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IMPACT OF THE ASEAN-KOREA FREE TRADE AGREEMENT (AKFTA) ON POVERTY: THE ROLE OF TECHNOLOGY TRANSFER

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Abstract: *The technology transfer from trade liberalization plays an important role in the reduction of poverty. However, there are no studies about this phenomenon in Laos. In this paper, we try to assess the impact of the ASEAN-Korea Free Trade Agreement (AKFTA) on poverty by focusing on the role of technology transfer. Our simulations show that the impact of the tariff cut on Laos' economy and its poverty is small but the role of technical transfer is larger. Therefore, Lao government should play attention on technology transfer in order to promote the economic growth and poverty reduction.*

Keywords: *Trade liberalization, Poverty, Income Distribution, Technology Transfer, CGE model, Micro-simulation, developing countries.*

JEL Classification: *F15; F17*

1. INTRODUCTION

The government of Laos has designated trade liberalization as one the most important keys to economic growth and to the reduction of its poverty (GOL, 2011). Laos joined the Association of Southeast Asian Nations (ASEAN) in 1997 and the ASEAN Free Trade Area (AFTA) in 1998. The negotiations on the ASEAN-Korea Free Trade Agreement (AKFTA) were launched in 2004 and it was officially signed in 2006. The agreement entered into force in ASEAN, including Laos, in 2008.

After the free trade agreement, FDI increased as did the technology transfer from foreign investment.[1] Laos has achieved high economic growth during the past decades. However, poverty is still high and inequality has increased (NSB, 2008). Therefore, understanding the impact of technology is important, especially for a small but fast-growing economy and a less developed country like Laos. In general, trade liberalization induces foreign capital and technology transfer. The technology increases

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the productivity of manufacturing and generates more income from labor. Further, this increase in income reduces poverty and increases economic growth. But in developing countries, this effect is unclear because of their ability to absorb capacity and their level of education. Muendler (2004) finds that the adoption of foreign technology in the receiving country normally takes time because of the learning effects, factor complementarities, and the necessary production rearrangements.

This paper makes two contributions. First, according to our best knowledge, it is the first study of the impact of trade liberalization that includes technology in Laos uses CGE modeling. As Laos is a least developed country, this finding is very important for policy makers trying to promote technology transfer for long term development in Laos. Secondly, most of the studies on the impact of trade liberalization neglect the technology transfer, especially in LDC, this paper attempts to estimate the impact of trade liberalization, including consideration of the benefits of technology transfer.

2. LABOR PRODUCTIVITY AND HUMAN DEVELOPMENT INDEX

There are no studies concerning the relationship between trade liberalization and technology transfer in Laos. It is not clear whether trade liberalization increases technology transfer in the context of Laos.

Before estimating the impact of technology transfer, it is important to consider labor productivity and human development index (HDI). The labor productivity growth of ASEAN countries and Korea are shown in Table 1. Labor productivity measures the amount of goods and services produced by one hour of labor. The labor productivity measures the amount of real GDP produced by an hour of labor. Growing labor productivity depends on three main factors: investment and savings in physical capital, new technology, and human capital. It shows Laos has the second highest labor productivity growth between ASEAN countries and Korea during the period of 2000-2011.

Table 1
Labor Productivity[2] Growth of ASEAN and Korea

(Unit: percentage)

	1990-1995	*1995-2000*	*2000-2005*	*2005-2011*	*1990-2000*	*2000-2011*
Brunei	-0.2	-1.9	-1.2	-2.2	-1.0	-1.7
Cambodia	4.3	3.4	3.6	4.6	3.7	4.1
Indonesia	6.5	-1.4	3.6	2.8	2.6	3.2
Malaysia	6.6	0.9	3.0	1.0	3.7	2.0
Myanmar	3.3	5.6	10.6	9.2	4.5	9.9
Philippines	-0.4	1.9	1.1	2.7	0.8	1.9
Singapore	4.1	3.7	3.1	0.4	3.9	1.8
Thailand	8.2	0.4	3.0	2.1	4.3	2.5
Vietnam	5.2	4.7	4.8	4.2	5.0	4.5
Lao PDR	3.3	3.9	4.1	5.1	3.6	4.6
Korea	5.0	4.2	2.9	3.0	4.6	3.0

Source: APO (2013)

The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and having a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions. It is an important indicator to measure development and sustainability. Laos has a much lower HDI ranking than Korea and other ASEAN member countries on adult literacy rate, mean years of schooling, research and development, electrification rate and internet users (Table 2 and 3). Therefore, the FTA with Korea will bring more technology transfer with innovation, education, telecommunication, and electrification to Laos.

