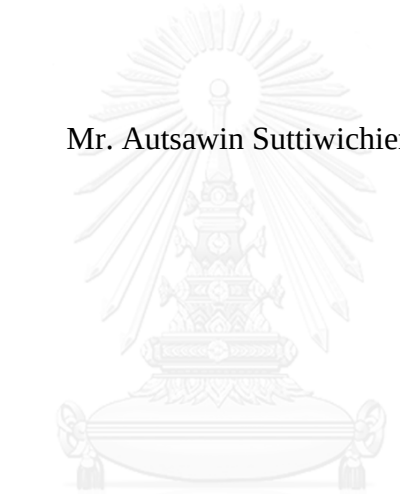
EFFECTS OF ASEAN ECONOMIC COMMUNITY ON ECONOMY AND LABOR MARKET: THE CASE OF THAILAND

Mr. Autsawin Suttiwichienchot



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ประชาคมเศรษฐกิจอาเซียน (AEC) มีกำหนดจะก่อตั้งอย่างเป็นทางการในปลายปี ค.ศ. 2015 โดยมีวัตถุประสงค์ หลัก คือ เพื่อบูรณาการเศรษฐกิจของภูมิภาคเอเชียตะวันออกเฉียงใต้ (ASEAN) ให้กลายเป็นตลาดเดียวและเป็นฐานการผลิตของอุตสาหกรรม การศึกษานี้พยายามคาดการณ์ผลกระทบของ AEC ต่อเศรษฐกิจไทย และตลาดแรงงานในประเทศ รวมทั้งการหานโยบายที่เหมาะสมเพื่อรักษาระดับการเติบโตของเศรษฐกิจไทยในระยะยาว การศึกษานี้ใช้โมเดล Static single-country computable general equilibrium (CGE) และโมเดล Dynamic multi-countries CGE การศึกษานี้ ประกอบด้วย 3 คำถามวิจัยหลัก คือ ขนาดของผลกระทบของ AEC ต่อเศรษฐกิจและตลาดแรงงานในประเทศไทย ขนาดของผลกระทบจากนโยบายค่าแรงขั้นต่ำต่อเศรษฐกิจและการจ้างงานในไทยซึ่งเป็นส่วนหนึ่งของประชาคมเศรษฐกิจอาเซียน สุดท้าย ขนาดของผลกระทบของค่าใช้จ่ายในการย้ายงานข้ามอุตสหากรรม และประสิทธิภาพแรงงานที่มีต่อเศรษฐกิจไทย รวมทั้งความสัมพันธ์ระหว่าง AEC และค่าใช้จ่ายในการย้ายงานข้ามภาคอุตสหากรรม เป็นอย่างไร

จากผลของการศึกษาพบว่าจากการรวมกลุ่มประชาคมเศรษฐกิจอาเซียนจะส่งให้ผลิตภัณฑ์มวลรวมภายในประเทศที่แท้จริง (Real GDP) ของภูมิภาคเอเชียตะวันออกเฉียงใต้เพิ่มขึ้น นอกจากนี้ทุกประเทศอาเซียนจะมีการเจริญเติบโตทางเศรษฐกิจที่มากขึ้นหลังจาก AEC โดยสาเหตุหลักมาจาก การยกเลิกภาษีนำเข้าและภาษีส่งออกระหว่างประเทศสมาชิก การลงทุนที่มากขึ้น และต้นทุนของการค้าระหว่างประเทศสมาชิกลดลง

ค่าแรงขั้นต่ำเป็นหัวข้อของการอภิปรายที่สำคัญสำหรับประเทศไทยเพราะผู้ใช้แรงงานเรียกร้องขอค่าแรงขั้นต่ำเพิ่มขึ้นอยู่เสมอ จากผลการศึกษาแสดงให้เห็นความสัมพันธ์ทางลบระหว่าง ค่าแรงขั้นต่ำกับจีดีพี และค่าแรงขั้นต่ำกับการจ้างงานในไทย สาเหตุหลักมาจากต้นทุนการผลิตที่สูงขึ้น จากผลการศึกษาพบว่าทั้งนโยบายการเพิ่มค่าแรงขั้นต่ำ และนโยบายให้เงินอุดหนุนค่าแรงขั้นต่ำนั้น ไม่เหมาะสมสำหรับประเทศไทยซึ่งเป็นส่วนหนึ่งของประชาคมเศรษฐกิจอาเซียน เพราะนโยบายเหล่านี้จะลดการลงทุนและลดแรงจูงใจในการพัฒนาประสิทธิภาพของแรงงาน นอกเสียจากจะใช้นโยบายเหล่านี้ควบคู่ไปกับการเพิ่มประสิทธิภาพแรงงาน ถึงแม้ว่านโยบายลดค่าแรงขั้นต่ำจะนำไปสู่การเพิ่มขึ้นของ จีดีพี การลงทุน และการจ้างงาน ทั้งแรงงานที่มีฝีมือและไร้ฝีมือ แต่เป็นเรื่องยากสำหรับนักการเมืองซึ่งต้องการคะแนนเสียงที่จะออกนโยบายการลดค่าแรงขั้นต่ำได้ การศึกษานี้ได้ทำการวัดผลของการปรับค่าแรงขั้นต่ำและการปรับประสิทธิภาพแรงงานในหลายทางเลือก ซึ่งผลที่ได้ขึ้นอยู่กับผู้ออกนโยบายที่จะเลือกว่าประเทศไทยควรมีค่าแรงขั้นต่ำที่เท่าไหร่ ซึ่งผู้ออกนโยบายต้องคำนึงถึงสภาพตลาดในช่วงเวลานั้นด้วย

จากผลของการศึกษานี้แสดงให้เห็นรูปแบบฤดูการย้ายถิ่นเพื่อหางานทำของแรงงานในประเทศไทย ซึ่งสอดคล้องกับทฤษฎีการคาดการณ์ค่าจ้างของ Harris-Todaro นอกจากนี้จากข้อมูลเชิงประจักษ์พบว่า มีค่าใช้จ่ายเกิดขึ้นเมื่อแรงงานย้ายจากภาคเกษตรไปสู่นอกภาคเกษตร จากผลการศึกษาแนะนำว่ารัฐบาลควรสนับสนุนนโยบายที่ช่วยลดค่าใช้จ่ายนี้ รวมถึงนโยบายเพิ่มประสิทธิภาพแรงงาน และควรใช้ทั้งสองนโยบายนี้เพื่อใช้รักษาการเจริญเติบโตทางเศรษฐกิจ นอกจากนี้จากผลของการศึกษายังแสดงให้เห็นว่าเศรษฐกิจที่ดีขึ้นซึ่งเป็นผลจาก AEC นั้นจะทำให้ค่าใช้จ่ายในการเคลื่อนย้ายสูงขึ้น เพราะแรงงานไม่ต้องการเปลี่ยนงาน ซึ่งเป็นผลกระทบเชิงบวกต่อบริษัทและนายจ้าง เพราะไม่ต้องเสียค่าฝึกแรงงานใหม่อยู่เสมอ

สาขาวิชา เศรษฐศาสตร์ ลายมือชื่อนิสิต .....

ปีการศึกษา 2558 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

5385908629 : MAJOR ECONOMICS
KEYWORDS: ASEAN ECONOMIC COMMUNITY / SINGLE-COUNTRY GENERAL EQUILIBRIUM / MULTI-COUNTRIES GENERAL EQUILIBRIUM / ECONOMY / LABOR MARKET / THAILAND / MINIMUM WAGE / HARRIS-TODARO THEORY OF EXPECTED WAGE / SWITCHING COST

AUTSAWIN SUTTIWICHIENCHOT: EFFECTS OF ASEAN ECONOMIC COMMUNITY ON ECONOMY AND LABOR MARKET: THE CASE OF THAILAND. ADVISOR: SAN SAMPATTAVANIJA, Ph.D., 318 pp.

The ASEAN Economic Community (AEC) will establish at the end of 2015. The main objective is to integrate region economies to become a single market and production base. This study attempts to estimate the impact of AEC on Thai economy and labor market in Thailand and to suggest the appropriate policies to sustain Thai economy in the long run by using the static single-country computable general equilibrium (CGE) model and the dynamic multi-countries CGE model. The study consists of 3 main research questions. How large is the impact of AEC on economy and labor market of Thailand. How large is the impact of wage policies on economy and employment of Thailand as a part of AEC. Lastly, how large is the impact of switching cost and labor productivity on Thai economy as well as what is the relationship between AEC and switching cost.

For the first research question, the study estimates that AEC could enhance real GDP of ASEAN economies and every ASEAN country will have a better growth path under AEC. Most of these benefits result from the integration effects of zero tariff, more investment, and cheaper trade cost.

For the second research question, the minimum wage in Thailand is an important topic for debate with labor representatives seeking an increase in the minimum wage. The study's result indicates the negative correlation between minimum wage and GDP as well as minimum wage and employment due to higher cost of production. Therefore, whether increased minimum wage or subsidy wage policies are not appropriated for Thailand as a part of AEC because these policies would reduce investment and human capital accumulation, unless labor productivity is enhanced to compensate the negative effect from these policies. Although decreased minimum wage leads to the increases in GDP, investment, and employment for both skilled and unskilled labors in every sector, it is politically hard for politicians who want votes from the public. The study provides various measurements of adjustment both minimum wage and labor productivity. The rest is for policy maker to decide how much minimum wage to increase in accordance with market conditions.

For the third research question, the study shows the existence of the systematic pattern of domestic migration in Thailand's labor market, which conforms to Harris-Todaro's theory of expected wage equilibrium. Moreover, the empirical analysis shows that there exists the consistent range of switching cost which is the cost incurs when labors move from agricultural to non-agricultural sectors. Based on these key findings, the government programs supporting the reduction of switching cost and increased labor productivity are the top-priority tasks and should implement both of them in order to sustain the economic growth. In addition, the simulation result also indicates that better economic situation which results from AEC leads to higher switching cost because labor prefers not to change job. This effects is positive to firms' business because they do not have to pay frequently for training program.

Field of Study: Economics Student's Signature .....

Academic Year: 2015 Advisor's Signature .....

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Autsawin Suttiwichienchot

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Chapter 1

Introduction

1.1 Background

The Association of Southeast Asian Nations (ASEAN) have 10 members including Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic (PDR), Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam and they will officially establish ASEAN Economic Community (AEC) at the end of 2015. The main objective is to integrate region economies to become a single market and production base. The key agreements in the AEC blueprints are allowing free flow of services, investment, capital, and skilled labor within ASEAN members (ASEAN, 2008). Removing such barriers will reduce trade costs leading to improve the competitiveness of members and increase trade in the region (Petri, Plummer, & Zhai, 2012). However, there are positive and negative sides for economic integration which AEC should consider lessons from those successors[1] in order to mitigate the adverse effect. Next chapter will analyze both positive and negative lessons from a successful example of regional economic integration namely European Union (EU).

The AEC builds on ASEAN Free Trade Area (AFTA) but drives further beyond tariffs to non-tariff barriers. Moreover, AEC intends to change ASEAN to be a single market and production base, region of equitable economic development, competitive economic region, and region completely coordinated into the worldwide economy (ASEAN, 2008). Therefore, AEC is a driving force of cooperation between the member countries to create the economic integration in the region. The benefits of economic integration on economy are as following.

Firstly, the volume of trade could increase by eliminating tariff and non-tariff barrier because trade flows should increase which reflecting from the elimination of

[1] Several numbers of economic integration have established in the past such as North American Free Trade Agreement (NAFTA), Union of South American Nations (SACN), Eurasian Economic Community (EAEC), and European Union (EU).

regulatory barriers such as shorter procedure and removed customs checks. Secondly, an increase in the volume of total trade will change in the cost and price structure and may also be affected along with the optimum allocation of resources. Thus, countries within economic integrated region could link their production networks by leveraging each other's comparative advantages. Thirdly, producers and consumers within economic integrated region can benefit from larger market size because economies of scale become possible and this benefits to producer in term of production cost and to consumer in term of product price and varieties. In addition, the large market would create a high degree of specialization of production and this would encourage the investment flows into industries which have a comparative advantage (Rashid, Zhai, Petri, Plummer, & Yue, 2009; European Bank, 2012).

The AEC would not only impact Thai economy but also impact labor market. According to the specific factor model[2], labor will move from low income (low MPL) to high income countries (high MPL) and this movement may determine the long-run country growth (Krugman & Obstfeld, 2009). Countries that lose skilled labor would face the lower growth rate because skilled labor is the key role of producing innovations thereby generating growth (Romer, 1990; Benhabib & Spiegel, 1994). In addition, numerous literatures support that there are more economic benefits than costs from migrant labor (Martin, 2007). For example, migrant labor fill the job that native labor does not want such as 3D jobs (dirty, difficult, and dangerous) and migrant labor add more output and income to nation or increase welfare.

There were variety of model uses in order to estimate the impact of economic integration. The regression-based model is a popular technique for the interpretation of factors that are believed to responsible for migratory movements. However, migration movement is complex and cannot explain by a single equation model (Willis, 1975). The interaction between cause and effect suggests that it is necessary to specify a model of migration which takes into account the interactions between the various independent factors involved in the process. This study aims to investigate the economy-wide

[2] A model is aimed to investigate the implications of short-run factor immobility between sectors. With one specific factor (e.g. capital) in each sector plus another factor (e.g. labor) that is mobile between sectors (Krugman & Obstfeld, 2009).

perspective on the interaction between economic factors and labor movement due to AEC. A computable general equilibrium (CGE) model is suited to test and investigate the relationships between all agents, sectors, and other economies by consisted of equations describing the interaction of whole economy caused by various economic shocks (Nana, Sanderson, & Hodgson, 2009).

There are 3 mains research questions in this study. The first research question is how large the impact of AEC affects economy and labor market of Thailand. Under the advent of AEC, Thailand will face some challenged both outside and inside countries including challenged by countries with certain comparative advantages and by the issue of aging society. Therefore, Thailand should prepare for those effects by improving its competitive advantage and preventing the future threats. Thus, the overall long-term development policy in line with these challenges should be strongly promoted. The study measures and quantifies the effect in to different economic aspects in order to precisely choose the appropriated policies for Thailand in the long run.

Moreover, aging society pressures in many developed countries will heighten labor recruitment competition internationally while Thailand's incompetence in migrant labor administration would be a limitation on this competition (NESDB, 2012). Therefore, Thailand may not have enough migrant labor to meet the demand for labor in the future because the decline in the fertility rate and the proportion of working age, thus the supply of Thai working labor will be less in the future (NESDB, 2012). Therefore, development of human capital is needed to replace the shortage in the labor supply as will be shown in this study.

The second research question is how large the impact of wage policies affect economy and employment of Thailand as a part of AEC. The minimum wage in Thailand is an important topic for debate with labor unions seeking an increase in the minimum wage. One key question concerns the potential effects for the economy and employment levels if the Thai government responded positively to such demands and raised the wage level while wages in other ASEAN members were not increased at the same time, this would affect Thai economy directly and affect other ASEAN members as well since every ASEAN economy will be closer linkage under AEC. Therefore, it is important to consider the policy options available for Thailand's policy makers.

The last research question is how large the impact of switching cost and labor productivity affect Thai economy and what is the relationship between AEC and switching cost. The impact of switching cost and labor productivity is the most common recommendation towards the improvement of the production capability. Since one of the main objective of AEC is to become the production base, Thailand could benefit from this result by able to identify the appropriated use for these policies. Moreover, the relationship between AEC and switching cost is interesting to explore because AEC will change economic environment in Thailand by more or less inflows of migrant labors. If this relationship is quantified, the movement of labor could inform policy makers of the dynamic change in labor market.

This study develops a dynamic multi-countries CGE model to investigate the impact of AEC as well as the effect of minimum wage policy on economy and employment in Thailand. Furthermore, the study also develops a static single-country CGE model to investigate the impact of switching cost and labor productivity on Thai economy and examine the relationship between AEC and switching cost.

1.2 Objectives

1. To build a static single-country CGE model and dynamic multi-countries CGE model.

2. To estimate the impact of AEC on economy and labor market of Thailand.

3. To estimate the impact of wage policies on economy and employment of Thailand as a part of AEC.

4. To estimate the impact of switching cost and labor productivity policies on Thai economy and the relationship between AEC and switching cost.

1.3 Scope of the study

The study intends to estimate the impact of AEC on economy and labor market of Thailand. The study examines the effect of various types of policies shock on economy and employment in Thailand as a part of AEC. These shocks include minimum wage, switching cost, labor productivity, export, and government spending. The study expects to contribute some alternative solutions to sustain Thai economy in

the long run while Thailand faces competitive challenge and also becomes an aging society.

1.4 Outline

The study is organized into 7 chapters.

Chapter 1: the introduction includes objectives and scope of the study.

Chapter 2: literature reviews contain 3 parts. The first part of the chapter includes the brief history of European Union and ASEAN, analysis of lessons from the EU, and discussion of the AEC direction. Moreover, the second part of the chapter includes the overview of ASEAN and Thai labor markets, labor immigration in Thailand, and ASEAN economy. The last part of the chapter reviews literatures including theory of migration, the theory of economic integration, the literature regarding the effect of migration on economy by analyzing empirical model and CGE model, and the literature regarding the effect of economic integration on economy by analyzing empirical model and CGE model.

Chapter 3: introduce CGE model, this chapter persuades and explains the motivating reasons for the use of CGE model in the study.

Chapter 4: to fulfill objective 2, this chapter simulates the effect of AEC which represents by additional effects of zero tariff, improve investment climate, and reduce trade cost. Then, the chapter will estimate the impact of AEC on economy and labor market of Thailand by using dynamic multi-countries CGE model.

Chapter 5: to fulfill objective 3, this chapter estimates the impact of wage policies on economy and employment of Thailand as a part of AEC by using dynamic multi-countries CGE model.

Chapter 6: to fulfill objective 4, this chapter estimates the impact of policies on Thai economy and the partial relationship between AEC and switching cost by using static single-country CGE model.

Chapter 7: conclusion and discussion.

Chapter 2

Literature Reviews

This chapter contains 6 sections. Section 1, a brief overview of EU and ASEAN histories in order to provide general background of integration footstep of these regions. Then, the direction of AEC can be set according to some lessons from EU. AEC would change the environment of economic activities and competitions in the region. Furthermore, labor movement is one of the main issue of AEC and it is closely related with economy. Therefore, labor market situation and economies of ASEAN and Thailand are presented in section 2.

Since, this study is focus on effects of AEC on Thai economy and labor market, migration and economic integration in both theory and empirical research should be reviewed. Section 3 and 4 review literatures regarding theories of migration and economic integration. Section 3 and 4 review researches regarding migration and economic integration by analyzing empirical model and CGE model.

2.1 European Union and ASEAN Economic Community

Several numbers of economic integration have established in the past such as North American Free Trade Agreement (NAFTA), Union of South American Nations (SACN), the European Union (EU), and Eurasian Economic Community (EAEC). ASEAN members also aim to have such integration.

Prior attempts of integration have aimed to remove barriers to trade by expanding the free movement of labor, goods, and capital across international borders in order to achieve free trade in the region. Also, in November 2002, ASEAN committed to the creation of economic integration known as AEC in order to achieve free flows of goods, services, capital, and skilled labor by the year 2015 (Plummer, 2006). Thus, AEC is a driving force of cooperation between the member countries to create the economic integration in the region. The objective of this chapter is to analyze both positive and negative lessons from a successful example of regional economic

integration namely European Union (EU). The outline of this chapter is as follows: EU evolution, the evolution of AEC, lessons from the EU, the direction of AEC.

2.1.1 EU evolution

As a result of World War II, Europe considered to have economic integration because three primary motivations which were to avoid wars, to draw markets and resources together for economic reconstruction, and to build a strong integrated region. The following will give a brief review of EU evolution in historical timeline since 1945 (Church & Phinnemore, 1994; Archer, 2008; McAllister, 2010).

1945 – 1959 was the beginnings of cooperation. With the prevention of recurrent conflict between nations in the territory as its ultimate goal, the European Community (EC) was formulated in 1951 following World War II. Shaped under the Treaty of Paris in the 1950s with six member nations including Belgium, France, Italy, Luxembourg, the Netherlands, and Germany, western Europe began its shift in the direction of fiscal amalgamation at a district level with the European Coal and Steel Community (ECSC). These six nations also agreed to the Treaties of Rome in 1957, thereby forming the European Economic Community (EEC) as well as the European Atomic Energy Community (EURATOM). The EEC Treaty of Rome created a fundamental of a customs union. They began to remove trade barriers between country members and moved toward creating a common market.

The elimination of customs duties during EC mutual trade activities spawned an era of economic development between 1960 and 1969. Aspiring to eradicate food deficiencies, they also settled on cooperative management over the production of provisions. Subsequently, agricultural surplus of produce became a reality. The ECSC and EURATOM combined with the EEC in 1967, thereafter named the European Communities.

The enlargement of an initial phase of the growing community occurred between 1970 and 1979. On 1 January 1973, the number of member nations increased to nine with the addition of Denmark, Ireland, and the United Kingdom. An energy catastrophe and economic issues in Europe were consequences of the Arab-Israeli war in October 1973. In an effort to generate jobs and infrastructure in underprivileged areas, significant investment was undertaken by the EC regional policy. Employing

voters in each EC Member State, the earliest direct elections to the European Parliament transpired in 1979.

Further expansion occurred in Europe between 1980 and 1989. Greece became the tenth member of the EU in 1981, with Spain and Portugal joining five years later. The Single European Act was endorsed by EU governments in 1986 as well, which was a treaty aimed at generating a free market by permitting goods, service, labor, and capital to travel without restraint between EU member nations. The Berlin Wall between East and West Germany was demolished on 9 November 1989, which was a source of international political turmoil, but opened the region for the first time in 28 years and eventually lead to the reintegration of Germany as one nation in October 1990.

