.007	-3133.7	238.4	0.004
31	Paper products, publishing	-91.0	-0.1	0.000	-246.0	-0.4	0.000
32	Petroleum, coal products	0.0	0.0	0.000	0.0	0.0	0.000
33	Chemical, rubber, plastic produ	0.0	0.0	0.000	0.0	9.7	0.001
34	Mineral products nec	17.1	2.1	0.001	765.6	1.6	0.000
35	Ferrous metals	0.0	0.0	0.000	0.0	0.0	0.000
36	Metals nec	0.0	0.0	0.000	0.0	0.0	0.000
37	Metal products	-24.2	5.1	0.001	60.3	16.3	0.002
38	Motor vehicles and parts	-2502.3	236.7	0.102	-1219.8	115.4	0.052
39	Transport equipment nec	-2750.7	167.8	0.084	-9296.8	567.1	0.120
40	Electronic equipment	-1343.4	31.3	0.018	-3611.5	86.2	0.016
41	Machinery and equipment nec	-125.2	3.1	0.002	-199.6	16.0	0.002
42	Manufactures nec	-1752.4	17.7	0.008	-3974.8	61.6	0.011
43	Electricity	-247.5	3.1	0.001	-3436.8	165.2	0.016
44	Gas manufacture, distribution	-149.3	-1.6	-0.001	-86.1	-0.9	0.000
45	Water	-22.9	-0.1	0.000	-778.7	6.5	0.001
46	Construction	-1138.4	177.1	0.045	9684.0	742.8	0.168
47	Trade	-13486.6	402.1	-0.014	-125743.4	4986.2	0.086
48	Transport nec	2017.5	185.9	0.015	-5361.4	646.4	0.077
49	Water transport	118.6	0.0	0.000	51.0	4.1	0.002
50	Air transport	-2.5	0.0	0.000	-246.3	4.1	0.001
51	Communication	-282.7	-1.2	0.000	-1912.1	50.9	0.005
52	Financial services nec	-344.6	7.8	0.000	-1391.5	225.4	0.023
53	Insurance	-212.1	-2.8	0.000	-133.6	-1.8	0.000
54	Business services nec	77.3	11.6	0.002	4434.0	357.7	0.038
55	Recreational and other services	-3505.8	175.0	0.055	-21780.6	1187.9	0.277
56	Public Administration, Defense,	-4321.9	366.7	0.059	-5401.3	2934.0	0.370
57	Dwellings	0.0	-179.3	-0.128	0.0	-862.1	-0.242

Sources: Authors' computations based on the GTAP model and LECS 3.