Table 2
Human Development Index (HDI)[3]

Country	*HDI Rank (2012)*	*HDI Value (2012)*	*Adult literacy rate[4] (2005-2010)*	*Mean years of schooling[5] (2010)*
Singapore	18	0.895	96.1	10.1
Brunei	30	0.855	95.2	8.6
Malaysia	64	0.769	93.1	9.5
Thailand	103	0.690	93.5	6.6
Philippines	114	0.654	95.4	8.9
Indonesia	121	0.629	92.6	5.8
Viet Nam	127	0.617	93.2	5.5
Cambodia	138	0.543	77.6	5.8
Lao PDR	138	0.543	72.7	4.6
Myanmar	149	0.498	92.3	3.9
Korea	12	0.909	—	11.6

Source: UNDP (2013).

Table 3
Innovation and technology of ASEAN and Korea

		R&D	*Innovation*	*Technology*
Country	*HDI Rank (2012)*	*Graduates in science and engineering[6] (2002-2011)*	*Electrification rate[7] (% of population)*	*Internet users[8] (per 100 people)*
Singapore	18	—	100	71.1
Brunei	30	21.9	99.7	50.0
Malaysia	64	37.7	99.4	56.3
Thailand	103	—	99.3	21.2
Philippines	114	23.8	89.7	25.0
Indonesia	121	22.8	64.5	9.9
Viet Nam	127	—	97.6	27.9
Cambodia	138	12.5	24.0	1.3
Lao PDR	138	12.8	55.0	7.0
Myanmar	149	—	13.0	—
Korea	12	31.5	99.7	82.5

Source: UNDP (2013)

The global competitive index report states that it is based on the latest theoretical and empirical research. It is made up of over 110 variables, of which two thirds come from the Executive Opinion Survey, and one third comes from publicly available sources such as the United Nations. The global competitive rankings between Laos and Korea are large. Therefore, the potential of technology transfer from AKFRA is still high.

Table 4
Global Competitiveness Rank of ASEAN and Korea

The Global Competitiveness Index[9] *2013-2014 rankings*				
	GCI 2013-2014		*GCI 2012-2013*	
Country	*Rank*	*Score*	*Rank*	*Change*
Singapore	2	5.61	2	0
Malaysia	24	5.03	25	1
Brunei Darussalam	26	4.95	28	2
Thailand	37	4.54	38	1
Indonesia	38	4.53	50	12
Philippines	59	4.29	65	6
Vietnam	70	4.18	75	5
Lao PDR	81	4.08	n/a	n/a
Cambodia	88	4.01	85	-3
Myanmar	139	3.23	n/a	n/a
Korea	25	5.01	19	-6

Source: WEF (2013).

3. LITERATURE REVIEW

There is a great deal of literature on the use of the Global Trade Analysis Project (GTAP) to analyze the impacts of trade liberalization and technology transfer. Meijl and Teongeren (1999) introduced endogenous knowledge spillovers and biased technical changes into a multi-region applied CGE model. Their results show the achieved factor-specific productivity growth with the magnitude of the spillover coefficient. The cost reduction can be achieved by technical change, and the technical change can increase the output. The technology spillover has some important implications for trade policy because protective measures preclude countries not only from cheaper imports but also from foreign technologies. Tyers and Yang (2000) use a GTAP model to control for the effects of expanded trade on technical changes and labor markets. Two alternative production structures are used: skill enhancement when capital and skill are substitutes and capital enhancement when capital and skill are complements. Das (2002a) uses a CGE model to analyze the impact of reductions in trade restrictions, transportation costs, and increases in technology flows. He finds that trade, and TFP changes are associated with the openness in trade and that skilled labor has a higher advantage of the transmitted technology. Das (2002b) uses the CGE model to analyze the impact of technology transmission and its potential capture by the recipients. The productivity differences depend on their absorptive capacity and structural similarity.