Europe without boundaries began between 1990 and 1999. Europeans became closer neighbors as the result of the disintegration of communism throughout central and eastern Europe. The Treaty of Maastricht was endorsed in 1992, initiating the European Union (EU). The single market movement was realized in 1993, with the unrestricted movement of goods, services, labor, and capital between EU nations. Innovative kinds of collaboration between member governments for concerns of security and defense were instituted. The Economic and Monetary Union, using a single currency administered by the European Central Bank, was constructed by the agreement of EU leaders. Austria, Finland, and Sweden became EU member countries in 1995. Permanently settling specific monetary units at a prearranged rate to the unified currency, 12 of the 15 EU members (Denmark, Sweden, and the United Kingdom opted out) implemented the euro as its currency in 1999.

Additional growth occurred between 2000 and 2009. For the majority of Europeans, the euro was the new currency. Greece enrolled in the euro zone in 2001. In anticipation of EU expansion and the admittance of 10 new member countries in 2004, the Treaty of Nice was enacted and established amendments to the EU's conventions. With euro notes and coins supplanting the national currencies in 12 of the 15 member nations including Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain, the euro took full effect on 1 January 2002. Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia joined the EU in 2004. Romania and Bulgaria

joined the EU on 1 January 2007. EU leaders arrived at an accord on the Constitutional Treaty, causing all previous EU Treaties to be combined into a single document.

Closer economic support between EU countries was the result of a fiscal catastrophe hitting the international economy in September 2008, which uncovered the economic weaknesses of variance between EU countries. Disproportionate borrowing by several countries, particularly Greece, as well as increased property bubbles in other countries, especially Ireland and Spain, were unintentionally caused by a universal monetary policy. When the financial crisis struck, EU susceptibility was further supplemented by the precarious activities of numerous European banks. Authorized by all EU member nations, the Treaty of Lisbon took effect on 1 December 2009, which bestowed the EU with more competent working processes and progressive institutions.

A decade of prospects and trials began in 2010, with Croatia becoming the 28th member state by signing the EU accession treaty on 9 December 2011. The decade produced optimism that investments in new green and climate-friendly technologies, as well as more intimate European collaboration, would lead to enduring expansion and benefit, despite the fact that it began with a significant economic emergency.

The EU of the 1950s is significantly different to the EU of today. The resolve between European politicians to avert future encounters in Europe after World War II was directly responsible for the eventual construction of the EU. Joining EU countries together by creating closer industrial and economic support was merely the initial goal. In reaction to various challenges and with numerous countries joining it since its inception, the EU's responsibilities have matured (Dinan, 2014). Nowadays, the EU is mainly responsible for managing the European marketplace by facilitating trade, investment, and labor movement.

2.1.2 ASEAN evolution

Indonesia, Malaysia, Philippines, Singapore, and Thailand formed The Association of Southeast Asian Nations (ASEAN) on 8 August 1967 in Bangkok, Thailand. The ten-member group of nations comprising the ASEAN of today was created by the addition of Brunei Darussalam on 7 January 1984, Viet Nam on 28 July

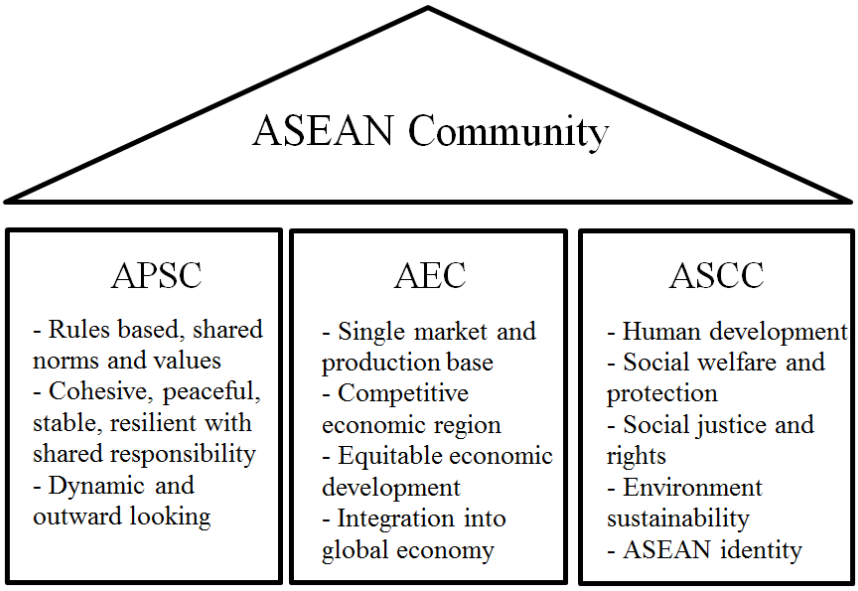
1995, Lao PDR and Myanmar on 23 July 1997, and Cambodia on 30 April 1999 (Keling , Md.Som, Saludin, Shuib, & Ajis, 2011).

The Preferential Trading Arrangement (PTA) and several other industrial support plans in 1977 were initial actions for economic collaboration and incorporation in the area. The primary accord of alliances is the ASEAN Free Trade Area (AFTA), endorsed in Singapore on 28 January 1992. AFTA is supported by the 1995 ASEAN Framework Agreement on Services (AFAS) and the 1998 ASEAN Investment Area (AIA) agreement (Mukim, 2005), and envelops trade for goods. The establishment of the ASEAN Economic Community (AEC) in 2003 produced an integrated market and production base via the free flow of goods, services, foreign direct investment, skilled labor, and nearly unrestricted flow of capital, which deepened economic integration.

Accelerated economic development, social advancement, and cultural enrichment in the region to endorse regional peace and strength through reverence for justice as well as the rule of law between countries of the region are just some of the principle aims and purposes of ASEAN. Additional goals include the provision of support to others through education and research services in the educational, professional, technical and administrative fields, as well as sustaining intimate and mutually advantageous collaboration with accessible regional and international organizations with comparable intentions and rationale. Further, there is continuous investigation of all opportunities for closer support between member nations (ASEAN Secretariat, 2012).

The aims of AFTA include increasing ASEAN's economic advantage as a source of production in the global market through the abolition of tariffs and barriers within ASEAN, as well as attracting more foreign direct investment (FDI) in ASEAN since every ASEAN member nation participates in various manufacturing industries. The member nations approved the creation of the ASEAN Community as a means of extending the reach of their current economic boundaries, which is comprised of three pillars, specifically the ASEAN Political-Security Community (APSC), ASEAN Economic Community (AEC), and ASEAN Socio-Cultural Community (ASCC) (ASEAN Secretariat, 2009). Figure 2.1 shows the three pillars of ASEAN community and each pillar’s blueprint.

Figure 2.1: Blueprint of three pillars



Source: ASEAN Secretariat (2009)

2.1.2.1 ASEAN Political - Security Community

Mutual aid in the arenas of politics and security comprise the principle aim of the ASEAN Political-Security Community (APSC), with its ultimate goal being for member nations in the region to live peaceably with each other, as well as the rest of the world, in a democratic and balanced environment.

The resolution of intra-regional disparity through peaceful means solely and holding their security as necessarily connected to one another by geographic location, common vision and objectives is a pledge undertaken by each member nation of the APSC. Political advancement, molding and sharing of standards, conflict counteractive action, conflict determination, post-conflict peace building, and executing mechanisms are only some of its components.

The ASEAN Charter and the principles and purposes it contains are guiding ideals of the APSC Blueprint, which offers a schedule and roadmap for the creation of the APSC by 2015. In an effort to preserve its importance and have durable characteristics, the blueprint also contains safeguards for flexibility to maintain activities beyond 2015. The APSC Blueprint was approved by ASEAN Leaders at the 14th ASEAN Summit on 1 March 2009 in Cha-am/Hua Hin, Thailand, as shown in Figure 2.1.

2.1.2.2 ASEAN Economic Community

The ASEAN Economic Community (AEC) will establish in 2015. The objective is to integrate ASEAN economy to become a single market and production base, a region of equitable economic development, a competitive economic region, and a region completely incorporated into the global economy (ASEAN Secretariat, 2012).

The key agreements in the AEC blueprints are allowing free flow of services, investment, capital, and skilled labor within ASEAN members. The AEC builds on ASEAN Free Trade Area (AFTA) but drive further beyond tariffs to non-tariff barriers to include free flow of services and facilitate skilled labor movement, which have not implemented in AFTA, in order to continuing improvement from AFTA.

Human resources advancement and competence-building, acknowledgment of professional abilities, closer discussion on macroeconomic and fiscal policies, trade financing measures, and superior infrastructure and communications connectivity are some of the specific areas of support. Others include the expansion of electronic operations through e-ASEAN, combining improving private sector involvement and consolidating commercial enterprises over the region, as shown in the second pillar of Figure 2.1.

2.1.2.3 ASEAN Socio - Cultural

Blending the people of ASEAN by fostering recognition of the ASEAN Community so that it is people-oriented and socially responsible comprises the goal of the ASEAN Socio- Cultural Community (ASCC). It endeavors to form an all-encompassing general identity while building a compassionate and allocation society that is inclusive. It also strives for the well-being, livelihood, and benefit of the people. Six vital areas, including the promotion of human maturity, enhancing social welfare and protection, encouraging social justice and rights, ensuring environmental sustainability, structuring the ASEAN Identity, and confining the development gap comprises the focus of the ASCC (ASEAN Secretariat, 2012).

Promoting the ASEAN commitment to address the quality of life for its societies, the human aspect of ASEAN collaboration is reflected in the ASCC Blueprint. Through implementation of tangible and productive actions that are people-centered and communally trustworthy, the aims of the ASCC can be reached. Based on

the postulation that the three pillars of the ASEAN Community are mutually dependent and organized, a precise set of supportive activities has been devised. Further, ensuring complementarities and unison of purpose are only possible with linkages. The blueprint's elements are shown in the third pillar of Figure 2.1.

2.1.3 Lessons from the EU

There are three main concerns that AEC should learn from EU.

2.1.3.1 Financial and monetary cooperation

The first point involves financial and monetary cooperation and integration, although ASEAN countries are not going to have such monetary integration but only planning to have stock market integration. Nevertheless, it is worthwhile looking at what happened in Europe. Empirical studies found that monetary union has more extensive effects on trade and investment flows than the custom union (Frankel & Rose, 1998).

Comparative economic-divergence issues remain essential, emphasized by the examples of the EU on financial assistance when assembling comparisons. Obviously, the requisites of the EU and ASEAN are dissimilar with respect to economic collaboration. Especially for government leaders, integration may be admired within the region of ASEAN, but is less so in Europe. Further, numerous EU states had persistent macroeconomic, notably monetary, issues. For the sake of EU integration, the Economic and Monetary Union (EMU) permitted concerned members to execute required austerity procedures. Only after a moderately long process, the ensuing interest rates, inflation, and other monetary variables lead to union.

Using the EU events as a guide, financial and monetary cooperation between ASEAN nations could result in numerous benefits. To begin with, in order to generate a more stable macroeconomic situation, ASEAN can construct the required accords, including restrictions on budget deficits, government debt, and inflation. The nation with the most superior international credit ratings would be in a position to dictate monetary policy, with lower-ranked nations having access to the introduction of trustworthiness. Thirdly, making it uncomplicated to price risk regionally and reducing the cost of capital would be a consequence of interest-rate spreads. Lastly, ASEAN

could be more appealing to foreign investors, as well as encourage intraregional capital flows, through economic proposals for balancing rules, accounting standards and regulatory structures.

However, the debt crisis in the EU can be attributed to all its member countries having to adhere to a single set of financial and monetary policies despite the vastly different characteristics of their economies. Some analysts have questioned whether the EU can survive as constituted or whether some countries may eventually have to leave.

Unlike the European Union, ASEAN integration will not have a single currency, monetary policy or central bank, thus individual nations will maintain greater freedom to determine their own economic paths. In instituting supra-national power overseeing the financial policies of its member nations, the EU is much more than just an economic union and ventures further than a free-trade agreement. The hazards of economic incorporation in ASEAN are quite dissimilar to the EU if there is to be no pecuniary policy or universal currency like the euro.

2.1.3.2 Different level of openness and development

Economic integration within ASEAN has been quite different from that of the EU. Firstly, ASEAN intra-regional trade and investment before integration are less than the EU. Secondly, ASEAN is far more distinct with respect to the level of economic advancement in each member nation, unlike the EU, which already had developed nations prior to the early stages of its creation. The EU region remains dominated by developed countries to this day, despite the extension of the EU and its variety in May 2004 to involve the ten Central and Eastern European nations. The five founding ASEAN countries have witnessed enormous transformation in their productive structures in general, particularly in the area of trade. At the same time, the CMLV in ASEAN members lingers at the initial phases of the economic growth process.

Table 2.1: Trade statistic, GDP, and degree of openness of ASEAN and EU, 2009-2013 (unit in US million dollar)

Unit in US million dollar		2009	2010	2011	2012	2013
ASEAN	Export	579,419	780,372	882,545	929,248	945,107
	Import	526,730	725,780	853,017	958,719	985,946
	Total trade	1,106,149	1,506,152	1,735,562	1,887,967	1,931,053
	GDP	1,538,189	1,898,083	2,204,626	2,333,674	2,395,253
	Trade openness (Percentage)	72	79	79	81	81
EU	Export	1,458,221	1,799,848	2,082,388	2,187,103	2,306,373
	Import	1,636,789	2,025,339	2,301,705	2,324,500	2,231,283
	Total trade	3,095,011	3,825,187	4,384,092	4,511,603	4,537,656
	GDP	17,001,814	16,934,783	18,308,288	17,251,951	17,958,073
	Trade openness (Percentage)	18	23	24	26	25

Source: ASEAN Trade Statistics Database, World Bank Database, and Eurostat

Comparing to the most EU countries, ASEAN countries are small in economic terms and very open in trades. According to Table 2.1, ASEAN had trade openness in average 78.4% while EU had 23.2% from 2009 to 2013. Therefore, trade and multinational networks are sources of incorporation for ASEAN members in international markets. For the governments of ASEAN nations, this comprises a focal point of policy as well. ASEAN nations as a concerted group would still be unable to sway international terms of trade because the AEC is comparatively small in terms of the global market and the fact that many of the ASEAN nations are considered underdeveloped, unlike the EU.

2.1.3.3 Difference in policy prospective

From 1957 with the Treaty of Rome, until the implementation of the custom union in 1994, EU integration took almost four decades for the region to develop into a fully functioning, integrated market. In fact, it wasn't until the mid-1980s that the process gathered pace with the increased ingenuity of integration, resulting in a monetary union becoming established just five years following the custom union's inception.

By understanding that an Asian Economic Community must be increasingly far ranging in nationwide markets, this is a clear warning for the ASEAN community. In fact, at the end of the 1980s, it was the same situation for AFTA. Numerous analysts

hypothesized that ASEAN would have no future as a regional organization, once the area's political demands developed. Unperturbed, ASEAN leaders reacted on the economic front by progressing rapidly, with AFTA becoming the first key enterprise in this practice. Since that time, AFTA has developed and grown with all ten countries of Southeast Asian nations now onboard with ASEAN, collaboration has improved extensively in investment (AIA) and the widening of services is keenly tracked within the AFAS. To this end, it really can become reality should ASEAN leaders are able to continue with the positive momentum, although an AEC will necessitate a huge responsibility and commitment to move further develop the process.

2.1.4 The direction of AEC

The Europeans leapt into a complex model without an appropriate infrastructure and an identical degree of economic development is hazardous, as was exhibited in recent financial, fiscal, and banking problems. Therefore, an AEC would not change ASEAN into a European-style union.

Conversely, the AEC strives to integrate ASEAN into one market and one production base, provide an area of impartial economic development, be profitable, and ultimately become a region 100% incorporated into the global economy. By achieving the free flow of goods, services, and skilled labor (three pillars for economic integration), with two supporting pillars, that is freer flows of capital and free flows of investment, the AEC blueprint is able to realize its goals.

Trade liberalization is the basis of the first pillar of integration. Under the AEC, trade liberalization builds upon accomplishments from previous decades that started with the amalgamation of trade through AFTA. A considerable decrease in tax has now been achieved under AFTA. ASEAN-6 provided zero tariffs to 99% of products and goods, as of 1 January 2010, whilst by 2015, countries of the CLMV aim to accomplish the same objectives. This is extended by the AEC which offers a blueprint for liberalization past AFTA. Not only will all tariffs will be cut to zero through the AEC, non-tariff barriers, such as sensitive industry classification, restrictions and subsidies, will be abolished, too. A fully united regional production hub will ensure ASEAN is at the fulcrum of worldwide trading, as well as assist the expansion of production networks and connect opportunities that are currently separated in the trading industry.

The blueprint is not only sympathetic to Asia's modern growth model of a regional production hub, but also of its growing intraregional trade.

With the goal of promoting regional trade and competitiveness by lowering compliance costs, precise procedures to continue to make trade easier have been carried out, like simplification of rules of origin and liberalization. With regard to trade and customs procedures, modifications to decrease administrative problems have also been deployed. Additionally, improved competitiveness and reduced transaction costs have been made possible through synchronized and standardized trade, as well as enhanced customs processes and procedures.

Another goal of the AEC is to achieve free flow of services as a second pillar for integration, as well as the liberalization of trading. The services sector in ASEAN countries have to react quickly and be adaptable to competitive demands which has been highlighted by the AEC. Reduced costs and improved services, encourages liberalization in services and stimulates competition. In addition, this competitive edge could ensure an improved transfer of knowledge from within the region and beyond. These outside services include areas such as better risk management scope through non-Asian contribution in financial services, as well as business management and organization. Additionally, economies of scale and improved competition could point towards better service competitiveness & effectiveness and increased services export markets, whilst services liberalization can provide interim adjustment costs.

AFAS has endeavored to remove intraregional trade limitations and improve liberalization in services General Agreement on Trade in Services (GATS), since its inauguration in 1995. AFAS has always emphasized the importance of professional business services, telecommunications, tourism, transport and financial services, and liberalization is down solely to the judgment of the Central Banks and Ministries of Finance of member countries. Financial services liberalization has been given a greater amount of flexibility in the AEC than other service sectors, because financial services liberalization is often highly influential in maintaining financial and socioeconomic stability, as well as the expansion of the financial division. A number of countries are given the opportunity to be more progressive with liberalization limitations in financial sectors or modes as recognized by member countries by 2015. Between 2015 and 2020, further subsectors to be liberalized gradually. While the capital market is earmarked for

liberalization by 2015 in Thailand, the banking sector has been allowed more flexibility, with the liberalization timeframe stretched to 2020.

The third pillar of integration is based on a single production base and market which cannot be concluded unless it has the free movement of aspects of production, which includes the free movement of labor. The free flow of skilled labor corresponds to other freedoms, like freedom of capital flows and services. Combined they have vital implications for both investment and productivity growth. One concern is that the free movement of labor opens up concerns regarding emotions, as it activates apprehension associated with cultural influence to immigration concerns.

Labor mobility from an ASEAN perspective relates only to professional and skilled laborers, by way of carefully handled mobility or aided entrance for the freedom of natural persons connected in trade for goods, investments and services, in accordance with existing parameters set out by the country. However, some countries still have specific rulings continuing to prevent total freedom of movement. In Thailand, foreign laborers are still prohibited from gaining legal employment in several occupations by the Alien Employment Act, while many other occupations are heavily controlled by professional associations. To continue to improve the free flow of labor by 2015, like the use of mutually recognized professional qualifications, country-specific regulations have to be assessed again.

Emphasis is often placed on the quick-fix solutions by skeptics for the possible dangers of labor mobility. A temporary consequence regularly mentioned is the 'brain-drain' away from migrants' home countries. That said, the ongoing 'brain gain' in receiving countries and a subsequent increase in labor output should be advantageous as a whole for ASEAN countries. Through the introduction of international standards and practices, it could offer local professionals improved competition. During medium and long-term labor mobility, the brain drain is counterbalanced by improved wage structures and a reverse brain drain as laborers who return bring wealth, experience, skills, their business, social networks and wealth back to their native countries.

Three vital pillars for trade and industry integration have been mentioned, including free trade in services, goods, and mobility of skilled labor. Equally, there are two additional sections of liberalization, both of which are just as vital in the support of integrating the economy, including freer flows of capitals and free flows of

investment. Investment liberalization and investment cooperation and protection in ASEAN are applied though the 1998 Framework Agreement on the AIA as well as the 1987 ASEAN Agreement for the Promotion and Protection of Investment. It was improved under the AEC Blueprint, which was signed in 2009 by the ASEAN Comprehensive Investment Agreement (ACIA). The ACIA considers international best practices and is founded on promotion, protection facilitation and, most essentially, liberalization. Operating under the AEC Blueprint, all ten ASEAN countries continue to invest in liberalization, based on the basic principles of national treatment, MFN treatment of investors and open regionalism.

As a final point, the AEC is created to make a freer flow of capital possible, both within and into the region, as well as provide accessibility. Providing a freer flow of capital is made possible through progressive capital account liberalization to allow capital outflows and inflows, as well as ensure the improvement of local capital markets to direct capital more efficiently. Through enhanced market flow and increased accessible markets, capital market development, will improve the accessibility whilst reducing capital costs in each country. ASEAN's individual capital markets are linked onto a common platform, ensuring ease of investment abilities, as well as endeavoring to provide equal regulations throughout each country. Additionally, as a larger market capitalization creates more room for balanced economies, it should help alleviate financing costs.

2.2 Labor market situation and economies of ASEAN and Thailand

2.2.1 ASEAN labor market overview

Considerable labor deficits and surpluses are generated by the income disproportion between geographically neighboring ASEAN nations, the differential rates of population expansion, and the nonexistence of regional redistributive procedures. The result of these variances is the significant migration of labor from poorer countries with less resources and opportunities to richer countries with more resources and opportunities.