The results show productivity growth in the sector of heavy manufacturing and high benefits of skilled labor. Das and Andriamananjara (2006) compare the economic effects of a hub-and-spokes (HAS) type of bilateral trade configuration and use a CGE model to account for the possibility of technology spillover and its effect among participating economies. The results indicate that the high-tech sectors show higher output growth. Das (2008) simulates a global CGE model to find out whether technology spillover improves productivity, increases income, decreases inequality, and alleviates poverty. The recipient regions receive welfare gains from the innovative technologies of their leading trade partners. Income inequality declines with increased trade flows, and technology transmissions that alleviate poverty. Ken et al. (2003) use an applied general equilibrium (AGE) model to evaluate free trade agreements. The dynamic GTAP model allows for the productivity enhancing effects of import competition, increased exports, as well as FDI-Productivity linkage using the case of the Japan-ASEAN FTA.

In addition, technology brings economic benefits to both developed and developing countries, but developed countries benefit more. Lee (2009) compares the role of trade and FDI in the productivity of 25 OECD countries. He finds positive results from international trade linkages and that FDI plays an important role in the productivity of both services and manufacturing. Mendi (2007) studies the technology diffusion mechanism in OECD countries. The author finds no positive effect from technology in G7 countries, but non-G7 countries increase their TFPs through technology imports.

Leimbach and Edenhofer (2007) find technological spillovers induced by FDI that result in higher welfare gains, but these gains are relatively small. In the real world, capital transfers towards developing countries are not as high as could be expected. Pavcnic (2000) studies the impact of trade liberalization on plant productivity in the case of Chile. This study finds that the gains from the scale of economies are not likely in developing countries where the increasing returns to scale are usually associated with the import-competing sector. China is the top FDI destination among all of the developing countries, and the FDI exerts spillover effects and affects its TFP growth (Tuan, *et al.*, 2009). Nataraj (2011) investigates the impact of trade liberalization in India on its manufacturing industry and finds that both formal and informal liberalization scares firms. However, the results indicate that the overall effect of the trade reforms is to increase productivity.

These positive results come from the following literature. Technological innovation and commercialization of agriculture have both optimistic and pessimistic viewpoints on their economic gains to the poor. Bringer and Braun (1991) look for evidence of the benefits of technological innovation and commercialization in the context of an economy that is open to trade and capital flows. They find an optimistic result in agricultural growth and the alleviation of poverty from technology and commercialization through the "social engineering" of the poor. The productivity growth in South Africa is driven by technology adoption and foreign capital. The increase in GDP is due to increased productivity and higher investment due to cheaper

investment goods, more technology adoption, and the productivity induced by capital accumulation. Higher productivity leads to long-term equilibrium income and capital per worker. A more open economy reduces the cost of technology adoption and contributes to a higher degree of technological catch up (Rattso and Stokke, 2012).

There are also negative impacts of trade liberalization through technology transfer. In Mexico in the 1980s, the wages of more-educated, more-experienced workers rose relative to those of less-educated, less-experienced workers. The increase in the wage gap between the skilled and unskilled labor was associated with trade reform. Trade is the vehicle through which new technologies enter most developing countries (Hanson and Harrison, 1995). Muendler (2004) investigates Brazil's trade liberalization during the 1990s that pressured firms' to raise productivity, but the use of input from foreign firms was very limited. The increases in productivity were small because the more inefficient firms were shut down since the federal government slashed import trade barriers but left export trade barriers largely untouched. India's economic liberalization increased firms' productivity and efficiency, but it negatively impacted R&D because firms were more reliant on the purchasing of foreign technology. This reliance led to declining productivity growth in the firms that rely on importing technology instead of in-house technology. On the other hand, the liberalization of exports boosted the productivity and efficiency of the manufacturing industry, which reduces high underemployment and provides better jobs to low-skilled laborers in India (Mitra et al., 2014). Trade liberalization induces technology changes, but reduces the GDP and increases pollution. International technology spillovers increase market output, but trade does not induce pollution-saving technological diffusion (Managi, and Kumar, 2009).

There are few studies related with the impact of trade liberalization on Lao economy and poverty (Oh and Kyophilavong, 2014; Oh and Kyophilavong, 2013; Kyophilavong, 2012a; Kyophilavong, 2012b; Kyophilavong and Shinya, 2012). However, those studies did not consider the role of technical transfers from the trade liberalization.

4. MODEL

To evaluate the effect of AKFTA on Laos' economy, poverty, and inequality by considering the role of technology transfer, the Global Trade Analysis Project (GTAP) model is widely used for trade policy (Hertel, 1997).

The GTAP model assumes perfectly competitive markets. The regional household allocates expenditures across three categories: private household, government, and savings. It derives income from the "sale" of the primary factors to the producers that combine them with domestically produced and imported intermediate composites to produce final goods. A global bank intermediates between the global savings and the regional investments by assembling a portfolio of regional investment goods and selling the shares in this portfolio to regional households to meet their savings demands (Hertel, 1997).