Labor migration is already a reality in ASEAN with millions working in other member countries both legally and under illegally conditions. Each year thousands of

migrants move between ASEAN member countries in search of work. Table 2.2 shows the migration matrix between ten ASEAN countries for 1990, 2010, and 2013. Figure 2.2 shows intra-ASEAN net migration by country. Cambodia, Indonesia, Lao PDR, Myanmar, Philippines, and Vietnam were the net migrants export countries to ASEAN, on the other hand, Malaysia, Singapore, and Thailand were the net import countries.

According to Table 2.2, there are 5.87 million and 6.51 million ASEAN citizens currently residing in other ASEAN member states in 2010 and 2013 respectively. ASEAN countries can be extensively divided into net receiving and net sending countries for labor, according to Table 2.2, Cambodia, Lao PDR, Myanmar, Indonesia, Vietnam, and the Philippines are net senders while Singapore, Thailand, Malaysia, and Brunei Darussalam are net receivers (Figure 2.2). The majority of migrants are low-skilled, and many are illegal migrants[3] (Huelser & Heal, 2014).

The number of intra-region movement was increasing over time. Myanmar exported the highest number of migrants to other ASEAN countries while Brunei exported the smallest number of migrants. Thailand is the most popular destination countries among member countries. The total number of migrants in Thailand had 5 hundred thousand persons in 1990 and increased 7 times to about 3.5 million in 2013. The growth is the highest number among ASEAN members. This indicates the high demand of labor in Thailand.

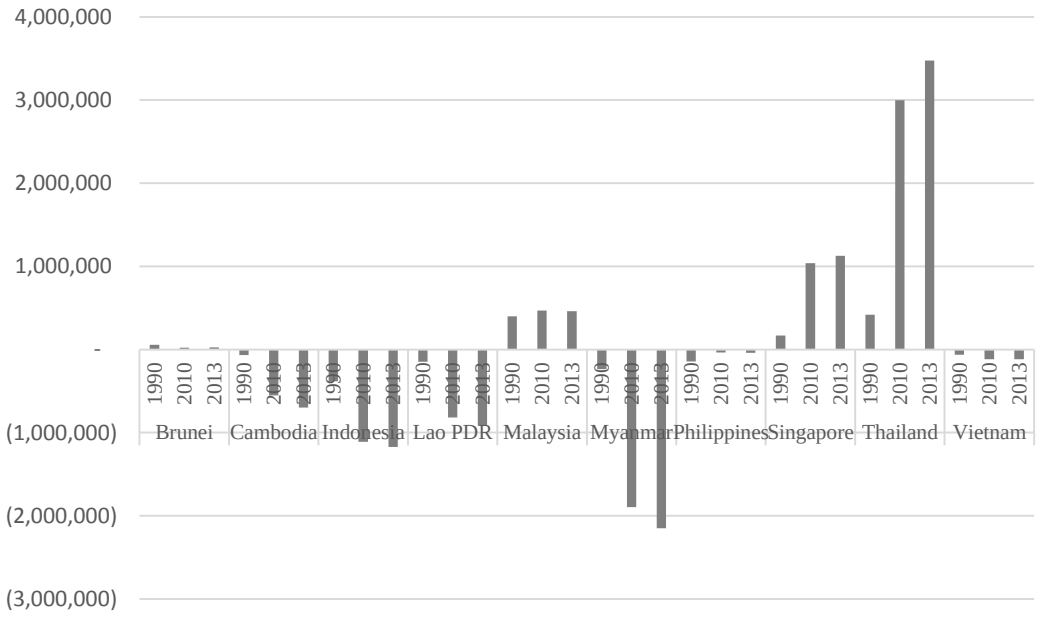
[3] Illegal migration is defined by the International Organization for Migration. Illegal migration is usually restricted to cases of smuggling of migrants and trafficking in persons.

Table 2.2: ASEAN migration matrix 1990, 2010, and 2013 (unit in person)

ASEAN migration matrix										
Country of destination	**Country of origin (unit is person)**									
	Brunei	**Cambodia**	**Indonesia**	**Lao PDR**	**Malaysia**	**Myanmar**	**Philippines**	**Singapore**	**Thailand**	**Vietnam**
South-Eastern Asia										
2013	6,178	767,711	1,216,009	930,976	1,049,780	2,150,790	44,150	102,106	104,891	140,763
2010	5,893	628,225	1,151,880	833,402	976,482	1,894,764	41,286	97,689	101,289	140,415
1990	4,837	97,762	398,148	165,614	242,767	237,664	166,859	52,503	71,807	87,274
Brunei										
2013			352		643		3,468	2,285	25,451	
2010			307		561		3,024	1,992	22,191	
1990			3,324		40,306		7,837	1,499	6,612	
Cambodia										
2013			108	265	175	53	156	125	31,472	37,225
2010			117	288	190	57	169	136	34,142	40,382
1990			49	121	80	24	71	57	14,349	16,971
Indonesia										
2013					1,979		3,517	19,681	19,681	
2010					1,921		3,415	19,108	19,108	
1990					5,406		3,472	4,346	1,458	
Lao PDR										
2013		1,201				282			1,652	11,447
2010		1,183				278			1,628	11,278
1990		1,398				404			2,277	13,852
Malaysia										
2013	5,975	13,876	1,051,227			247,768	21,345	78,092	8,137	85,709
2010	5,705	13,249	1,003,723			236,572	20,381	74,564	7,770	81,836
1990	4,713	1,089	368,270			6,658	152,622	45,569	45,361	18,765
Myanmar										
2013										
2010										
1990										
Philippines										
2013	82	40	3,325		798	424		825	342	416
2010	79	38	3,196		767	408		793	329	400
1990	110	29	3,883		254	57		138	187	18,807
Singapore										
2013			152,681		1,044,994		14,176		17,644	
2010			136,979		971,827		12,820		15,658	
1990			21,507		195,428		1,176		1,438	
Thailand										
2013		750,109	645	926,427	1,191	1,892,480	1,196	632		5,966
2010		611,508	621	829,240	1,216	1,648,602	1,213	675		6,519
1990		73,756	545	165,019	1,293	229,504	1,266	809		18,879
Vietnam										
2013	121	2,485	7,671	4,284		9,783	292	466	512	
2010	109	2,247	6,937	3,874		8,847	264	421	463	
1990	14	21,490	570	474		1,017	415	85	125	

Source: UN DESA, Global Migration Database

Figure 2.2: Intra-ASEAN net migration, 1990-2013 (unit in person)



Source: UN DESA, Global Migration Database

Relaxing trade in services was the ultimate aim of AFAS. With the objective of easing the stream of services throughout the ASEAN region, ASEAN member countries have participated in a series of compromises since 1995. In the global perspectives of developing trade in services between ASEAN member nations, conciliations are conducted for the transfer of labor (GATS mode 4). The free flow of skilled labor comprises one of the objectives structured in the ASEAN Economic Community Blueprint.

For each member nation, domestic laws are far more restraining. Article 33 of the Blueprint states, "in allowing for managed mobility or facilitated entry for the movement of natural persons engaged in trade in goods, services, and investments, according to the prevailing regulations of the receiving country, ASEAN is working to facilitate the issuance of visas and employment passes for ASEAN professionals and skilled labor who are engaged in cross-border trade and investment-related activities." Subsequently, Article 34 offers that in making the free flow of services possible (i.e., by 2015), ASEAN is acting concurrently towards synchronization and consistency, with the objective of assisting the free flow of skilled labor inside the region. The

ASEAN agenda goes beyond a push to make visa and work permit processing easier. This is primarily because it entails acknowledgment of the professional qualifications distributed by each nation using recognized procedures. Coordination and homogeny of professional qualifications between member nations is undoubtedly a complicated task.

Member nations concurred during the 2003 ASEAN Summit in Bali that they would deal with these concerns by implementing Mutual Recognition Arrangements (MRAs), appropriate within particularized lines of work. They are designed to specify the responsibilities of the country of derivation as well as the responsibilities for the skilled laborers.

In consideration of an MRA, the common tactic states that eligibility to work in a host nation requires that the skilled labor meet the prerequisites relevant in the home country of the same labor. These prerequisites involve appropriate qualifications, professional registrations and/or licenses, minimum experience, satisfactory completion of continuing education, the absence of professional delinquency or imminent investigations thereof, and perhaps other prerequisites including medical check-ups or proficiency evaluations. Nonetheless, a host country's domestic laws and regulations will always play a deciding role in judging the qualifications of a skilled laborer for employment in a specific host country. What is more, a skilled laborer is required to follow the host country's professional conduct rules, relevant local laws and regulations, as well as insurance/liability constraints provided the skilled laborer is deemed suitable to work in the host country. Further, conditions exists for reciprocal respect in the context of cultural and religious distinctions. Nurses, architects, engineers, medical practitioners, and dental practitioners have MRAs currently adopted for them. Member nations have established a structure for accountants and surveyors, whereby their credentials can be acknowledged.

It is vital to be cognizant that these treaties or agreements do not serve to override local law when bearing in mind the applicable stipulations. In other words, member nations retain the power to enforce substantial constraints on the movement of people. The Alien Employment Act enforces work permit conditions for foreign employees in Thailand, as an example. Additionally, it may not be viable to abide by relevant professional requirements of the host country for select professions, especially

considering such issues as language barriers and cultural differences. Without the uninhibited movement of natural persons and skilled labor, ASEAN countries will not observe all the advantages of an integrated market.

2.2.2 Thailand labor market overview

2.2.2.1 Overview of Thai labor

Thailand has been transformed its structure from the agricultural-based nation to the export-driven economy since the implementation of its First National Economic and Social Development Plan in 1950s. This greatly enhanced national GDP of Thailand. The transformation caused the demand of labor in the agriculture decreased while demand for manufacturing and service sectors increased. Furthermore, it created a very unique characteristic of the Thailand's labor market by allowing the seasonal migration between the agricultural sector and non-agricultural sectors. This seasonal pattern is studied by (Sussangkarn , 1987; Sussangkarn & Chalamwong, 1994; Ashakul, 1996).

According to Table 2.3, the average growths of population above 15 years old and total labor force from 2007 to 2013 were increased by 1.24% and 1.12% per year respectively. In addition, average growth of person not in labor force 15 year and over of age from 2007 to 2013 was increased by 1.55% per year while average growth of unemployment was declined by 7.44% per year. These indicate that labor supply in Thailand has shorten because the average growth of labor supply is lower than the average growth of person not in labor force 15 year and over of age while and average unemployment keeps reducing.

Table 2.3: Number of population 15 years and over by labor force status, 2007-2013 (unit in thousand persons)

Labor Force Status	2007	2008	2009	2010	2011	2012	2013
Total (Over 15 year and over of age)	50,471	51,045	51,903	52,817	53,462	54,004	54,514
Total Labor Force	36,429	36,942	37,700	38,427	38,643	38,922	39,408
1. Current labor force	36,237	36,758	37,539	38,279	38,440	38,729	39,198
1.1 Employed	35,686	36,249	37,017	37,706	38,037	38,465	38,939
1) At work	35,018	35,640	36,496	37,135	37,441	37,923	38,501
2) With job but not at work	668	610	521	571	597	542	439
1.2 Unemployed	552	508	522	572	402	264	259
1) Looking for work	101	89	93	111	88	51	53
2) Not looking/available for work	450	419	429	461	315	213	206
2. Seasonally inactive labor force	192	184	162	148	204	193	210
Persons not in Labor Force 15 year and over of age	14,042	14,103	14,203	14,390	14,819	15,082	15,106
1. Household work	4,519	4,568	4,658	4,670	4,724	4,649	4,556
2. Studies	4,337	4,340	4,230	4,199	4,233	4,317	4,245
3. Too young/old/incapable of work	4,255	4,336	4,323	4,468	4,581	4,745	4,715
4. Others	931	858	992	1,054	1,281	1,371	1,590

Source: The Labor Force Survey, National Statistical Office, Ministry of Information and Communication Technology

Table 2.3 shows the percentage of population 15 years and over by labor force status from 2007 to 2013. In 2013, labor force was 71.6% while unemployment only 0.5%. However, the percentage of person who was too young, too old, and incapable of work was increasing from 8.5% in 2007 to 9.1% in 2013. This statistic showed the reduced of labor force in the future.

Table 2.4: Percentage of population 15 years and over by labor force status, 2007-2013 (unit in percentage)

Labor Force Status	2007	2008	2009	2010	2011	2012	2013
Total (Over 15 year and over of age)	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total Labor Force	72.4	72.6	72.8	72.3	72.1	72.3	71.6
1. Current labor force	72.0	72.3	72.5	71.9	71.7	71.9	71.2
1.1 Employed	71.0	71.3	71.4	71.1	71.2	71.4	70.7
1) At work	69.8	70.3	70.3	70.0	70.2	70.6	69.9
2) With job but not at work	1.2	1.0	1.1	1.1	1.0	0.8	0.8
1.2 Unemployed	1.0	1.0	1.1	0.8	0.5	0.5	0.5
1) Looking for work	0.2	0.2	0.2	0.2	0.1	0.1	0.1
2) Not looking/available for work	0.8	0.8	0.9	0.6	0.4	0.4	0.4
2. Seasonally inactive labor force	0.4	0.3	0.3	0.4	0.4	0.4	0.4
Persons not in Labor Force 15 year and over of age	27.6	27.4	27.2	27.7	27.9	27.7	28.4
1. Household work	8.9	9.0	8.8	8.8	8.6	8.4	8.6
2. Studies	8.5	8.1	7.9	7.9	8.0	7.8	7.8
3. Too young/old/incapable of work	8.5	8.3	8.5	8.6	8.8	8.6	9.1
4. Others	1.7	1.9	2.0	2.4	2.5	2.9	2.9

Source: The Labor Force Survey, National Statistical Office, Ministry of Information and Communication Technology

Table 2.5 shows the number of employed persons by industry from 2007 to 2013. According to Table 2.5, the average growth of employment from 2007 to 2013 was increased by 1.24% per year. In addition, average growths of employment in agricultural and non-agricultural sectors from 2007 to 2013 were increased by 1.22% and 1.28% per year respectively. Agricultural sector has less employment and less employment growth than non-agricultural sector, it indicates that whether Thailand tends to less depend on agricultural or use more capital in this sector.

Table 2.5: Number of employed persons by industry, 2007-2013 (unit in thousand persons)

Industry	2007	2008	2009	2010	2011	2012	2013
Total	36,249	37,017	37,706	38,037	38,465	38,939	38,907
1. Agricultural	14,306	14,699	14,693	14,547	14,883	15,433	15,407
1.1 Agriculture, forestry and fishing	14,306	14,699	14,693	14,547	14,883	15,433	15,407
2. Non-Agricultural	21,943	22,317	23,014	23,490	23,582	23,506	23,500
2.1 Mining and quarrying	63	58	51	41	50	73	66
2.2 Manufacturing	5,619	5,453	5,374	5,350	5,301	5,393	5,435
2.3 Electricity, gas, steam and air conditioning supply	102	106	102	107	101	96	99
2.4 Water supply; sewerage, waste management and remediation activities	76	98	98	52	89	67	89
2.5 Construction	2,149	2,214	2,303	2,356	2,372	2,493	2,543
2.6 Wholesale and retail trade; repair of motor vehicles and motorcycles	5,574	5,754	6,048	6,236	6,037	5,995	6,008
2.7 Transportation and storage	1,058	1,117	1,141	1,108	937	926	948
2.8 Accommodation and food service activities	2,343	2,384	2,593	2,654	2,546	2,307	2,300
2.9 Information and communication	64	75	73	76	181	214	199
2.10 Financial and insurance activities	342	373	375	367	395	418	440
2.11 Real estate activities	106	107	119	102	106	131	132
2.12 Professional, scientific and technical activities	254	235	226	237	268	239	257
2.13 Administrative and support service activities	315	342	353	375	394	389	394
2.14 Public administration and defence; compulsory social security	1,251	1,299	1,349	1,488	1,596	1,713	1,640
2.15 Education	1,046	1,062	1,133	1,246	1,287	1,201	1,181
2.16 Human health and social work activities	633	681	699	701	671	660	645
2.17 Arts, entertainment and recreation	166	184	192	213	230	228	238
2.18 Other service activities	486	516	520	519	740	677	630
2.19 Activities of households as employers; undifferentiated goods and services-producing activities of households for own use	233	218	238	234	247	253	204
2.20 Activities of extraterritorial organizations and bodies	2	1	2	3	3	4	3
2.21 Unknown	60	39	25	25	28	31	50

Source: The Labor Force Survey, National Statistical Office, Ministry of Information and Communication Technology

Table 2.6 shows the percentage of employed persons by industry from 2007 to 2013. The employment shares of agricultural and non-agricultural sectors were 39.6 and 60.4 in 2013 respectively. Manufacturing and whole wholesale & retail trade; repair of motor vehicles and motorcycles employed the most number of labor.

Table 2.6: Percentage of employed persons by industry, 2007-2013 (unit in percentage)

Industry	2006	2007	2008	2009	2010	2011	2012	2013
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1. Agricultural	39.7	39.5	39.7	39.0	38.2	38.7	39.6	39.6
1.1 Agriculture, forestry and fishing	39.7	39.5	39.7	39.0	38.2	38.7	39.6	39.6
2. Non-Agricultural	60.3	60.5	60.3	61.0	61.8	61.3	60.4	60.4
2.1 Mining and quarrying	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2
2.2 Manufacturing	15.4	15.5	14.7	14.3	14.1	13.8	13.9	14.0
2.3 Electricity, gas, steam and air conditioning supply	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.3
2.4 Water supply; sewerage, waste management and remediation activities	0.2	0.2	0.3	0.3	0.1	0.2	0.2	0.2
2.5 Construction	6.0	5.9	6.0	6.1	6.2	6.2	6.4	6.5
2.6 Wholesale and retail trade; repair of motor vehicles and motorcycles	15.5	15.4	15.5	16.0	16.4	15.7	15.4	15.4
2.7 Transportation and storage	3.0	2.9	3.0	3.0	2.9	2.4	2.4	2.4
2.8 Accommodation and food service activities	6.4	6.5	6.4	6.9	7.0	6.6	5.9	5.9
2.9 Information and communication	0.2	0.2	0.2	0.2	0.2	0.5	0.5	0.5
2.10 Financial and insurance activities	1.0	0.9	1.0	1.0	1.0	1.0	1.1	1.1
2.11 Real estate activities	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
2.12 Professional, scientific and technical activities	0.7	0.7	0.6	0.6	0.6	0.7	0.6	0.7
2.13 Administrative and support service activities	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0
2.14 Public administration and defence; compulsory social security	3.2	3.5	3.5	3.6	3.9	4.2	4.4	4.2
2.15 Education	2.9	2.9	2.9	0.0	3.3	3.3	3.1	3.0
2.16 Human health and social work activities	10.7	1.7	1.8	1.9	1.8	1.7	1.7	1.7
2.17 Arts, entertainment and recreation	3.3	0.5	0.5	0.5	0.6	0.6	0.6	0.6
2.18 Other service activities	8.5	1.3	1.4	1.4	1.4	1.9	1.7	1.6
2.19 Activities of households as employers; undifferentiated goods and services-producing activities of households for own use	4.1	0.6	4.0	0.6	0.6	0.6	0.6	0.5
2.20 Activities of extraterritorial organizations and bodies	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.21 Unknown	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1

Source: The Labor Force Survey, National Statistical Office, Ministry of Information and Communication Technology

2.2.2.2 Overview of labor immigration in Thailand

Thailand has been attracting low wage labor from neighboring countries since early 1990s. It started a policy to enroll works from Myanmar in ten areas along the border in 1992. That policy has consistently extended in degree to incorporate works in low-skilled occupations from Cambodia, Lao PDR, and Myanmar in every province in Thailand (Paitoonpong & Chalamwong, 2012).

In the early 1990s, Thailand faced the shortage of unskilled labor supplies in agricultural sectors, especially in North and North-Eastern provinces because native Thai labors left agricultural sector in these provinces to seek the higher income sectors such as manufacturing and service sectors in the Central regions. Thus, there was the influx of unskilled labors from neighboring countries where the wage rate was less than minimum wage in Thailand. These migrant labors replaced those natives who left agricultural sector.

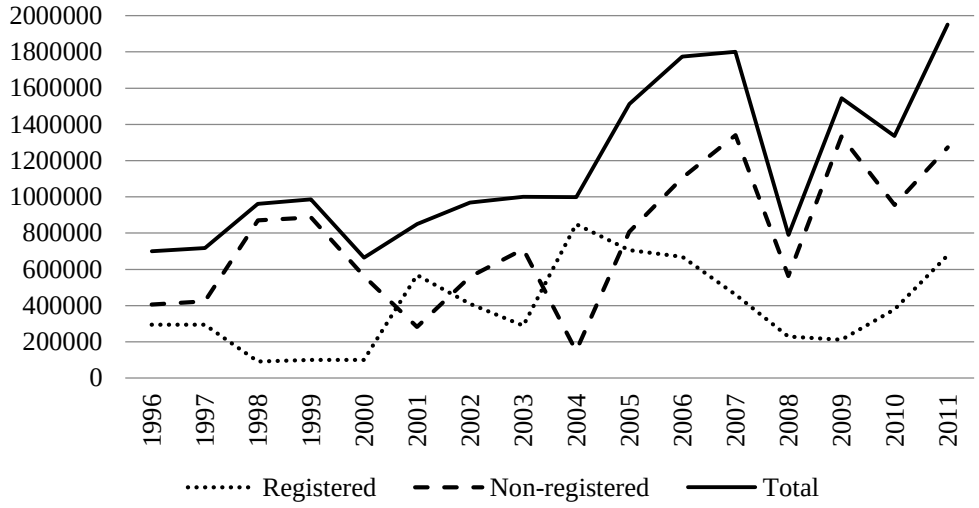
Table 2.7: Foreign labors in Thailand, 1996-2011 (unit in person)

	Registered	Non-registered	Total	Registered (%)
1996	293,652	406,348	700,000	42
1997	293,652	424,037	717,689	41
1998	90,911	870,556	961,467	9
1999	99,974	886,915	986,889	10
2000	99,956	563,820	663,776	15
2001	568,249	281,751	850,000	67
2002	409,339	558,910	968,249	42
2003	288,780	711,220	1,000,000	29
2004	849,552	149,848	999,400	85
2005	705,293	807,294	1,512,587	47
2006	668,576	1,104,773	1,773,349	38
2007	460,014	1,339,986	1,800,000	26
2008	228,353	562,311	790,664	29
2009	210,745	1,334,157	1,544,902	14
2010	379,560	955,595	1,335,155	28
2011	678,235	1,272,415	1,950,650	35

Source: Martin (2007) and Ministry of Labour

In year 1996, most agriculture is the major job that was taken by immigrants and most migrants are from Cambodia, Lao PDR, and Myanmar (Athukorala, Manning, & Wickramasekara, 2000). In addition, the total number of migrants is approximately around one million which 70-80% was from Myanmar (Athukorala *et al.*, 2000). After ten years, the percentage of Myanmar migrants increased to 90% and the number of migrant increased to two million approximately which equal to 6% of Thai labor force as shown in Table 2.7 (Kulkolkarn, 2007).

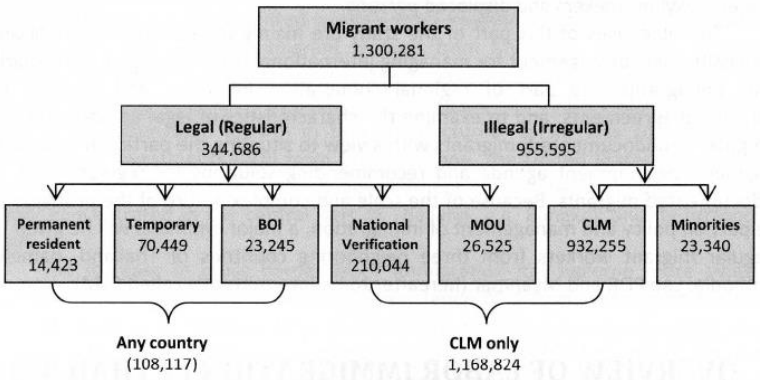
Figure 2.3: Migrant labors in Thailand, 1996-2011



Source: Martin, 2007 and Ministry of Labour

Table 2.7 and Figure 2.3 show the number of migrant labors increased more than twice during 1996 to 2011. According to Figure 3, the number of migrants dropped significantly due to global financial crisis in 2008 but rapidly recover within three years. The movement of non-registered line is similar to total line because the majority of migrants are non-registered. The number of registered migrant is quiet steady, this indicates that Thailand failed to get migrant into the system.

Figure 2.4: Migrant labors in Thailand by category, December 2010 (unit in person)



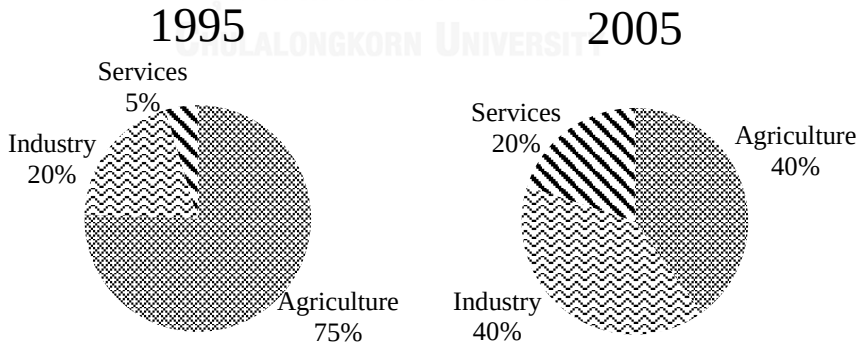
Source: Number of migrants from the Office of Foreign Workers Administration, cited via Paitoonpong and Chalamwong, (2012)

Figure 2.4 shows the real structure of immigrant in Thailand which indicates that immigrants are from several sources. In addition, the majority of migrant labors in Thailand was from CLM countries, both legally entered and illegally entered, of 1,168,824 persons which representing for 89.9% of the total migrant labors. In addition, the rest including migrant labors from other countries and minorities were 108,117 persons and 23,340 respectively.

Most of illegal labors are basic and unskilled labors such as housemaid, labor and labors in manufacturing industries, orchard and gardening, restaurants and beverages. Also illegal migrant labors from ethnic minority groups are mostly permitted to work in construction. Illegal migrant labors by cabinet resolution are mostly permitted to work in agriculture and livestock, construction, fisheries related industries, housemaid, and fishery sectors (Paitoonpong & Chalamwong, 2012).

Table 2.8: The number of migrant labors year 1995 and 2005 (unit in person)

	1995		2005	
	Migrants	Distribution (Percentage)	Migrants	Distribution (Percentage)
Agriculture	561,432	0.76	720,000	0.40
Industry	147,095	0.20	720,000	0.40
Services	34,272	0.05	360,000	0.20
Total	742,799		1,800,000	

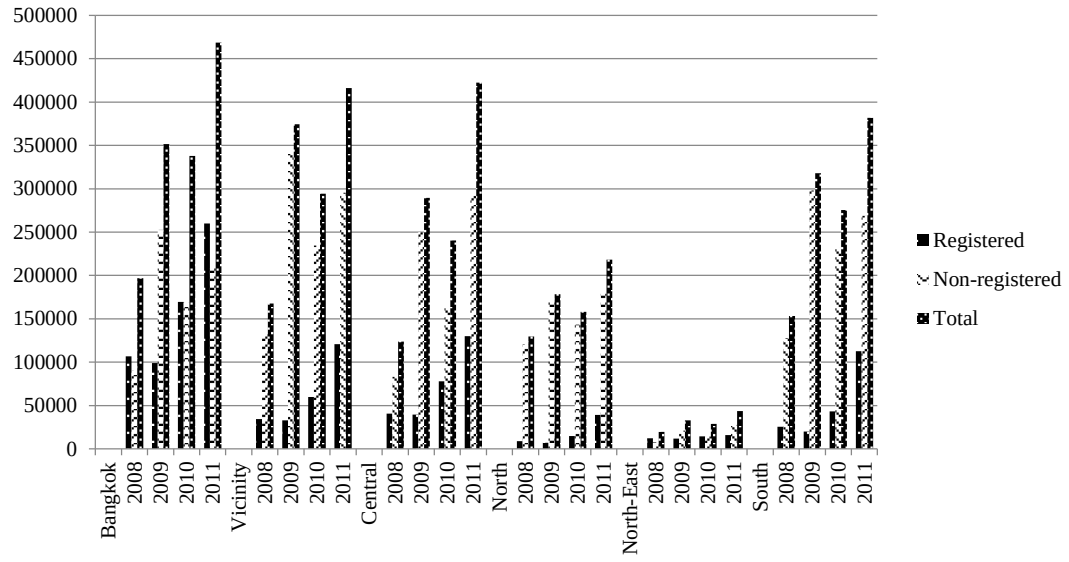


Source: Martin (2007)

Table 2.8 indicates that most migrants were taking agricultural jobs in year 1995. Most agricultural jobs were concentrated around the border provinces. Ten years later, the share of agriculture dropped significantly while the share of industry and

service sectors significantly increased, many migrants moved from agriculture to industrial and service sectors as they moved from the border provinces to Central Thailand and Bangkok where the wage rates were higher. Although the share of agricultural sector dropped from 76% in 1995 to 40% in 2005, the number of migrant in agricultural sector was increased by 28%. Therefore, migrant labors are important to sustain the economic operation in Thailand.

Figure 2.5: Migrant labors in Thailand classified by regions, 2008-2011 (unit in person)



Source: Ministry of Labour

Table 2.9: Migrant labors in Thailand classified by regions, 2008-2011 (unit in person)

	Registered	Non-registered	Total	Registered (%)
The Whole Kingdom				
2008	228,353	562,311	790,664	29
2009	210,745	1,334,157	1,544,902	14
2010	379,560	955,595	1,335,155	28
2011	678,235	1,272,415	1,950,650	35
Bangkok				
2008	106,834	90,147	196,981	54
2009	98,823	252,768	351,591	28
2010	169,444	168,442	337,886	50
2011	260,074	208,573	468,647	55
Vicinity				
2008	34,220	133,302	167,522	20
2009	33,022	341,494	374,516	9
2010	59,702	234,681	294,383	20
2011	120,634	295,548	416,182	29
Central				
2008	40,629	83,216	123,845	33
2009	39,680	249,851	289,531	14
2010	77,853	162,457	240,310	32
2011	129,841	292,473	422,314	31
North				
2008	8,836	120,665	129,501	7
2009	7,207	171,182	178,389	4
2010	14,790	143,395	158,185	9
2011	39,026	179,161	218,187	18
North-East				
2008	12,259	7,288	19,547	63
2009	11,941	20,940	32,881	36
2010	14,404	14,564	28,968	50
2011	15,945	27,660	43,605	37
South				
2008	25,575	127,693	153,268	17
2009	20,072	297,922	317,994	6
2010	43,367	232,056	275,423	16
2011	112,715	269,000	381,715	30

Source: Ministry of Labour

Table 2.9 and Figure 2.5 show the number of migrant labors in Thailand classified by regions. They indicate that migrant are concentrated in Central regions (Bangkok, Central, and Vicinity) of Thailand because most of service and manufacturing sectors are concentrates in Central regions. On the other hand, migrant labors are less concentrated in North-East regions because, nowadays, most migrants may prefer working in service and manufacturing sectors to agricultural sectors. In addition, the number of migrants in all regions is increasing which indicates that Thailand still has the inflow of migrant but most of them are non-registered or illegally working.

Table 2.10: Migrant labors in Thailand classified by industry provinces 2008-2011 (unit in person)

	Registered	Non-registered	Total		Registered	Non-registered	Total
Chiang Mai				Khon Kaen			
2008	3,818	61,179	64,997	2008	1,796	914	2,710
2009	2,650	75,780	78,430	2009	1,652	2,365	4,017
2010	6,982	61,389	68,371	2010	2,992	1,583	4,575
2011	26,404	51,684	78,088	2011	4,067	2,756	6,823
Samut Prakan				Prachin Buri			
2008	11,928	19,657	31,585	2008	1,292	424	1,716
2009	12,278	58,759	71,037	2009	1,493	3,821	5,314
2010	25,803	36,449	62,252	2010	1,911	2,244	4,155
2011	21,351	53,652	75,003	2011	2,359	5,286	7,645
Chonburi				Ubon Ratchatani			
2008	14,350	15,331	29,681	2008	1,080	545	1,625
2009	13,296	56,965	70,261	2009	1,060	1,394	2,454
2010	29,586	28,901	58,487	2010	839	937	1,776
2011	49,155	65,255	114,410	2011	583	1,907	2,490
Rayong				Udon Thani			
2008	5,680	6,490	12,170	2008	1,012	347	1,359
2009	5,115	31,019	36,134	2009	916	1,016	1,932
2010	8,668	20,365	29,033	2010	735	717	1,452
2011	12,711	45,996	58,707	2011	496	1,106	1,602
Phra Nakon Si Ayutthaya							
2008	3,774	2,633	6,407				
2009	3,983	9,802	13,785				
2010	5,319	6,594	11,913				
2011	8,439	7,344	15,783				

Source: Ministry of Labour

Table 2.10 shows the number of migrant in every industry province from 2008 to 2011 in Thailand. The increment in cross border migrants has turned out to be more obvious before crisis. Higher wage, low unemployment, and better living standard are major pull factors. Not every producers could be able to change from labor incentive to more capital incentive operation, thus labor incentive producers that aimed to maintain their competitiveness employed an extensive pool of low wage labor from neighboring countries.

The large cross-border migrant flows to Thailand have made effects on labor market and domestic economy. The positive effects incorporate the filling the required supply of unskilled labors and the contribution of such labors to the nation economic growth. In contrast, the negative impacts include the pressure on wages of Thai labors, the barricade of technological intensity. In addition, migrant labors are often linked with national security problem and social problems including human trafficking (Pholphirul, 2012). This pattern of movement and its effects will proceed for quite a while unless there is a political improvement.

From past studies demonstrated that international migration has a net positive effect on the Thai economy, for instance, around 750,000 immigrants (about 2.2% of

the labor force) could raise the Thai GDP by about 0.55% (Sussangkarn, 1996). Martin (2007) used the reestablishment of the model to the information ten years after altering the share of migrant labor, he observed that immigrants around 5% of aggregate labors increased GDP by approximately 1.25%. In addition, Pholphirul and Rukumnuyakit (2010) used a similar methodology to Martin (2007) and found that the net contribution of immigrant labors to the Thai economy was approximately 0.023 percent. Besides, if migrants were eliminated real GDP will shrink by -0.75%, the loss of real GDP was observed for the most part in agriculture (-1.33%), followed by manufacturing goods (0.9%), and services (-0.53%) (Pholphirul & Rukumnuyakit, 2010).

The advantages of migration ensue to employers and the migrants themselves whereas low skilled Thai labors encounter a net loss due to reductions in occupation opportunities and marginally lower wages. Utilizing international migrant labors might lead to create a long-term negative effect on the Thai economy if employers depend on low-wage labor and participate less in research and development and in expanding labor productivity. Hiring unskilled migrant can help enhancing firm's cost competitiveness by saving labor cost, on the other hand, this may be required to lessen the firm's incentives in innovative investment. Pholphirul and Rukumnuyakit (2010) evaluated 10% expansion of employing unskilled migrants has a tendency to decrease firm's probability of research and development (R&D) investment by around 4%.

The negative impacts of immigration on low skilled Thai wages have a tendency to be little. From simulation of Pholphirul and Rukumnuyakit (2010), they established that employing migrants in agricultural segment has a tendency to diminish overall employment by 0.67% and lessen wage rate by about 4.34%. Generally, the issue of immigrant labor is whether immigrants are substitute or complement to native labors.

Immigrants are substitute or complement to native labors in the job markets depending on the number of immigrants (Kulkolkarn & Potipiti, 2009). Kulkolkarn & Potipiti (2009) claimed that when there are small numbers of immigrants, they will harm native labors by depressing wages in the unskilled labor segment. This leads to the movement of native labors to other sectors. These sectors may require native language which is a barrier to enter for immigrants. However, if there is further immigration, immigrants will become complement to native labors through the efficiency gain from the division of labor between native and immigrants. This is

because labor markets eventually become completely segmented. Nevertheless, too many immigrants will harm native labors because they start to enter and compete for jobs in other sectors.

In addition, the connection between immigration and productivity relies upon whether migrants are substitute or complementary to local labors. If there is high substitute effect between migrants and locals, particularly in the low skilled segments, employing 10% more of unskilled migrant labor causes a drop of the labor productivity by around 5%. On the other hand, employing 10% more of skilled labors help increasing the labor productivity approximately 28% (Pholphirul & Rukumnuyakit, 2010).

In 2015 Thailand will be one of a member of AEC, thus this would affect much to labor demand. There would be a greater movement of labor between member countries due to higher economic activity. The greater flow of labor within ASEAN would affect to demand side and supply side of Thailand. Therefore, estimate the number of migrant after AEC is important for government to plan for manpower in the future.

2.2.3 Economy of ASEAN

ASEAN is covering an area of 4.46 million cubic kilometers which is equivalent to approximately 3% of the total land area of the world. Total population is more than 600 million persons, which is approximately 9% of the world's population. Because of a single economic unit, it is syndicated nominal GDP of USD 2 trillion ranks eighth in the world (FCO, 2013).

Table 2.11: Selected basic ASEAN indicators, 2013

Country	Total population	Annual population growth	GDP at current prices	Income per capita	Unemployment rate	International merchandise trade		
						Exports	Imports	Total trade
	thousand	percentage	US$ million	US dollar	percentage	million US dollar	million US dollar	million US dollar
Brunei	406	1.60	16,117	39,679	1.70	11,445	3,612	15,057
Cambodia	14,963	1.50	15,511	1,037	0.30	9,148	9,176	18,324
Indonesia	248,818	1.38	860,850	3,460	6.17	182,552	186,629	369,180
Lao PDR	6,644	1.99	10,283	1,548	1.90	2,593	3,292	5,885
Malaysia	29,948	1.46	312,072	10,420	3.10	228,331	205,897	434,229
Myanmar	61,568	0.97	54,661	888	4.00	11,436	12,009	23,445
Philippines	99,385	1.83	269,024	2,707	6.40	53,978	65,131	119,109
Singapore	5,399	1.63	297,941	55,182	2.90	410,250	373,016	783,265
Thailand	68,251	0.50	387,574	5,679	0.72	228,730	249,517	478,247
Vietnam	89,709	1.05	171,219	1,909	3.60	132,664	132,110	264,774
ASEAN	625,091	1.28	2,395,253	122,508		1,271,128	1,240,388	2,511,517

Sources: ASEAN Finance and Macro-economic Surveillance Unit Database, ASEAN Merchandise Trade Statistics Database, and ASEAN Foreign Direct Investment Statistics Database

Table 2.11 shows the selected basic ASEAN indicator at year 2013. Indonesia has the highest number of population and GDP in the group. On the other hand, Brunei has the lowest number of population but ranks second in the income per capita. Singapore has the highest income per capita which higher than Myanmar about 62 time. This indicates a highly different in economic development. Although Thailand ranks second in GDP, it has the lowest population growth in the group. This shows the sign of slower economic growth in the future due to aging society. Philippines and Indonesia have high unemployment rate which are over 6% while Cambodia and Thailand have less than 1%. Singapore has the highest value of total trade following by Thailand and Malaysia which both have almost equal in value of total trade.

2.2.3.1 Trade in goods

According to Table 2.12, trade within ASEAN has been growing stronger. The value of goods traded within ASEAN increased significantly because ASEAN has made significant progress in removing tariffs on intra-ASEAN trade (ASEAN Secretariat, 2012). In line with such developments, the portion of intra-ASEAN trade in total trade

share has enlarged to 24.2% in 2013 which is 25% of the region's total GDP (ASEAN Secretariat, 2014a).

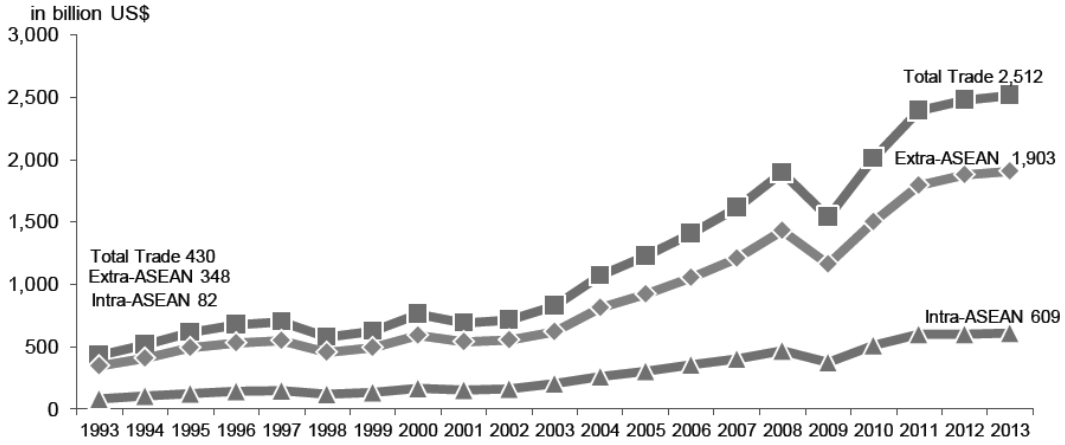
Table 2.12: Intra- and extra-ASEAN trade, 2013 (unit in billion US dollar)

Country	Intra-ASEAN exports		Extra-ASEAN exports		Total exports	Intra-ASEAN imports		Extra-ASEAN imports		Total imports
	Value	Share to total exports (percentage)	Value	Share to total exports (percentage)		Value	Share to total imports (percentage)	Value	Share to total imports (percentage)	
Brunei	2,644	23.1	8,801	76.9	11,445	1,844	51.0	1,768	49.0	3,612
Cambodia	1,301	14.2	7,847	85.8	9,148	2,818	30.7	6,358	69.3	9,176
Indonesia	40,631	22.3	141,921	77.7	182,552	54,031	29.0	132,598	71.0	186,629
Lao PDR	1,234	47.6	1,358	52.4	2,593	2,495	75.8	797	24.2	3,292
Malaysia	63,982	28.0	164,350	72.0	228,331	55,051	26.7	150,847	73.3	205,897
Myanmar	5,625	49.2	5,811	50.8	11,436	4,244	35.3	7,765	64.7	12,009
Philippines	8,615	16.0	45,363	84.0	53,978	14,171	21.8	50,959	78.2	65,131
Singapore	128,787	31.4	281,463	68.6	410,250	77,885	20.9	295,130	79.1	373,016
Thailand	59,321	25.9	169,410	74.1	228,730	44,348	17.8	205,169	82.2	249,517
Vietnam	18,179	13.7	114,485	86.3	132,664	21,353	16.2	110,757	83.8	132,110
ASEAN	330,318	26.0	940,810	74.0	1,271,128	278,240	22.4	962,148	77.6	1,240,388

Source: ASEAN Merchandise Trade Statistics Database

Figure 2.6 shows the movement of ASEAN total trade, extra-ASEAN, and intra-ASEAN trade from 1993 to 2013. Intra-ASEAN trade improved at a more rapid rate than either whole ASEAN trade or extra-ASEAN trade with yearly growth be an average of 10.5% as compared with 9.2% and 8.9%, correspondingly (between 1993 and 2013). Overall trade posted a six fold rise from the time of the establishment of AFTA, from 430 billion US dollar in 1993 to 2.5 trillion US dollar in 2013. Intra-ASEAN trade has increased by more than seven times in the same period from 82 billion US dollar to 609 billion US dollar, although extra-ASEAN trade rose over five times, from 348 billion US dollar to 1.9 trillion US dollar. Extra-ASEAN trade approximately accounted for three-fourths of total trade.