This study uses the version 8 of the GTAP database. Version 8 reflects the world economy in 2012. In order to analyze the effects of AKFTA, we use 57 sectors and aggregated into 20 regions in the following simulations:

Simulation scenario 1: Reducing tariff

This simulation shows the impact of AKFTA on the Lao economy through reduced tariff rates. We assume that the Common Effective Preferential Tariff (CEPT) Scheme of the AKFTA will be reduced to zero in 2015.[10]

Simulation scenario 2: Improve technology transfer

This simulation considers the improvement of technology transfer through AKFTA. This approach is followed by Das (2002a) and Das (2008). We assume that a factor input technology in Laos will increase 5%, and 10% from the baseline.[11]

5. RESULTS

The result of the tariff eliminations and technology transfer, productivity between Laos (with ASEAN) and Korea on selected macroeconomic variables is shown in Table 5. The increase in productivity has positive impacts on GDP and welfare, and the impacts are significantly bigger than tariff eliminations alone. Tariff cuts increase real GDP by 0.05%, but increase productivity by 5%, real GDP by 10.05%, increase 10%, and real GDP by 15.07%. Combining the tariff cut and increase of productivity by 10% will increase 15.12%, and welfare will increase about USD 424.15 million from the baseline of 2012. The terms of trade improve with AKFTA. Laos will gain about USD 72 million per year from trade with AKFTA. The welfare gains are small for tariff cuts compared with the increase in productivity. Welfare gains will increase only USD 13.73 million from a tariff cut. But if productivity increase by 5% or by 10%, welfare will increase USD 205.03 million or USD 410.05 million respectively.

There are positive and negative impacts from AKFTA on output in Laos. The positive sectors are Gas and Electricity (Table 6). On the other hand, some sectors lose with AKFTA (Table 7). The coal and processed rice sectors in particular seem to suffer negative impacts.

It shows that Lao will not gain in terms of GDP and welfare of a tariff cut, The impact of AKFTA on returns to factors of production is shown in Table 10. Following the literature, we assume that the changes in the income returns of unskilled labor relate to a change in poverty because most of the poor in Laos are unskilled labor. The AKFTA increases the returns to land (1.85%), unskilled labor (2.01%), skilled labor (1.43%), and capital (1.76%). Clearly, AKFTA is good for poverty in the case of Laos. However, a deeper analysis on the impact of AKFTA on poverty needs to be considered.

Table 5
Macroeconomic results of AKFTA in increase of productivity

Macroeconomic variables Simulation	*Tariff cut (1)*	*Increase Productivity 5% (2)*	*Increase Productivity 10% (3)*	*Tariff cut +Increase Productivity 10% (1)+(3)*
Real GDP (%)	0.05	10.05	15.07	15.12
Welfare (equivalent variation) ($US million)	13.73	205.03	410.05	424.15
Trade Balance ($US million)	-6.95	-32.53	-65.07	-72.02

Source: Authors' simulations

There are both positive and negative impacts from AKFTA on output in Laos. The positive sectors are Gas and Electricity, Eleciricity, and Paddy Rice (Table 6). The Gas sector is significantly high because of high potential of reserve of gas in Laos, and foreign high technology can develop this sector in the future. The electricity sector increased due to high potential of hydropower generation. The paddy rice sector will increase productivity because of high agricultural technology and more irrigation systems.

Table 6
Top 10 sectors for positive impact of output from AKFTA

No	*Sectors*	*AKFTA Effects (%)*
1	Gas	407.05
2	Electricity	17.68
3	Paddy Rice	15.88
4	Iron & Steel	15.61
5	Dwellings	13.14
6	Chemical Rubber Products	11.76
7	Electronic Equipment	11.16
8	Oil	10.63
9	Paper & Paper Products	9.01
10	Other Transport Equipment	8.56

Source: Authors' simulations

On the other hand, some sectors lose with AKFTA (Table 7). The coal, processed rice, and beverages and tobacco products sectors in particular seem to suffer negative impacts. Currently, coal is used for cement production and electronic power plants. New technologies will replace those traditional industries. The processed rice, beverages and tobacco products will suffer from a lack of manufacturing infrastructure in Laos. Therefore, it will increase exports as raw material not as processed or final product.