Figure 2.6: Trend of ASEAN total trade and intra-ASEAN trade, 1993-2013 (unit in billion US dollar)



Source: ASEAN Secretariat (2014)

As ASEAN continued moving toward an economically integrated Community with an integrated trading market joined with a worldwide supply chain, total ASEAN trade increased to 2,512 billion US dollar in 2013 from 825 billion US dollar in 2003. As a main element of ASEAN economic integration, ASEAN trade in goods has altered in composition and direction throughout the years with the effects of these progressions fluctuating across nations and sectors (ASEAN Secretariat, 2014b).

Table 2.13: Intra-ASEAN trade by sector (unit in million US dollar)

Partners	Products	Exports		Imports		Balance	
		2012	2013	2012	2013	2012	2013
		Value in million US dollar					
Intra-ASEAN	Food and live animals	17,076	16,608	14,074	13,863	3,002	2,745
	Beverages and tobacco	4,470	5,033	1,770	1,916	2,700	3,117
	Crude materials, inedible, except fuels	6,095	5,690	7,984	7,432	-1,889	-1,743
	Mineral fuels, lubricants and related materials	80,149	87,029	77,775	85,670	2,375	1,358
	Animal and vegetable oils, fats and waxes	5,893	3,788	5,305	3,115	588	673
	Chemicals and related products, n.e.s.	30,877	32,760	24,144	25,567	6,733	7,193
	Manufactured goods classified chiefly by material	32,722	33,102	26,423	26,579	6,300	6,522
	Machinery and transport equipment	117,096	117,284	93,266	93,455	23,830	23,830
	Miscellaneous manufactured articles	19,487	21,502	15,999	16,256	3,488	5,246
	Commodities not classified elsewhere in the Standard International Trade Classification (SITC)	9,990	7,524	11,453	4,386	-1,463	3,138
	TOTAL	323,855	330,318	278,193	278,240	45,662	52,078

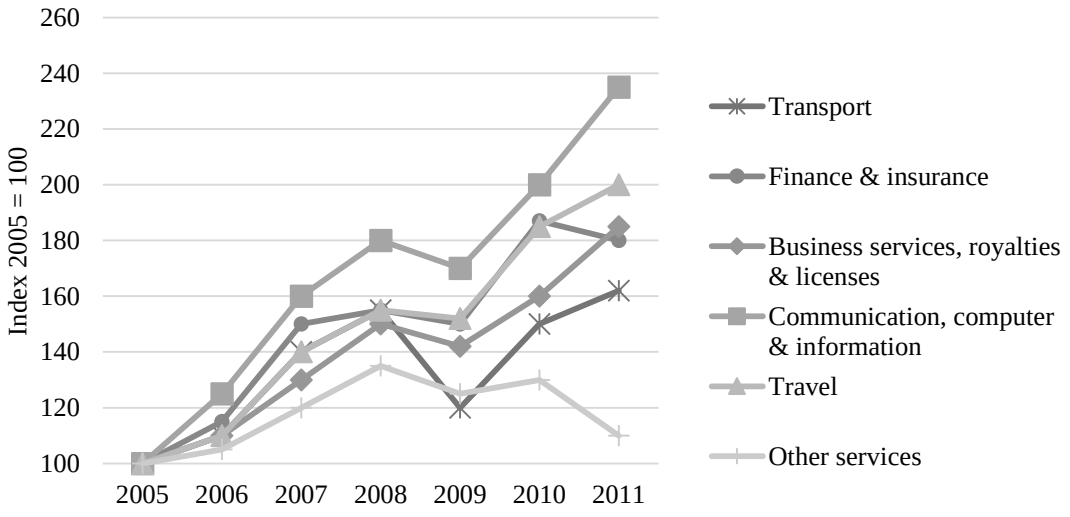
Source: ASEAN Secretariat (2014)

Table 2.13 shows intra-ASEAN trade by sector. Machinery and transport equipment were the highest value of export and import products for intra-trade while beverage and tobacco were the lowest. This may indicate that machinery and transport equipment were re-exported between members due to long supply chain while beverage and tobacco were likely produced and consumed within country.

2.2.3.2 Trade in services

There is no limitation to ASEAN services suppliers for delivering services or for establishing companies across national borders within ASEAN countries, subject to domestic regulation (ASEAN Secretariat, 2009). This is one of the agreement list in AEC blueprint which aims to achieve free flow of trade in services including financial services and air transport. In encouraging the free flow of services by 2015, ASEAN is also living up to expectations towards acknowledgment of expert capabilities with a perspective to encourage their movement inside the region (ASEAN Secretariat, 2009).

Figure 2.7: Index of current value of ASEAN service imports by sectors, 2005 = 100, 2005 – 2011



Source: ASEAN Secretariat (2012)

Figure 2.7 shows the total value of service imports into ASEAN in order to gauge the extent of reductions in barriers to trade as the ASEAN region integrates. There has been a significant increase in the value of total service imports by ASEAN

countries. While this trend is consistent with declining barriers to trade, it may also reflect increasing globalization and rapid development in information and communications technologies more generally (since in this instance the data include imports from outside ASEAN).

According to Figure 2.7, import in services has also increased rapidly, especially in priority integration sectors such as communication, computer & information services, travel services, finance & insurance services, business services, and royalties & licenses. However, the rapid growth in ASEAN's service imports has been more than matched by growth in exports (ASEAN Secretariat, 2012).

Table 2.14: Trade in Services Balance of ASEAN Countries, 2005-2012, (unit in million US dollar)

Country	2005	2006	2007	2008	2009	2010	2011	2012
Brunei Darussalam	- 822	- 745	- 203	- 529	- 1,048	- 557	- 467	-
Cambodia	476	492	632	627	615	697	889	1,073
Indonesia	- 9,122	- 9,874	- 11,841	- 12,998	- 22,739	- 9,324	- 11,178	- 9,523
Lao PDR	148	153	202	306	496	67	219	236
Malaysia	- 2,380	- 1,890	690	46	1,344	543	- 2,031	- 4,543
Philippines	- 1,340	137	1,077	1,160	3,274	2,735	3,572	-
Singapore	- 2,690	- 2,644	- 2,590	- 2,674	- 5,916	1,554	1,869	752
Thailand	- 6,863	- 8,012	1,287	- 12,892	- 19,269	- 10,706	- 10,569	- 3,441
Viet Nam	- 26	- 8	-	- 950	- 2,421	- 2,461	- 2,980	- 3,616
ASEAN	- 22,619	- 22,391	- 10,746	- 27,904	- 45,664	- 17,452	- 20,676	- 19,062

Source: ASEAN Secretariat (2013)

Table 2.14 shows trade in services balance of ASEAN countries excluding Myanmar due to no data available. ASEAN always has trade deficit with the rest of the world due to the high value of import in communication, computer & information services, travel services, finance & insurance services, business services, and royalties & licenses. However, ASEAN's services trade deficit with the rest of the world has declined by 15% from around 22 billion US dollar in 2005 to less than 19 billion US dollar in 2012.

2.2.4 Economy of Thailand

Thailand's economy is the second largest in ASEAN after Indonesia and it is situated in the center of the region with the vast majority of its borders joined with neighboring ASEAN nations. Moreover, Thai economy is highly linked to international trade. Thailand's degree of openness[4] was 123% of GDP in 2013 after Singapore and Malaysia which were 263% and 139% respectively.

Table 2.15: Trade of Thailand, 2005-2013

Thailand	2005	2006	2007	2008	2009	2010	2011	2012	2013
Value in million US dollar									
Export	109,623	121,579	153,571	174,967	152,497	195,312	228,821	229,524	228,730
Import	117,991	127,109	139,966	177,568	133,770	189,728	230,084	247,778	249,517
Total trade	227,614	248,688	293,537	352,535	286,267	385,040	458,905	477,302	478,247
Export to ASEAN	23,867	26,944	32,894	39,487	32,491	44,335	72,227	56,730	59,321
Import from ASEAN	21,552	23,540	24,993	29,888	26,760	42,276	39,224	42,806	44,348
Total trade for AEAN	45,419	50,484	57,887	69,375	59,251	86,611	111,451	99,536	103,669
Percentage									
Growth of export		10.9	26.3	13.9	-12.8	28.1	17.2	0.3	-0.3
Growth of import		7.7	10.1	26.9	-24.7	41.8	21.3	7.7	0.7
Growth of total trade		9.3	18.0	20.1	-18.8	34.5	19.2	4.0	0.2
Growth of export to ASEAN		12.9	22.1	20.0	-17.7	36.5	62.9	-21.5	4.6
Growth of import to ASEAN		9.2	6.2	19.6	-10.5	58.0	-7.2	9.1	3.6
Growth of total trade of ASEAN		11.2	14.7	19.8	-14.6	46.2	28.7	-10.7	4.2
Share of ASEAN Export	21.8	22.2	21.4	22.6	21.3	22.7	31.6	24.7	25.9
Share of ASEAN Import	18.3	18.5	17.9	16.8	20.0	22.3	17.0	17.3	17.8
Share of ASEAN Total trade	20.0	20.3	19.7	19.7	20.7	22.5	24.3	20.9	21.7

Source: ASEAN Secretariat (2014b)

Table 2.15 shows trade of Thailand from 2005-2013. The value of total trade of Thailand was double from 2005 to 2013. The value of trade on ASEAN had greater growth than total trade. Moreover, Thailand had 21.7% share in ASEAN total trade in 2013.

[4] Degree of openness is calculated by $\frac{\text{Export+Import}}{\text{GDP}}$

Table 2.16: Number of employment in Thailand by sector, 2010-2013 (unit in thousand persons)

Sectors	Thousand persons		
	2010	2011	2012
Agriculture, Fishery & Forestry	15,893	15,729	15,142
Manufacturing	5,163	5,203	5,733
Construction	2,010	2,062	2,461
Wholesales & Retail Trade, Restaurants, & Hotels	8,647	8,613	8,274
Transportation, Storage, Communication	1,068	1,084	1,180
Finance, Insurance, Real Estate and Business Services	1,097	1,112	1,207
Public Services	4,441	4,843	4,688
Others (Mining & Quarrying, Electricity, Gas & Water, Unknown)	189	225	266
Total	38,508	38,870	38,951

Source: ASEAN Secretariat (2013)

Table 2.16 shows the number of employment by sector. Agriculture, Fishery, and Forestry employed the majority of labors (ASEAN Secretariat, 2013). However, the number was declined overtime.

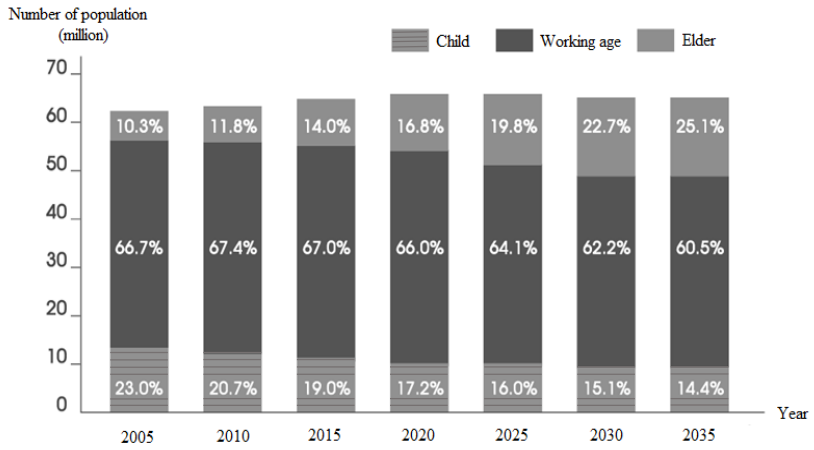
Table 2.17: Thai population and labor force: 2001-2010 (unit in thousand persons)

	Annual average (thousands)										Percentage change
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2001-2010
Population	62,936	63,461	64,006	65,082	65,110	65,280	65,740	66,321	66,876	67,276	6.9
Labor force	33,813	34,262	34,902	35,718	36,132	36,429	36,942	37,700	38,427	38,643	14.3
Employed	32,104	33,061	33,841	34,729	35,257	35,686	36,249	37,017	37,706	38,037	18.5
Unemployed	1,124	823	754	739	663	552	508	522	572	402	-64.2

Source: Office of the national economic and social development board, www.nesdb.go.th

Table 2.17 shows the number of Thai population and labor force. The growth of Thai labor force increased about twice compared to the number of population during 2001-2010. This suggested that there was not enough number of native labors to fill the jobs in Thailand. In addition, employment grew about three times faster than population growth, thus this was a confirmation of excess demand of labor in Thailand.

Figure 2.8: Thai population age groups forecast, 2005-2035



Source: IMF, US Census Bureau

Furthermore, Thailand is becoming the aging society. According to Figure 2.8, from 2005 to 2010 the growth of old population increased from 10.3% to 11.8% which 14.5% rate of growth. The rates of growths are 18% from 2010 to 2015 and 20% from 2015 to 2020. Therefore, the combination of Table 2.17 and Figure 2.8 indicate the employment rate is increasing while the share of working age is decreasing. This indicates that Thailand needs migrant labors to sustain the economic operation, especially unskilled labor and even need more in the future, if the growth is still sustained at this rate.

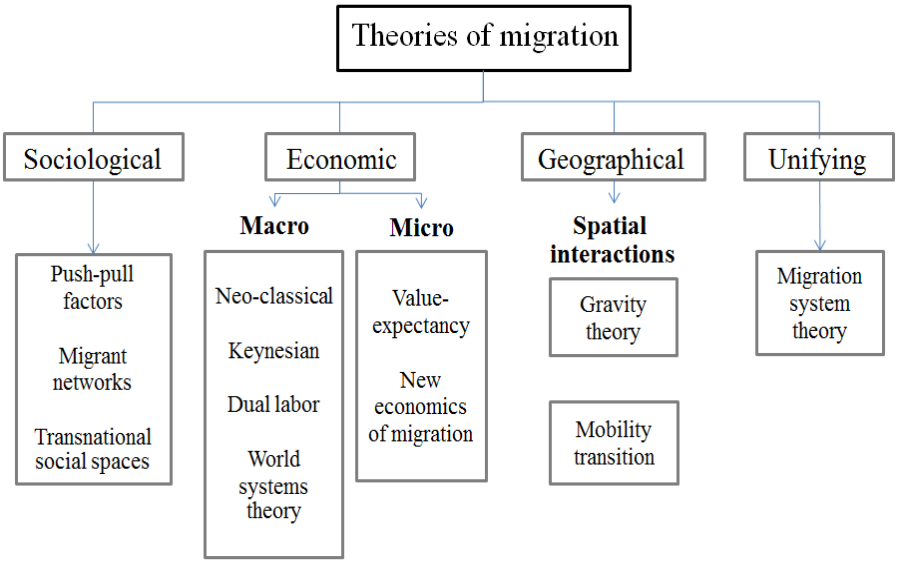
However, Cambodia, Lao PDR, and Myanmar countries are liberalizing their trade and developing their countries which in turn contribute to economic growth. Therefore, these countries are trying to attract their labors back home because these labors are considered as experience labors. If Thailand wants to sustain its economy and prevent the shock of large outflow of migrant labors, it has to motivate migrant labors to continue working in Thailand by improving their working benefits for all migrants and solving their illegal status problem for some migrants.

The study attempts to estimate the impact of AEC on Thai economy and labor market in Thailand by CGE model. Therefore, next section begins with the reviews of theories of migration and economic integration, then the reviews of previous studies regarding the effects of migration and economic integration which used CGE model as well as other models.

2.3 Theory of migration

Economists classified the migration theories based on various disciplines of science including sociology, economics, and human geography (Bijak, 2006). The structure of the discussion will be as follow: sociological, economic (macro and micro), geographical, and unifying theoretical perspectives of migration flows which are shown in Figure 2.9.

Figure 2.9: Classification of migration theories



Source: Bijak (2006)

2.3.1 Sociological theories

Migration is determined by pull elements at destination and push elements at the source region (Lee, 1966). These elements can be separated into hard and soft ones (Öberg, 1996). The former group incorporates critical situation within country for instance armed conflicts, humanitarian crises, and ecological catastrophes, whereas the latter is less serious issues for example social exclusion, poverty, and unemployment. In addition, these pull and push factors do not influence equally on each migrant depending on migrant's characteristics. Nevertheless, in general, the favorable pull elements at destination has a tendency to attract migrants who are positively selected in terms of human capital or motivation, however this is not the situation when the

unfavorable push elements at the source region assume an important part in prompting the migration process such as war (Bijak, 2006). In short, if there is a war in the country, this push factor alone could push migrant to move to other countries without considering any pull factor at destination countries.

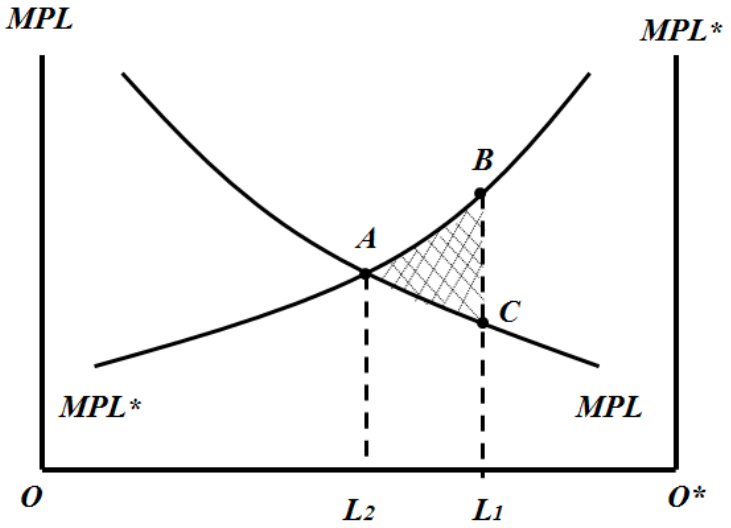
The presences of migrant networks in the destination country are a very important pull factor (Heering, Van Der Erf, & Van Wissen, 2004). This is because networks of people interconnected by family or friendship ties would diminish various costs, monetary as well as psychological cots, and risks associated with migration. In addition, migrant networks also encourage the flow of migrants between the source and destination nations and becoming more intense as the stock of migration in the destination increases. Thus, migration flows have a difficulty to control by the authorities of the destination country and turn out to be more independent from the factors that initially brought on them (Bijak, 2006).

Furthermore, the thought of migrant networks has been simplified within the theory of transnational social spaces (Faist, 2006). The transnational social spaces theory explains the return migration, phenomena of chain migration, the saturation of population flows at a certain level, and perpetuation of migration processes.

2.3.2 Macroeconomic theories

The labor migration theories follow either the macro- or micro-level point of view. The section will begin with the perspective of macroeconomic theories of migration. According to the classical macroeconomic migration theory, the difference of productivity between countries will induce labor movement from relatively low (poor) to relatively high (rich) productivity-country (Klein & Ventura, 2009). Figure 2.10 shows this consequence.

Figure 2.10: Causes and effects of international labor mobility



Source: Krugman and Obstfeld (2009)

Figure 2.10 shows causes and effects of international labor mobility (Krugman & Obstfeld, 2009). The horizontal axis represents the total workforce and the vertical axis represents the marginal product of labor for home country which is on the left and for foreign country is on the right. Initially, the labors employed in home country equal to OL_1 and the labors employed in foreign country equal to L_1O^*. The real wage is lower in home country (point C) than in foreign country (point B). Labors will move from home country to foreign country until the real wages are equalized (point A), and home country will lose labors from OL_1 to OL_2 and foreign country will gain labors equal to L_2O^*.

The neoclassical macroeconomic migration theory clarifies that the wage differentials between two nation economies will motivate migration and capital movements (Massey, et al., 1993). The movements of both production factors in inverse ways until the wage differentials of two economies are convergence. In the neoclassical approach, migration occurs in disequilibrium and ends when the equilibrium is reached.

Keynesian view on migration-induced labor market, on the other hand, is able to be used in the nonexistence of wage differentials (Jennissen, 2004). The process reached the economic equilibrium over the exclusion of differences in unemployment, not in wages.

Different from the purely neoclassical and Keynesian approaches, the dual labor markets theory is based on the economic motives of migrants. The dual labor markets theory describes the labor markets movement in a sense that the local labors move to more professional jobs, while immigrants engage in the 3D (dirty, dangerous, and difficult) jobs. Moreover, immigrant labors are a more flexible production factor than the local one who is secured by many institutions such as trade unions, regulations of work conditions (Bijak, 2006).

Furthermore, the world systems theory generalizes the macroeconomic perspective by assuming that international migration is related to the developments of the capitalist system and global markets (Wallerstein, 2011). The flows of good and capital from developed countries to the developing countries in search of land, raw materials, labors, and new consumer markets are counterbalanced by the flow of labor in the opposite direction. For example, the increasing demand for unskilled labor in developed countries where the employments in the manufacturing sector are less attractive for the local labors (skilled labor), who desires to work in service sectors. In addition, capital flows to developing countries to commercialize agricultural production leading to an increase in labor productivity and a reduction of demand for the native labor (unskilled labor).

In the world systems theory, international migration almost has no effect on wage and employment differentials between nations. Jennissen (2004) claimed that this theory can be observed as a perspective on free trade which is contemporarily thought to decrease disparities of income, employment, and migration. In any case, this theory is expressed only verbally, not in formal mathematical models, and it is excessively broad all together, making it difficult to serve as a direct reference for migration forecasting (Bijak, 2006).

2.3.3 Microeconomic theories

Based on neoclassical microeconomic theory, the individual migration decisions are based on cost-benefit analysis or value expectation of individual (Todaro, 1969). According to this theory, potential migrant chooses the destination based on maximizing the net present value of his or her expected future income minus various costs of migration.

$$V_u(0) = \int_{t=0}^{n} p(t) Y_u(t) e^{-rt} dt - C(0)$$

The expected earning is measured by the difference in real income between source and destination which represents by $Y_u(t)$ and the probability of obtaining a job in destination which represents by $p(t)$. The probability of obtaining job is proxy by time requirement for example within a year, or one year, or two year. $C(0)$ is the initial fixed cost of migration. The potential migrant has to balance the probabilities and risks of being unemployed and the wage premium at the destination.

On the other hand, new economics of migration explains the presence of migration flows in the absence of difference in income levels. Both individual preferences and the dissimilarity in the purchasing power of savings created by migrants between the source and destination are an important role of migration (Stark, 2003). In summary, this method believes that migration is not driven by absolute, but by relative income differentials to the reference group of possible migrants.

2.3.4 Geographical theories

From the standard growth model or Solow model, if assuming that labor cannot move across country, then poor country has to save and invest in order to raise its capital to labor ratio toward the level of rich country. However, if factors are perfectly mobile the convergence can be achieved instantaneously as shown in Figure 2.10, labors will move across countries until real wages are equalized. Therefore, in the Solow model, labor movement or migration is the key to achieve economic convergence (Faini, 2003).

Human geography explains migration movements by focusing on the role of distance which is viewed as a factor that moderates the migration flows between regions. The gravity theory of migration assumes that migration between regions *i* and *j*, $m_{i,j}$ is a proportional to the product of population sizes in the source and destination regions (P_i and P_j), consistent with masses in the Newtonian model and in reverse proportional to the distance between the two regions, d_{ij} (Isard, 1960).

$$M_{i,j} = G\left(\frac{p_i p_j}{d_{ij}}\right)$$

Isard (1960) noted that the concepts of mass and distance can be explained in various ways. Either population sizes or such economic measures as employment or income can be used as masses while distance can be dignified either time or cost of transportation.

In addition, the geographical theories are more suitable for domestic migration than the international one, because they do not include elements such as institutional barriers which should be the importance factors of international migration (state borders, visa requirements, etc.) (Öberg & Wils, 1992). However, the international migration does not substantially differ from those of domestic migration because the effects of globalization and integration processes which lift the barrier of labor mobility away (Willekens, 1994). Thus, the geographical theories can be used for both domestic and international migration in the region that has highly integrated where labor movement barriers are low.

Mobility transition, a related environmental theory, endeavors to clarify variations in demographic conversion (Zelinsky, 1971). Uninterrupted diversification of human mobility patterns was instigated by social innovation. In the 18th and 19th centuries, migration advances were carried out predominantly towards the national borders and other bordering nations during the switch from a pre-modern to modern society. Migration from rural to urban parts was on the growth parallel to industrialization progression, which began to deteriorate in highly developed societies during the latter 20th century.

2.3.5 Unifying perspectives

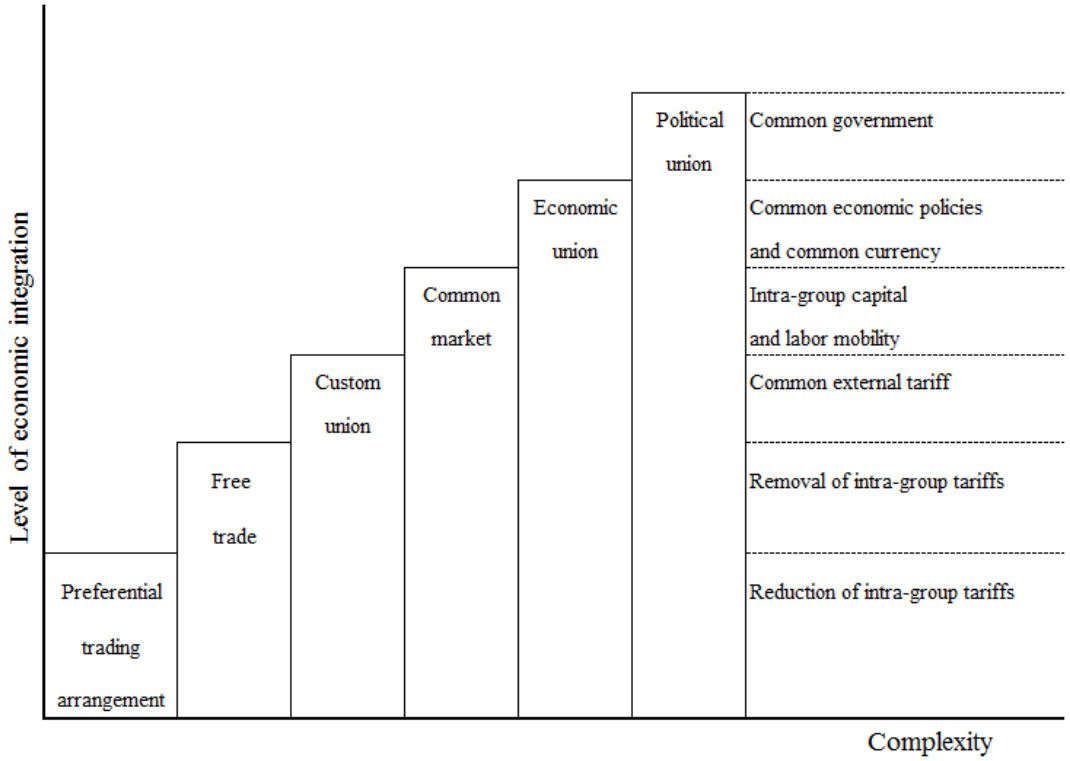
Different from other discipline theories of migration, there have been also some challenges to suggest a unified justification for migration flows and one of them is the migration systems theory. The migration systems theory explains that the migration patterns depend on various characteristics in source and destination (Zlotnik, 2002). Migration is in a nonstop interaction with historical, economic, cultural, and political connections between nations on the micro and macro levels, in an active system. The existence of criticism and its consequences causes migration flows to develop into a basis and conclusion of other relations. Particularly in light of the issues with accessibility and the conditions of international migration statistics, it is much too

intricate to be useful in performance, no matter how clear the benefits of such a blending and multi-perspective method (Zlotnik, 2002).

2.4 Theory of economic integration

With problems that occur from divergences in domestic monetary, fiscal, and other policies, the theory of economic integration distresses the economic effects of integration in its several forms (Balassa, 1962). The aim of economic integration is to expand market the market size in order to achieve greater rate of economic growth and development (Robson, 1968; European Bank, 2012). The economic benefits for larger market consist of higher trade volume, economies of scale, attracted more FDI, and specialization of production. Other advantages include the diversification of output which may contribute to economic stability as well as growth (Robson, 1968).

Figure 2.11: The degree of economic integration



Source: Balassa (1962)

Figure 2.11 shows 6 additive levels of economic integration. Economic integration is in numerous forms that signify by different degrees of integration. It starts with agreements to reduce of intra-tariff (preferential trade agreement), remove tariffs

and import quotas among member countries (Free trade area), create common external tariffs and quotas (Customs union), agreement on free movement of goods, services and labors (Common Market), synchronize structural, monetary, fiscal, and social policies (Economic Union), syndicate economic policies and form supra-national institutions (Political Union) (Balassa, 1962).

2.4.1 Preferential trade agreement

The most fragile variety of economic assimilation is a preferential trade agreement (PTA). In such an agreement, a set of trade partners is provided with decreased tariffs rather than exclusions. Further, any exclusion would be limited by the category of a specific product, with elevated tariffs likely continuing unchanged for residual product categories. Between World Trade Organization (WTO) members compelled to confer most-favored nation status (MFN) to other WTO members, this particular form of arrangement is prohibited. Nations required to act under the MFN rule may not show prejudice against other WTO member nations.

2.4.2 Free trade

Each member of a free trade area (FTA) retains its sovereignty in instituting trade policies with non-members, while at the same time eliminating tariffs on the products of other members (Appleyard, Field, & Cobb, 2008). In order to preserve a degree of control at the national level, the FTA can be restricted to specific sectors. However, non-member nations may find it more lucrative to export a product to the member nation with the least external safeguards and then work through that same nation in order to reach the other member nations with elevated protection levels against the world due to fluctuating external tariffs. Regarding this issue, the FTA normally employs rules of origin (ROO) (Appleyard *et al.*, 2008), which include regulations intended to preclude goods from being brought into the FTA nation with the lowest tariff and then passed on to a nation with elevated tariffs, thereby circumventing the system. Formulated by Canada, Mexico, and the United States in 1994, NAFTA is a prime example of FTA.

2.4.3 Custom union

When members consent to remove tariffs between members and set a common external tariff (CET) for non-members, the result is a customs union (CU) (Appleyard *et al.*, 2008). In any compromise or cooperation of trade agreements with nonmembers, all members act and make decisions as a singular entity. The CU tackles the predicament of re-exports while evading the issue of applied ROO. When a CET exists, an ROO is no longer compulsory, primarily because imports into the CU area meet the same tariff in each CU member country. Consequently, no enticement for trans-shipment of imports involving members exists. However, it introduces the problem of policy coordination. All members must be capable of concurring on tariff rates across dissimilar import products in a CU. Belgium, the Netherlands, and Luxembourg, which were admitted to the European Community (EC) in 1958 but shaped their agreement in 1947, are a prime example of a customs union.

2.4.4 Common market

When members consent to remove tariffs between them, in addition to obstructions to factor developments among the members, a common market (CM) results (Appleyard *et al.*, 2008). Additionally, non-members are bound by and an implemented general external trade policy. An elevated level of economic integration and development of national control with respect to individual economies is characteristic of the free movement of labor and capital among members, including anticipated advantages such as returns in effectiveness through a more suitable distribution of resources. A common market was founded within the European Community (EC) in 1957 with the Treaties of Rome, which formally took effect on 1 January 1958. On 1 November 1993, it became the EU.

2.4.5 Economic union

Not only does economic unification involve the merger of economic organizations and the synchronization of economic policy for all participating members (Appleyard *et al.*, 2008), it is also inclusive of the features of CM and institutes a universal currency for its members. This typically involves the determination of a monetary policy for all members, decided by a central monetary authority comprised

of select parties from its member nations. An economic union commonly sets up a number of supranational institutions with binding influence upon its members, while the separate political structures of each member nation remain intact. Members often find it extremely demanding to relinquish the domestic independence the scheme demands, no matter how much economic integration is desired. A major concern for individual member nations is the diminishing of autonomy in monetary policy that comes with membership.

2.4.6 Political union

Political union represents the most advanced form of integration with a common government and the sovereignty of member is significantly reduced. This degree of integration is only found within nation states such as federations where there is a central government and regions having a level of autonomy.

In conclusion, all stages differ in the degree of association in economy and policy. The PTA is the weakest form of economic integration. It offers tariff reductions to partner countries in some product categories. The FTA is formed when at least two countries fully eliminate tariffs in their inner border. To exclude regional exploitation of zero tariffs within FTA there is ROO for the goods originating from the territory of a member. The CU introduces unified tariffs on the exterior borders of the union or called CET. The CM adds to CU, the free movement labor and capital. The economic union introduces a shared currency adds to CM. The political union introduces a shared fiscal and monetary policy by unifying economic policies (tax, social welfare benefits, etc.).

2.4.7 Benefits and costs of economic integration

Countries integrate their economy to expand market size in order to achieve a greater rate of economic growth and development. The economic benefits for larger market consist of higher trade volume, economies of scale, and specialization of production according to comparative advantage. Furthermore, larger market size may make it possible to attract more foreign capital and to increase employment. Other advantages include the diversification of output which may contribute to economic stability as well as growth (Robson, 1968). Moreover, the framework for welfare

analysis from the effect of economic integration consists of change in trade volume, trade cost, term of trade, output, firm scale, product variety, and investment (Baldwin & Venables, 1995). The following describes the benefits and costs of economic integration in detail.

Firstly, lower tariff and non-tariff trade barriers could increase the volume of trade. The effects would mainly reflect from the lower price of imported goods relative to domestic goods, thus stimulate the volume of trade between partners. Lower trade barrier reduces cost of international trade which reflects from the elimination of administrative burdens, particularly with regards to trade and customs procedures which would reduce the transaction costs (European Bank, 2012).

Secondly, the production on larger market size or regional scale leads to cost saving compared to their production on a national scale. It changes the cost and price structure of goods leading to the optimum allocation of resources which increases efficiency in production (Balassa & Stoutjesdijk, 1975). Furthermore, nations in a regional integration zone could form inter production chains by leveraging each other's comparative advantages.

Thirdly, a country participation in a regional integration would benefits from elimination barriers to its export from other members (Balassa & Stoutjesdijk, 1975). Exporting inside a regional group may oblige as an initial step to the extension of exports global by primarily constructing export ability captivating advantage of low tariff and non-tariff barriers within an area and then leveraging this competency to reach competitive advantage in exporting to other nations.

Fourthly, economies of scale become possible with the larger size of the market. Producers within a regional integration group could benefit from economies of scale because it creates a high degree of specialization of production. The level of rivalry in a regional market is also multiplied by a superior market size, which effectively guarantees that all advantages accumulating to the producers from the presence of a large market are forwarded to the end user. Due to improved production and superior utilization, as well as the escalation of income generated by overall growth and development, an upsurge in wide-ranging benefit is possible.

Fifthly, the likelihood of specialization for regional trade would embolden the movement of investment into productions which have a comparative cost advantage.

Moreover, since economic integration affects factor prices, including the rate of return on capital, in member countries, thus it creates the production-shifting effect which will raise the demand for capital in member nations. Capital will flow to the regional integration countries from the rest of the world.

Lastly, member nations can bolster their economic and political establishments through the assistance of regional economic assimilation. The prospect arises for assessment and modification of laws and regulations to fortify their execution as regions of economic policy experience cross-country harmonization. This results in the promotion of industry environment enhancement and liberalization.

Cost trade digression is a concurrent effect of regional economic integration. Trade from more resourceful peripheral exporters to less capable ones can be redirected by a comparative modification in tariff barriers. An easy example to consider is when the initiation of a general external tariff by a regional bloc results in a comparative increase of the import tariff for one country (country A) outside the region. When comparing the situation from the point of country B inside the region, you might anticipate an increase in imports from country B and a decline in imports from country A. As a result, monopoly situations may result from consumers having to buy goods from a less proficient producer (Balassa & Stoutjesdijk, 1975).

Although integration is certainly advantages to the members of the group as a whole, benefits are not automatically reaped by each single member. This consideration is likely to be especially important where integration involves the grouping of countries which are at somewhat different stages of development, for in this situation, market forces may direct the benefits of integration mainly towards the more advanced members (Robson, 1968). In addition, the balance of benefits and costs of regional integration will depend on market size, resource endowment, geographical location, and access to developed country markets as well as policies followed (Balassa & Stoutjesdijk, 1975).

2.5 The literature regarding the effect of migration on economy

There were various studies of the relationship between migration and economy both theoretical and empirical. Furthermore, the empirical studies are used by many models, while this study will focus on CGE model.

2.5.1 Using the empirical models

Although there are large numbers of literature that attempt to predict the size of potential labor migration in the enlarged EU, the prediction power is somewhat low. Early migration studies used the model-based to predict the potential labor migration and the prediction was between 10.5% and 15% of the Central and Eastern European immigrated to Western European during the first two decades after the fall of the Wall. Yet, actually the number of the potential labor migration was less than 2.5%. This is caused by predetermined values because the ex-ante values of key explanatory variables, such as wages and employment, have to be set by the researcher a priori in the model-based prediction (Kancs, 2011).

In addition, another interesting model, which attempted to predict the migration flows in the enlarged EU, has been developed by Kancs (2011). He adopted the Krugman's framework of the New Economic Geography (NEG) and used a general equilibrium model (GE) as the feedback process. In his model, not only migrants were attracted by wages, income, employment, and cost of living, but also migrants themselves feed-backed to affect those factors. However, his predicting result was also still far from the actual number. He suggested that the model should include the future expectations of labor because expecting improvements in the home country's economy may delay migration decision or even erase the idea of migration.

The different result of the model-based predictions and the actual numbers of migration is not only affected by the future expectation, but also affected by country preference (especially in rich countries). Moreover, free trade and free migration are equivalent which both lead to an equalization of factor prices (Wellisch & Walz, 1998). However, in reality, rich countries prefer free trade over free immigration because there are more problems in movements of labor than capital. The formal contains both economic and non-economic problems while the latter contains only economic problem. For example of economic problems contain jobs taken and distract resources such as health care and social benefits. While non-economic problems contain crime, drug, arms, and cultural prejudice.

Wellisch and Walz (1998) calculated social welfare in countries with a relatively small number of low-skilled native labors (rich countries) and they found that

social welfare is higher with free trade than with free migration due to the social benefits towards immigrant labors. In other words, immigrant labors increase costs to rich countries. To conclude, rich countries prefer free trade over free immigration because free trade does not increase the numbers of immigrant labors in rich country as much as free immigration.

There are more policies which also may affect social welfare by attracting migrant for example minimum wages policies and employment promotion programs. The problem is how to numerical calculate or measuring the effects of these policies. Given the large inflows of migrant labors to Thailand recently and such inflows would be larger as a consequence of AEC, it is obvious that immigrant labors will become serious debate.

The expecting improvement in the home country's economy is considered as a pull factor that holds labor to stay. In addition, future expectation is an individual level or micro level and this is based individual characteristic (Falvey, Greenaway, & Silva, 2010). While most of migration studies are macro level and the movement of migration depends on the present condition. Thus, it is interesting if both macro and micro levels can be linked in order to understand the real factors that determine the direction of migration.

The common aspects of the labor market study are the analysis of the interrelationship between macroeconomic conditions and the labor movement (Borjas, 1994). Kulkolkarn (2007) used a geographic approach to study the impact of immigration on unemployment rates and native wages. She found that if there is a 1% increase in immigration in 2001, natives' unemployment rate will increase about 0.5% in a province in Thailand in 2005. In addition, she claimed that unskilled labors are most affected by the immigration. However, she did not find the effect of immigration on wages.

In contrast with Borjas (1994), he did not find the negative impact of migrants on unemployment in the United States and European but he found a small negative impact on minimum native wages. This is because unskilled migrants may fill jobs not wanted by domestic labors (Yarbrough & Yarbrough, 2006). The difference result between Thailand and Western countries is the number of unskilled labors employed in tradable sectors. In Thailand, tradable sectors, especially agriculture and fisheries,

mainly employ unskilled labors. Since tradable sectors are highly competitive in the world market, firms are unable to raise price to respond higher wages but instead firms tend to hire the migration labors, which abundant, from neighboring countries to maintain the minimum wages. Therefore, between Thailand and Western cases is different in both qualitative and quantitative (Kulkolkarn, 2007).

Kulkolkarn and Potipiti (2009) analyzed the impact of immigration on labor markets in a destination country. They claimed that immigrants are substitute or complement to native labors in the job markets depending on the number of immigrants. When there are small numbers of immigrants, they will harm native labors by depressing wages in the unskilled labor segment. This leads to the movement of native labors to other sectors. These sectors may require native language which is a barrier to enter for immigrants. However, if there is further immigration, immigrants will become complement to native labors through the efficiency gain from the division of labor between native and immigrants. This is because labor markets eventually become completely segmented. Nevertheless, too many immigrants will harm native labors because they start to enter and compete for jobs in other sectors.

In addition, the wages or employment rates of unskilled labors in the receiving regions were not affected by the relatively unskilled migration inflows (González & Ortega, 2011). The growth in the unskilled labor force was engaged commonly over rises in total employment. This did not initiate from increases in output nevertheless was instead determined by fluctuations in skill intensities at the production level. The receiving regions that received a large inflow of unskilled migrants would adapt to use more unskilled labors or increase the intensity of unskilled labor uses. González and Ortega (2011) concluded that the industries those respond in lieu of this engagement were retail, construction, hotels and restaurants and local services. All these industries produce non-traded goods.

2.5.2 Using the CGE model

There were variety of model uses in order to explore the impact of economic integration. This study explores the economy-wide perspective on the interaction between macroeconomic factors and labor movement regarding AEC by using a static single country and dynamic multi-countries CGE models. This is because, firstly, the

CGE model is widely used tool to examine the impacts of shocks on economy in industry or country levels. Secondly, CGE model can capture the inter-relationships between agents, industries, and activities. Lastly, CGE model allows researcher to simulate numerous economic shocks or policy choices such as migrant restriction and trade liberalization in order to measure these impacts on economy (Iregui, 2003; Fougère, Harvey, Mérette, & Poitras, 2004; Sudtasan & Suriya, 2014).

For the selected literatures those using CGE model to explore the inter-relationship between macroeconomic conditions and the labor movement are as follow. Iregui (2003) used a multi-regional CGE model to investigate the worldwide efficiency gains from the elimination of global restrictions on labor mobility. Iregui (2003) found that the elimination of global restrictions on the labor migration generates worldwide efficiency gains ranging from 15% to 67% of world GDP. However, high skill targeted immigration did not appear to significantly increase the overall benefits to economy and efficiency gains are smaller when only skilled labor migrates because skilled labor represents a small fraction of the labor force (Nana *et al.*, 2009). Nana *et al.* (2009) argued that when an economy grows labor is required at all levels.