Table 7
Top 10 sectors for negative impact of output from AKFTA

No	*Sectors*	*AKFTA Effects(%)*
1	Coal	-11.9
2	Processed Rice	-2.91
3	Beverages and Tobacco products	-1.79
4	Motor Vehicles	-0.12
5	Wool	-0.04
6	Other Mining	0.14
7	Raw milk	0.32
8	Fishing	0.47
9	Construction	1.51
10	Petroleum & Coke	1.67

*Source:*Authors' simulations.

Table 8
Top 10 sectors for positive impact of trade balance from AKFTA

No	*Sectors*	*AKFTA Effects(%)*
1	Non-Ferrous Metals	41.22
2	Lumber	7.42
3	Oil	6.97
4	Electricity	6.67
5	Wearing Apparel	4.7
6	Other Transport	3.29
7	Forestry	3.12
8	Other Crops	2.2
9	Recreation & Other Services	1.37
10	Paddy Rice	0.57

Source: Authors' simulations

Table 9
Top 10 sectors for negative impact of trade balance from AKFTA

No	*Sectors*	*AKFTA Effects(%)*
1	Other Machinery & Equipment	-34.41
2	Motor Vehicles	-23.74
3	Chemical Rubber Products	-17.17
4	Non-Metallic Minerals	-9.54
5	Petroleum & Coke	-9.23
6	Iron & Steel	-8.27
7	Other Food	-6.89
8	Fabricated Metal Products	-6.38
9	Other Transport Equipment	-5.94
10	Textiles	-5.79

Source: Authors' simulations

The impact of AKFTA of technology transfer and productivity on returns to factors of production is shown in Table 7-10. From the literature, we assume that the changes

in the income returns of unskilled labor relate to a change in poverty because most of the poor in Laos are unskilled laborers. The AKFTA on technology transfer and productivity increases the returns to land (1.85%), unskilled labor (2.01%), skilled labor (1.43%), and capital (1.76%). The AKFTA of technology transfer and productivity alleviate poverty in the case of Laos, but to a limited degree.

Table 10
Change in returns to factors of production

Factor of productionSimulation	*Tariff cut*	*Technology Transfer*
Returns to land	1.36	1.85
Returns to un-skilled labor	0.96	2.01
Return to skilled labor	1.12	1.43
Return to capital	1.03	1.76

Source: Authors' simulations

6. CONCLUSION

The main objective of this study is to investigate the impact of the ASEAN-Korea FTA (AKFTA) on the national economy and the poverty of Laos by considering the role of technology transfer. We use the Global Trade Analysis Project's (GTAP) model. There are two simulation scenarios in our study. First is reducing the tariff cut to zero. Second is the improvement of technology change in Laos by 5%, and 10%.

Our simulation results show that the impact of AKFTA on Laos' economy and poverty is small if only considering the tariff cut. By considering the role of technology transfer from AKFTA, its impact is bigger. Therefore, policymakers should consider improving the capacity to gain technology transfers from foreign investors in AKFTA.

Notes

1. The technology transfer to developing countries can increase productivity. The OECD (2012) defines productivity as the hours worked per capita. The Asian Productivity Organization (APO) uses three criteria: GDP per worker, GDP per hour worked, and the Total Factor Productivity (TFP).
2. Labor productivity defined as average annual growth rate of GDP at a constant basic price per worker, using 2005 PPP.
3. HDI: A composite index measuring the average achievement in three basic dimensions of human development – long and healthy life, knowledge, and a decent standard of living.
4. Adult literacy rate: Percentage of the population aged 15 and older who can write a short understandable statement about their everyday life.
5. Mean years of schooling: Average number of years of education received by people aged 25 and older that is converted from the educational attainment levels by using the official durations at each level.
6. Graduates in science and engineering: People who have successfully completed the final year of a level or sublevel of education in science and engineering.

7. Electrification rate: Number of people with access to electricity, that is expressed as a percentage of the total population. It includes electricity sold commercially (both on-grid and off-grid) and self-generated electricity, but not unauthorized connections.
8. Internet users: People with access to the worldwide web that is expressed per 100 people.
9. Global Competiviness Index(CGI) aims to assess "the set of institutions, policies and factors that make a nation remain productive over the longer term while ensuring social and environmental sustainability". The central idea is to measure how sustainable is the productivity level of an economy with respect to environmental stewardship and social sustainability.
10. We do not consider the effects from the service sector.
11. We will shock afereg (5%, 10% and 15%) for Laos only.

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