In addition, Sudtasan and Suriya (2014) forecasted the impact of skilled labor movement in ASEAN Economic Community (AEC) on Thai economy. They simulated the influence of skilled labor movements in eight occupations that are permissible by the AEC agreement. The internal skilled labor movements in all of the eight occupations will produce a progressive influence to the Thai economy. In addition, immigration is economically benefit in the long-run, while there would have the adjustment problems in the short- and medium-run (Weyerbrock, 1995). However, Weyerbrock (1995) suggested that if government reacts to considerable labor immigration with lesser wage cuts such difficulties can be decreased significantly. In addition, Fougère *el al.* (2004) considered an anticipated imminent immigration movements would lessen a negative effect of ageing on real per capita GDP by approximately 30%.

Moreover, other studies simulated various policies shocks and claimed that only a reduction in inter-regional labor migration restrictions able to reduces disparity, increases aggregate output, improves income and welfare at the same time, while all other policies considered face a trade-off in at least one dimension (Park & Hewings,

2009; Chen & Groenewold, 2011). However, Xu and Li (2008) reported that inter-regional labor migration has little effect on the regional income disparity, mainly, due to the effect of capital-chasing-labor. In other word, the capital will move accompany with labor migration.

One of the major concerns of government is the impact of immigrant on wage (Chalamwong, 1996; Chan, Dung, Ghosh, & Whalley, 2005). Chalamwong (1996) used a CGE model to find the impact of immigrants from neighboring countries on the wages in Thailand. He used the data in year 1995 and found that if there are 700,000 unauthorized migrants, the wages of native unskilled labors would decrease by 3.5% comparing to no immigrants. In addition, Chan *et al.* (2005) included the adjustment costs in labor market and found that the impact of trade liberalization was sharper against poor rural households with segmented labor markets.

No widespread suppositions have been made by academics regarding the influence of inter-regional labor movement on regional disproportion in the context of international occurrences (Xu & Li, 2008). The relocation of labor forces can hasten the economic progress of less developed regions, supporting the decline of regional inequality, as illustrated by the neoclassical economic growth model (Braun, 1993). Labor resettlement can assist in reducing the differentiation in factor returns within regions. This in turn constricts regional inequality, as found and supported by other models (Taylor & Williamson, 1997).

Widely accepted due to their consistency, the deductions previously mentioned are consistent with common economic assessments (Barro & Sala-i-Martin, 1995). However, labor movement's promotion of regional economic convergence in selected nations has been shown by empirical research for seven nations, counting the US, UK, Germany, Italy, Spain, France, and Japan. At the same time, it expanded regional inequality in other nations (Barro & Sala-i-Martin, 1995). Thus, the endorsement of regional economic union as the consequence of labor movement is undefined. Migration puzzle is the common term used to describe this contradiction of theoretical and empirical studies (Shioji, 2001).

2.6 The literature regarding the effect of economic integration on economy

Previous exertions at integration have often concentrated on eliminating barriers to trade by developing the free movement of labor, goods, and capital across domestic borders aiming to reach free trade in the area. Several numbers of economic integration have established in the past such as North American Free Trade Agreement (NAFTA), Union of South American Nations (SACN), the European Union (EU), and the Eurasian Economic Community (EAEC). Association of Southeast Asian Nations (ASEAN) members also aim to have such integration, known as AEC by the year 2015.

The economic integration supports the competitiveness of members by removing the barrier of labor and capital movements across national boundaries. Removing such barriers would reduce costs leading to trade increases in the region. In addition, the increase in trade may create the economies of scale which referring to the producer's average cost per unit to fall as the scale of output is increased. The increase of trade between member countries is meant to lead to the increase of the GDP and hence to better welfare.

2.6.1 Using the empirical models

Benefits of economic integration are depending on static and dynamic effects (Siah, Choong, & Yusop, 2009). The static effects are dignified in terms of growing the efficiency of production and consumer welfare. The static effects are generally referred to one time alterations in the allocation of resources or effectiveness (Ramasamy, 1995). The dynamic effects of economic integration, encountering the total economic growth rate of participant nations in the long term.

Ramasamy (1995) estimated the effect of resource allocation among ASEAN members and found that Indonesia, Philippines, and Thailand achieved a net gain in welfare, while Malaysia and Singapore achieved net loss. He concluded that his work estimated only static effects or measuring only the short term but it was possible that the positive dynamic effects (or in the long term) of enlarged competition, economies of scale and the remunerations of intra-industry trade outlying offset the short term effects.

Various studies used gravity model to estimate the effect of economic integration (Clarete, Edmonds, & Wallack, 2003) and clarified the main factors (Thornton & Goglio, 2002). Clarete *et al.* (2003) used gravity model to estimate the effect of PTA on trade flows within and across membership groupings. They found that the PTA has contributed significantly to trade creation in regional level. Thornton and Goglio (2002) pointed out that the significance of economic dimensions, geographic distance, and shared language in intra-region bilateral trade. The results also presented that re-exports of ASEAN have been essential influences encouraging intra-regional trade. Siah *et al.* (2009) concluded that trade creation in ASEAN were inconclusive depending on country-specific and distance. However, they suggested that if members could reduce transaction costs, intra-trade could improve.

Moreover, trade creation occurring when economic integration creates a move in product source from a local producer whose resource costs are higher to a member producer whose resource costs are lower (Viner, 1950). However, trade creation benefits only when appropriate policies were implemented for regional integration such as liberalize border trade and reinforce bilateral trade relations over the elimination of tariff and nontariff barriers (Hassan, 2001).

Another method to estimate the effect of economic integration is a survey (Plummer, 1997). Plummer (1997) investigated the effect of ASEAN economic integration and concluded that ASEAN would benefit from regional integration. However, Frankel and Rose (1998) claimed that increased integration may result in more highly correlated business cycles because of intra-industry trade but Plummer (1997) suggested that ASEAN regional integration would help ASEAN countries overcome periodic crises by sharing regarding crisis management among members.

From the existing literatures, co-operation to economic integration would create a rise in trade efficiency and secure a supplementary economical use of resources so as to raise intra-ASEAN trade in the long run.

2.6.2 Using the CGE model

Various researches studied the interrelationship between macroeconomic conditions and demand-side policy by using CGE model (Carneiro & Arbache, 2003; Akapaiboon, 2010; Raihan, 2010). Akapaiboon (2010), Carneiro and Arbache (2003),

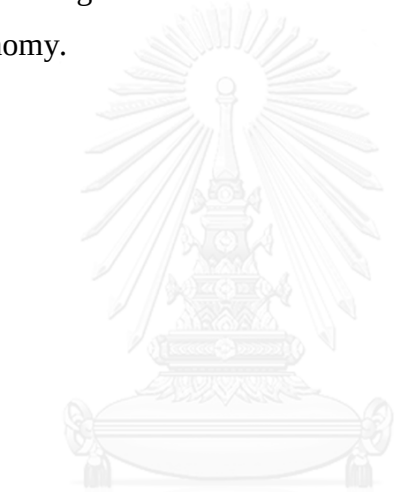
and Raihan (2010) investigated the effect of trade liberalization, representing by removing tariff. The simulation results revealed that trade liberalization has a positive consequence on economic welfare in Thailand, Brazil and Bangladesh. Akapaiboon (2010) suggested that the manufacturing sector's output enlarged after trade liberalization, although the output of the agricultural sector deceased. The reason was because a movement of labor from agricultural sectors to the expanding manufacturing and service sectors after trade reform. At the micro level, household income increases primarily because of growth in unskilled and skilled wages. Moreover, Carneiro and Arbache (2003) explored the impacts of export promotion and productivity shocks on the economy. For, the export promotion policy shock, they imposed a 20% increase in export leading to local inflation rates decrease by 0.26% and real GDP increases by 0.53%. For the productivity shock, they levied a 10% increase in the movement parameter of the production function leading to larger effectiveness contributes to lesser prices by reducing the inflation rate by 7.7% and real GDP rises by approximately 10%.

For research studied the interrelationship between macroeconomic conditions and supply-side policy by using CGE model (Razack, Devadoss, & Holland, 2009). Razack *et al.* (2009) established a CGE model for India and included Harris-Todaro economic characteristics of labor migration. Harris-Todaro migration equilibrium condition claims that the wages in the agricultural sector is equivalent to the manufacturing wage times the probability of being employed in the manufacturing sector (Todaro, 1969). In equilibrium, rural wage must equal the expected wage in the urban sector. By applying the model, Razack *et al.* (2009) are able to analyze the effects of agricultural production subsidy policies. The results showed that agricultural production subsidy raises agricultural production, decreases unemployment, increases the wage rate in the agriculture sector, escalates the consumption among the rural and urban households, and improves the rental rate for capital in agricultural sector.

Another research perspective studied economic integration directly affected to region welfare (Plummer & Yue, 2009). Petri *et al.* (2012) estimated the AEC economic impacts by using CGE model and they found that AEC increased ASEAN welfare by 5.3% or 69 billion US dollar. Although these were not specifically in their model, they suggested other positive impacts such as lower cost of capital due to freer movements of capital and improved financial systems, gains from freer movement of skilled labor,

and greater macroeconomic stability due to the macroeconomic policies necessary to support the AEC.

The study attempts to estimate the impact of AEC on Thai economy and labor market in Thailand by CGE model. There were variety of model uses in order to explore the impact of economic integration. This study uses both the static single and dynamic multi-countries CGE model. This is because, firstly, the CGE model is widely used tool to examine the impacts of shocks on economy in industry or country levels. Secondly, CGE model can capture the inter-relationships between agents, industries, and activities. Lastly, CGE model allows researcher to simulate numerous economic shocks or policy choices such as migrant restriction and trade liberalization in order to measure these impacts on economy.



Chapter 3

Computable General Equilibrium (CGE) Model

The chapter begins with a review of model choices in order to clarify that CGE model is appropriate for this study. A CGE model is built with the purpose of running different scenarios of shocks on trade and labor market policies. However, difference in these assumptions can affect empirical simulation results. Then, the chapter will demonstrate the main assumptions of the study in section 2. In the study's CGE model consists of 4 main agents which are producer, household, government, and the rest of the word (ROW), these agent's behavior will briefly explain in section 3. Section 4 shows the conceptual frameworks of the study and describes its linkage. Finally, data of the study is shown in section 5 for both dynamic multi-countries CGE model and static single- country CGE model.

3.1 Choices of model

This study aims to investigate the economy-wide perspective on the interaction between economic factors and labor movement due to AEC. A computable general equilibrium (CGE) model is suited to test and investigate the relationships between all agents, sectors and other economies by consisted of equations describing the interaction of whole economy caused by various economic shocks (Nana *et al.*, 2009).

CGE model is appropriate for this study because as following. Firstly, it can reproduces the implications of deep integration efforts such as free flows of trades, labors, labors, and capital as well as examine economy that affected by various shocks. Secondly, country economy is complex and cannot explain by a single equation because there are two ways interaction between agents and economic variables. Thirdly, industries in the CGE model represent as heterogeneity in productivity which enables us to investigate the intra-industry reallocation of resources and the export and import decisions by firms (Petri *et al.*, 2012). Thirdly, CGE model represents industries as heterogeneity in productivity which allow us to examine the intra-industry behavior

such as reallocation of resources and export and import decisions. Fourthly, CGE model allows us to have simulation such as increased competitive pressures to capture the producer's response or increased government spending to capture the response from economic agents and macro variables. Lastly, CGE model can include several recent advances in trade theory including achieving economy of scales, adding product varieties, changing intra-industry distributions of firm productivity (Petri *et al.*, 2012). Since AEC will lift border barriers and restrictions on foreign investment for country members, this implementation would change the region's industrial structure. Thus, CGE model is fit to the study objectives.

3.2 Model assumptions

The CGE model is used in this study in order to simultaneously investigate production, consumption, prices, and international trade for all goods and services in the economy. There are basic assumptions for the CGE model. Prices will be set at market-clearing levels[5], businesses will seek to maximize their profits[6], and customers will aim to maximize their utility[7]. Such an economy is expected to reach equilibrium when supply and demand are adjusted in response to relative costs of production to the point where they are equal in each market. The production structure of businesses is assumed to encompass zero pure profits[8].

Closure rules (Appendix G3) and exogenous growth variables are typical assumptions for this study. Difference in these assumptions can affect empirical simulation results. Closure rules are as following.

- Government spending growth equals to GDP growth

[5] The price level in a particular market at which supply and demand are equal.

[6] Profit maximization refers to the goal of producing goods or services to achieve the highest possible level of profit.

[7] Utility refers to the level of satisfaction derived from the consumption of the goods or services purchased; the goal of the consumer is to obtain the greatest possible utility.

[8] Pure profit, or zero economic profit, is earned when the earnings of a business from investment in capital are equal to the earnings it might derive from alternative investments.

- Investment growth equals to GDP growth
- Household saving growth equals to GDP growths
- Exchange rate is fixed
- GDP deflator of ROW is a numeraire (Appendix G2)
- Minimum consumption growth equals labor supply growth
- Wage of migrant labor growth equals to inflation growth

Exogenous growth variables, which are from several sources for growth projections, are used for the input of the model as shown in Table 3.1.

Table 3.1: Growth variables (unit in percentage per year)

Growth variables[9]			
Country	GDP growth (percent per year)	Labor supply growth[10, 11] (percent per year)	Saving rate growth (percent per year)
Cambodia	4.49	2.35	-3.88
Indonesia	5.89	1.66	3.87
Lao PDR	7.94	2.88	-0.30
Malaysia	4.10	2.05	-3.60
Philippines	4.43	2.35	-3.34
Singapore	4.89	2.41	-0.01
Thailand	3.27	1.02	-1.84
Vietnam	6.06	1.90	1.11
ROASEAN	9.75	1.95	5.11
ROW	1.85	1.38	-0.04

Source: Fouré, Bénassy-Quéré, & Fontagné (2012)

[9] Source: (Fouré, Bénassy-Quéré, & Fontagné, 2012)

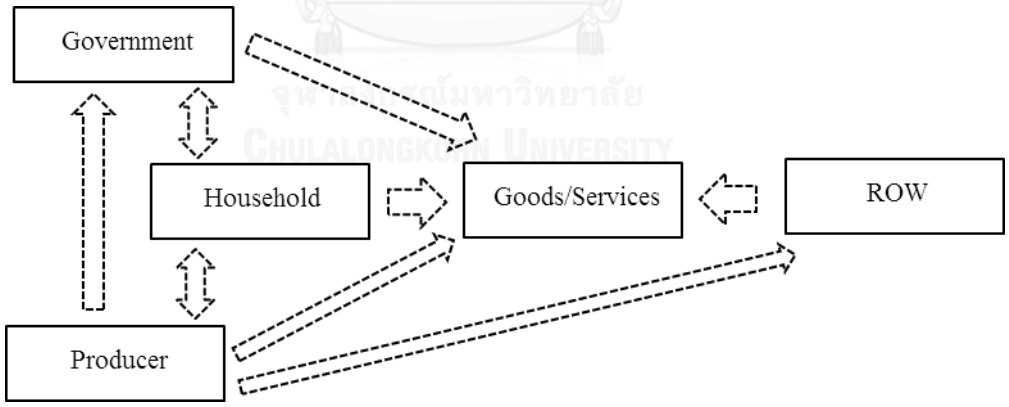
[10] The labour force is composed of workers aged at least 15 years who are defined by the International Labour Organization (ILO) as members of the economically active population. Therefore they provide labor to create goods and services. The labour force includes unemployed people, but members of the armed forces or people in seasonal or part time work may sometimes be considered differently depending upon the country concerned. Housewives, caregivers who are not paid and informal labour providers are not included in the labour force (ILO).

[11] International Labour Organization, key indicators of the labour market database

3.3 Model structure

Model structure in this study consists of 4 agents, which are producer, household, government, ROW (Robinchaud, Lemelin, Maisonnave, & Decaluwe, 2010). This section only shows the main equations but the complete list of equations, sets, variables and parameters are in Appendix A for single country model and Appendix B for multi-countries model. Figure 3.1 illustrates the interaction between 4 agents of the CGE models. According to Figure 3.1, producer hires and rents household's labor and capital to produce goods and services. Then producer sells goods and services to domestic market and exports to international market and pay taxes to government. Household earns income for its labor and capital from producer. Household spends its income for tax, goods and services, and saving. Government collects taxes from producer, household, and ROW (via import taxes) and spends for goods and services, and saving. ROW earns and spends via exporting and importing goods and services. The following show the main agents' behavior equations but the complete list of equations, sets, variables and parameters are in Appendix A and B.

Figure 3.1: The interaction between 4 Agents of the model



Source: A part of the study's framework

3.3.1 Producer

Production assumes constant returns to scale behavior. The production between value added and intermediate consumption are assumed to be perfect complementarity. Sequentially, intermediate consumption aggregate is a Leontief function of sectoral inputs while value added is a constant elasticity of substitution (CES) function of labor

and capital. Producer chooses the volume of labor and capital which are owned by household in order to maximize their profits. In an effort to maximize their profits, producer chooses the amount of labor and capital, which are owned by household.

Producer is assumed to operate in a perfect competition. Therefore, in each industry, producer or firm is maximizes profits subject to technology. At the same time, firm considers price of factors and goods and services as given or called price taking behavior. Value added consists of composite labor and composite capital, following a CES condition and it is shown in Equation 1.

$$VA_{j,z,t} = A_{z,t}^{VA} B_{j,z}^{VA} [\beta_{j,z}^{VA} LDC_{j,z,t}^{-\rho_{j,z}^{VA}} + (1 - B_{j,z}^{VA}) KDC_{j,z,t}^{-\rho_{j,z}^{VA}}]^{-\frac{1}{-\rho_{j,z}^{VA}}} \quad (1)$$

where

$VA_{j,z,t}$: Value added of industry j in region z in period t

$KDC_{k,z,t}$: Demand for composite capital by industry j in region z

$LDC_{l,z,t}$: Demand for composite labor by industry j in region z

$A_{z,t}^{VA}$: Multifactor productivity in region z in period t

$B_{j,z}^{VA}$: Scale parameter (CES – value added)

$\beta_{j,z}^{VA}$: Share parameter (CES – value added)

$\rho_{j,z}^{VA}$: Elasticity parameter (CES – value added)

Due to profit maximization behavior, firm employs labor and capital to the point where the value of marginal product of labor or capital equal to its price (wage rate and the rental rate). Profit maximization behavior with the CES production function is explained by the demand for labor relative to the demand for capital as shown in Equation 2.

$$LDC_{j,z,t} = [\frac{\beta_{j,z}^{VA}}{(1-\beta_{j,z}^{VA})} \frac{RC_{j,t}}{WC_{j,z,t}}]^{\sigma_{j,z}^{VA}} KDC_{j,z,t} \quad (2)$$

CES aggregator functions, $\rho_{j,z}^{VA} = \frac{1-\sigma_{j,z}^{VA}}{\sigma_{j,z}^{VA}}$.

On the value added side at the bottom level, the various types of labor cataloged as $l \in L = \{L_1, \dots, L_l, \dots\}$, are combined following the CES technology as shown in Equation 3. This indicates the imperfect substitutability between different types of labor. Firm minimizes its labor cost by selected its labor composition taking into account the comparative wage rates. Demand of each type of labor derives from the first-order conditions of cost minimization subjected to the CES technology as shown in Equation 4. Similarly, composite capital is a CES mixture of the various types of capital cataloged as $k \in K = \{K_1, \dots, K_k, \dots\}$. As similar case of composite labor, the imperfect substitute is assumed for the various types of capital such as resources, land, machinery, equipment, and building as shown in Equation 5. Demand of each type of capital derives from the first-order conditions of cost minimization subjected to the CES technology as shown in Equation 6.

$$LDC_{j,z,t} = B_{j,z}^{LD} \left[\sum_l \beta_{l,j,z}^{LD} LD_{l,j,z,t}^{-\rho_{j,z}^{LD}}\right]^{-\frac{1}{\rho_{j,z}^{LD}}} \quad (3)$$

$$LD_{l,j,z,t} = \left[\frac{\beta_{l,j,z}^{LD} WC_{j,z,t}}{WTI_{l,j,z,t}}\right]^{\sigma_{j,z}^{LD}} (B_{j,z}^{LD})^{\sigma_{j,z}^{LD}-1} LDC_{j,z,t} \quad (4)$$

$$KDC_{j,z,t} = B_{j,z}^{KD} \left[\sum_k \beta_{k,j,z}^{KD} KD_{k,j,z,t}^{-\rho_{j,z}^{KD}}\right]^{-\frac{1}{\rho_{j,z}^{KD}}} \quad (5)$$

$$KD_{k,j,z,t} = \left[\frac{\beta_{k,j,z}^{KD} RC_{j,z,t}}{RTI_{k,j,z,t}}\right]^{\sigma_{j,z}^{KD}} (B_{j,z}^{KD})^{\sigma_{j,z}^{KD}-1} KDC_{j,z,t} \quad (6)$$

where

$KD_{k,j,z,t}$: Demand for type *k* capital by industry *j* in region *z* in period *t*

$LD_{l,j,z,t}$: Demand for type l labor by industry j in region z in period *t*

$RTI_{k,j,z,t}$: Rental rate paid by industry *j* for type *k* capital in region *z*, including capital taxes in period *t*

$WTI_{l,j,z,t}$: Wage rate paid by industry *j* for type *l* labor in region *z*, including payroll taxes in period *t*

$B_{j,z}^{KD}$: Scale parameter (CES – composite capital)

$B_{j,z}^{LD}$: Scale parameter (CES – composite labor)

$\beta_{k,j,z}^{KD}$: Share parameter (CET – composite capital)

$\beta_{l,j,z}^{LD}$: Share parameter (CET – composite labor)

$\rho_{j,z}^{KD}$: Elasticity parameter (CES – composite capital); $-1 < \rho_{j,z}^{KD} < \infty$

$\rho_{j,z}^{LD}$: Elasticity parameter (CES – composite labor); $-1 < \rho_{j,z}^{LD} < \infty$

$\sigma_{j,z}^{KD}$: Elasticity of substitution (CES – composite capital); $0 < \sigma_{j,z}^{KD} < \infty$

$\sigma_{j,z}^{LD}$: Elasticity of substitution (CES – composite labor); $0 < \sigma_{j,z}^{LD} < \infty$

CES production function, $\rho_{j,z}^{KD} = \frac{1-\sigma_{j,z}^{KD}}{\sigma_{j,z}^{KD}}$ and $\rho_{j,z}^{LD} = \frac{1-\sigma_{j,z}^{LD}}{\sigma_{j,z}^{LD}}$.

Producer purchases aggregate intermediate consumption which comprises of various goods and services. Intermediate inputs are assumed to be perfectly complementary as following a Leontief production function which indicates substitutions are not possible.

$$DI_{i,j,t} = aij_{i,j} CI_{j,t} \qquad (7)$$

where

$DI_{i,j,z,t}$: Intermediate consumption of commodity *I* by industry *j* in region *z* in period t

$aij_{i,j,t}$: Input-output coefficient

$CI_{j,z,t}$: Total intermediate consumption by industry *j* in region *z* in period *t*

3.3.2 Household

Household earns income from its labor and capital and spend for household expenditures including direct taxes, consumption, and saving.

$$YH_{z,t} = YHL_{z,t} + YHK_{z,t} \qquad (8)$$

where

$YH_{z,t}$: Total household income in region *z*

$YHK_{z,t}$: Household capital income in region *z*

$YHL_{z,t}$: Household labor income in region *z*

Disposable income is from household income subtracting direct taxes as shown in Equation 9. The remains after saving is committed totally to consumption as shown in Equation 10.

$$YDH_{z,t} = YH_{z,t} - TDH_{z,t} \quad (9)$$

where

$YDH_{z,t}$: Household disposable income in region z

$TDH_{z,t}$: Household income taxes in region z

Household saving is a linear function of disposable income and calculated as disposable income minus expenditure.

$$CTH_{z,t} = YDH_{z,t} - SH_{z,t} \quad (10)$$

where

$CTH_{z,t}$: Household consumption in region *z* in period *t*

$SH_{z,t}$: Household savings in region z in period t

3.3.3 Government

Direct taxes, value added taxes, import, and export tariffs are elements of government income. Government spends its income by purchased a fixed quantity of goods and services. Equation 11 shows the sources of government incomes including household income taxes, taxes on production ($TPRODN_{z,t}$), and taxes on products and on imports ($TPRCTS_{z,t}$). Note that government income can set as account of large variety of tax instruments.

$$YG_{z,t} = TDH_{z,t} + TPRODN_{z,t} + TPRCTS_{z,t} \quad (11)$$

where

$YG_{z,t}$: Total government income in region *z*

$TPRODN_{z,t}$: Total government revenue from taxes on production in region *z*

$TPRCTS_{z,t}$: Total government revenue from taxes on products and imports in region *z*

Equation 12 shows the government budget is the difference between its incomes and expenditures on goods and services. The value is positive if government budget surplus, on the other hand the value is negative indicates government budget deficit.

$$SG_{z,t} = YG_{z,t} - G_{z,t} \quad (12)$$

where

$G_{z,t}$: Current government expenditure on goods and services in region z in period t

$SG_{z,t}$: Government savings in region *z* in period *t*

3.3.4 Rest of the world

ROW's revenues are from the value of the region's imports including international transport margins as shown in Equation 13. The amount of ROW savings is from the differentiation between foreign income and spending as shown in Equation 14. In addition, the value of exports, including exports of services as international trade margins, in the domestic market is the foreign spending. Equation 15 indicates ROW savings equal to the value of current account balance, but opposite sign.

$$YROW_{z,t} = e_{z,t}\{\sum_{i,zj} IM_{i,zj,z,t}\,[PWM_{i,zj,z,t} + \sum_{ij} PWMG_{ij,t}\, tmrg_{ij,i,zj,z}]\} \quad (13)$$

where

$YROW_{z,t}$: Rest of the world income

$e_{z,t}$: Exchange rate; price of international currency in terms of region *z*'s local currency

$IM_{m,zj,z,t}$: Quantity of product m imported from region *zj* by region *z*

$PMW_{m,zj,z,t}$: World price of commodity m imported from region *zj* by region *z* (expressed in international currency)

$PWMG_{i,t}$: World price of margin *i* (expressed in international currency)

$tmrg_{i,m,zj,z}$: Rate of type *i* margin services applied to imports of commodity m from region *zj* by region *z*

$$SROW_{z,t} = YROW_{z,t} - e_{z,t} \sum_{i,zj} PWX_{i,z,zj,t} EX_{i,z,zj,t} - e_{z,t} \sum_{i} PWMG_{i,t} MRGN_{i,z,t} \quad (14)$$

where

$SROW_{z,t}$: Rest-of-the-world savings with respect to region *z* in period *t*

$MRGN_{i,z,t}$: Domestic production of commodity *i* in region *z* exported as international margin services in period *t*

$PMW_{m,zj,z,t}$: World price of commodity *i* exported by region *z* to region *zj* (expressed in international currency)

$EX_{i,z,zj,t}$: Quantity of product *i* exported from region *z* to region *zj* in period *t*

$$SROW_{z,t} = -CAB_{z,t} \quad (15)$$

where

$CAB_{z,t}$: Current account balance of region *z* in period *t*

3.3.5 Producer supplies of products and international trade

Equation 16 indicates that producer allocates its products to market, subject to maximize sales revenue. Producer's products include distribution to the domestic market ($DS_{x,z,t}$), exports ($EXT_{x,z,t}$), and supply of international transport margin services ($MRGN_{x,z,t}$). Product directed to one market are assumed to be different from product directed to another market. Constant elasticity of transformation (CET) aggregator function represents this imperfect substitution.

$$XS_{i,z,t} = B_{i,z}^{X1} [\beta_{i,z}^{EX\_X1} EXT_{i,z,t}^{\rho_{i,z}^{X1}} + \beta_{i,z}^{D\_X1} DS_{i,z,t}^{\rho_{i,z}^{X1}} + (1 - \beta_{i,z}^{EX\_X1} - \beta_{i,z}^{D\_X1}) MRGN_{i,z,t}^{\rho_{x,z}^{X1}}]^{\frac{1}{\rho_{i,z}^{X1}}} \quad (16)$$

where

$XS_{i,z,t}$: Total output of industry *j* in region *z* in period *t*

$EXT_{i,z,t}$: Supply of composite commodity *i* by region *z* to the export market

$DS_{i,z,t}$: Supply of commodity *i* produced locally to the domestic market in region *z*

$MRGN_{i,z,t}$: Domestic production of composite commodity *i* in region *z* exported as international margin services

$B_{i,z}^{X1}$: Scale parameter (CET – composite supply)

$\beta_{i,z}^{EX\_X1}$: Export share parameter (CET – composite supply)

$\beta_{i,z}^{D\_X1}$: Domestic market share parameter (CET – composite supply)

$\rho_{i,z}^{X1}$: Elasticity parameter (CET – composite supply); $1 < \rho_{i,z}^{X1} < \infty$

Nested CET functions correspond to the producers' supply behavior. Aggregate output is distributed between 3 markets on the upper level (exports, domestic, and worldwide transport margins), while exports are distributed between destination regions on the lower level.

Buyer's behavior and producer's behavior are symmetric. Domestic product and imports are imperfect substitute, and also imports from one region are imperfect substitute for imports from another region. Therefore, demand of composite goods in the domestic market are a combination of domestic goods and composite imports. Composite imports consist of imports from different regions. CES aggregator functions represent this imperfect substitute as shown in Equation 17.

$$Q_{i,z,t} = B_{i,z}^{M1}[\beta_{i,z}^{M1} IMT_{i,z,t}^{-\rho_{i,z}^{M1}} + (1-\beta_{i,z}^{M1}) DD_{i,z,t}^{-\rho_{i,z}^{M1}}]^{\frac{-1}{\rho_{i,z}^{M1}}} \quad (17)$$

where

$Q_{i,z,t}$: Quantity demanded of composite commodity *i* in region *z*

$IMT_{i,z,t}$: Quantity demanded of imports of composite commodity *i* by region *z* from all other regions

$DD_{i,z,t}$: Domestic demand for composite commodity *i* produced locally in region *z*

$B_{i,z}^{M1}$: Scale parameter (CES – composite good)

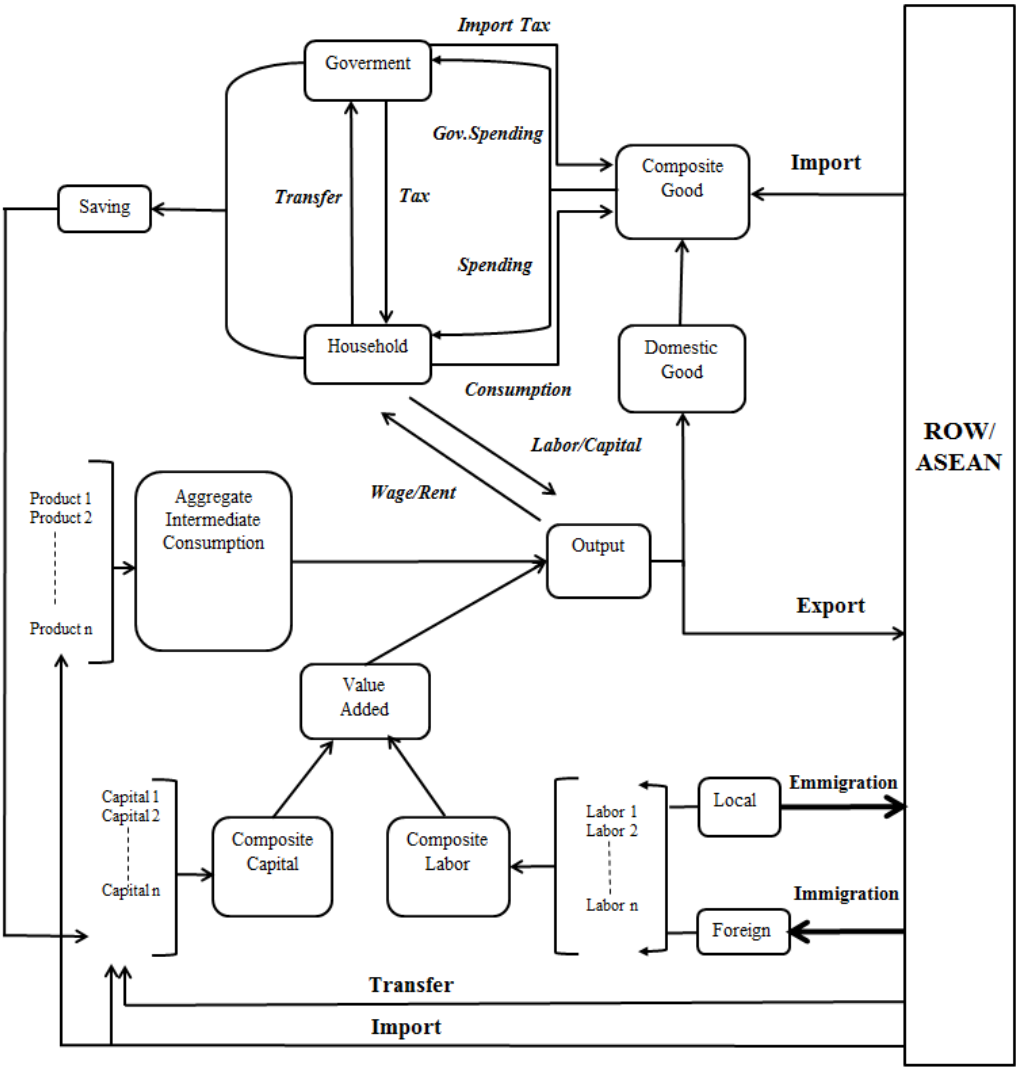
$\beta_{i,z}^{M1}$: Share parameter (CES – composite good)

$\rho_{i,z}^{M1}$: Elasticity parameter (CET – composite supply); $-1 < \rho_{i,z}^{M1} < \infty$

3.4 Conceptual frameworks

Figure 3.2 shows the whole structure of CGE model that will be used in this study. There are 5 main components in the framework which are production sectors, final consumption sectors (containing households, firms, and government), investment, the ROW, and markets (containing primary factor markets and goods and services markets).

Figure 3.2: Conceptual frameworks of the model



Source: The study's framework

The framework shows the domestic structure of economic interaction of one country which internationally links to the world market by international trade and labor

migration. The country will export the rest of domestic consumption goods and import composite goods. There are both domestic labor movement between sectors for both single and multi-countries models and international labor movement for multi-countries model. The inflow and outflow of income in the economic system are represented by the arrow line showing the direction of trading primary factors or goods and services within and with outside the country including taxes and transfers.

The single country model separately identifies forty industries and nine industries for the dynamic multi-countries model. A single output is produced by each of the industries in the model, according to a designated mix of primary and intermediate factor inputs. Intermediate inputs at the secondary level represent a combination of a domestic product and the imported version of the same item. The equivalent nature of these two inputs enables producers to switch between them in response to fluctuations in relative prices, reproduced in the model through the constant elasticity of substitution (CES) mixing function. This elasticity level cannot be infinite since it must take into consideration the technological limitations to making such substitutions. Meanwhile, the primary factor input uses a CES homothetic function in order to combine three different sources of physical capital and two separate labor types.

The output generated by each industry within the model is deemed to be sold to another industry where it becomes an intermediate input, or sold to an end-user in accordance with market demand. Given the demand in each market and the various taxes that apply, output generated by each industry is also shared among domestic and export markets with the firm's maximizing its total revenue. The model assumes that product directed to one market is somewhat different from product directed to another market. CET aggregator function represents this imperfect substitution which describes how readily product can be redirected from one market to another.

On the demand side of the equation, it is assumed that buyers are also able to substitute imported goods for locally produced items; domestic goods are considered imperfect substitutes for imports, and imports from one region are an imperfect substitute for imports from another region. In other words, goods are perceived as heterogeneous with respect to their origin. Thus, the products which are in demand domestically are considered to be composite goods. Composite goods are combinations

of locally produced goods and composite imports. Composite imports are a combination of imports from different regions. Imperfect substitutability is represented by CES aggregator functions (Decaluwé, Lemelin, Robichaud, & Maisonnave, 2012; Robichaud, Lemelin, Decaluwé, & Maisonnave, 2013).

The allocation of household income is made according to a linear expenditure system (LES) preference function which is applied across a range of product categories. It is possible for households to consume either the domestic version of a product or the imported item depending upon the relatives prices involved, and within the limitations determined by the CES function. Overall household consumption levels are related to income, which is in turn governed by factors connected with employment.

Final demand agents refers to the following groups of consumers: households, other industries seeking intermediate inputs, foreign demand via exports, and the state itself via government consumption demand. In addition, government consumption demand and aggregate investment are exogenous to the model for this study.

The demand curve for exports is not considered to be perfectly elastic in the model. Foreign demand is responsive to relative price changes compared to the prices of products within that country compared to the prices from other sources. Where the elasticity differs between product categories, this reflects both aggregation and additional export sales barriers which are not imposed by the market itself.

3.5 Data

3.5.1 Social Accounting matrix (SAM)

This section describes the database of the CGE model. The database reports the value of all transactions in an economy during a period of time, usually a year. The database can be organized and displayed as a Social Accounting matrix (SAM) (Table 3.2), a logical framework that provides a visual display of the transaction as a circular flow of national income and spending. The SAM's microeconomic data describe transactions made by each agent in the economy. Agents typically include industries, factors of production (labor and capital), household consumers, the government, and the ROW region, which supplies imports and demands exports (Burfisher, 2011).

A SAM is a square matrix of data as shown in Table 3.2. It is square because every economic agent in the economy has both a column account and a row account. The SAM's column accounts record each agent's spending. Row accounts record each agent's sources of income. Therefore, every cell in the SAM matrix describes a single transaction as being simultaneously expenditure by an agent's column account and the receipt of income by an agent's row account. This procedure for recording transactions visually records how any single transaction links agents in the economy. The SAM format enables the modeler to verify visually that the initial database is balanced.

A SAM is balanced when every agent meets this constraint by total spending (its column sum) equals total income (its row sum). When income is equal to spending in every account, then the economy's aggregate spending is equal to its aggregate income, and the database describes an economy in an initial equilibrium. A CGE model requires a balanced database as an initial starting point. Model shocks will disturb this equilibrium. Price, supply, and demand will then re-adjust until the economy is in a new equilibrium in which income again is equal to expenditure for all agents in the economy. Components of SAM for this study includes primary factors, household, firms, government, taxes, ROW, activities, domestic commodities, export commodities, and saving-investment.

Table 3.2: Social Accounting Matrix (SAM)

	Primary Factors	Households	Firms	Goverments	Tax	Rest of the World	Activities	Domestic Commodities	Export Commodities	Saving-Investment
Primary Factors							Value added			
Households	Primary Factors Ownership	Institution Transfer				Transfer from Rest of the World				
Firms	Primary Factors Ownership									
Goverments					Tax Income					
Tax		Direct Tax						Indirect Tax		
Rest of the World								Import		
Activities								Domestic Commodities supplies	Export Commodities supplies	
Domestic Commodities		Private Consumption		Public Consumption			Intermediate Demand			Investment/ Change in Inventories
Export Commodities						Export				
Saving-Investment		Private Saving		Public Saving		Borrowing from abroad				

Source: *Limskul (2013)*

3.5.2 Data acquirement

The estimation method consists of 2 stages. First, data of the base year is accumulated and SAM is constructed. Second, the coefficients and exogenous variables of the model are estimated by using SAM, which is called calibration.

3.5.2.1 Static single country CGE model

The CGE model is based from static single countries model (Limskul, 2013). The model parameters are calibrated on the Thailand's SAM of 2010. The model is implemented in GAMS and solved with NLP solver. In this model, SAM contains 40 production sectors, 40 commodities, 2 primary factors (labor and capital), 4 agents (households, firms, government, ROW), 3 types of tax (import tax, indirect tax, and direct tax).

Table 3.3: Forty sectors for static single country CGE model

Primary materials	1.Agriculture 2.Crude oil and coal 3.Metal ore and non-metal ore 4.Slaughtering
Manufacturing	5.Processing and preserving of foods 6.Rice and other grain milling 7.Sugar refineries 8.Other foods 9.Animal food 10.Beverages 11.Tobacco processing and products 12.Textile 13.Paper and paper products 14.Printing and publishing 15.Basic chemical products 16.Fertilizer and pesticides 17.Other chemical products 18.Petroleum refineries 19.Rubber products 20.Plastic wares 21.Cement and concrete products 22.Other non-metallic products 23.Iron and steel 24.Non-ferrous metal 25.Fabricated metal products 26.Industrial machinery 27.Computers and parts 28.Electrical machinery and apparatus 29.Motor vehicles and repairing 30.Other transportation equipment 31.Leather products 32.Saw mills and wood products 33.Jewelry & related articles 34.Other manufacturing products
Services	35.Public utilities 36.Construction 37.Trade 38.Services 39.Transportation and communication 40.Unclassified

Source: Limskul (2013)

The production activities are divided into forty sectors as shown in Table 3.3. The model differentiates one type of capital and one type of labor. Capital can flow freely and labor move when there exists certain income gap between 2 regions. There is one type of households. There is one government in each region to reflect their income, consumption, saving. Government income comes from various types of taxes. All equations and variables descriptions are showed in Appendix A.

3.5.2.2 Dynamic multi-countries CGE model

The CGE model is based from dynamic multi-countries model developed by Robichaud *et al.* (2013). The model parameters are calibrated on the multi-countries SAM of 2007 from GTAP version 8 (Narayanan, Aguiar, & McDougall, 2012). The model is implemented in GAMS and solved with NLP solver. In this model, SAM contains 9 production sectors, nine commodities, 5 primary factors, 4 agents (households, firms, government, ROW), 3 types of tax (import tax, indirect tax, and direct tax), and 10 regions.

Table 3.4: Fifty seven old sectors map to nine new sectors

Primary materials	
	Grains and Crops (Grains&Crops)
	1.Paddy rice 2.Wheat 3.Cereal grain nec[12] 4.Vegetables, fruit, nuts 5.Oil seeds
	6.Sugar cane, sugar beet 7.Plant-based fibers 8.Crops nec 9.Processed rice
	Livestock and Meat Products (LiveStk&Meat)
	10.Cattle, sheep, goats, horses 11.Animal products nec 12.Raw milk
	13.Wool, silk-worm cocoons 14.Meat: cattle, sheep, goats, horse 15.Meat products nec
	Mining and Extraction (Mining&Extractn)
	16.Forestry 17.Fishing 18.Coal 19.Oil 20.Gas 21.Minerals nec
Manufacturing	
	Processed Food (ProcFood)
	22.Vegetable oils and fats 23.Dairy products 24.Sugar 25.Food products nec
	26.Beverages and tobacco products
	Textiles and Clothing (Textiles&Clothing)
	27.Textiles 28.Wearing apparel
	Light Manufacturing (LightMnfc)
	29.Leather products 30.Wood products 31.Paper products, publishing 32.Metal products
	33.Motor vehicles and parts 34.Transport equipment nec 35.Manufactures nec
	Heavy Manufacturing (HeavyMnfc)
	36.Petroleum, coal products 37.Chemical, rubber, plastic products 38.Mineral products nec
	39.Ferrous metals 40.Metal nec 41.Electronic equipment 42.Machinery and equipment nec
Services	
	Utilities and Construction (Util&Constuct)
	43.Electricity 44.Gas manufacture, distribution 45.Water 46.Construction
	Other Services (OthServices)
	47.Trade 48.Transport nec 49.Sea transport 50.Air transport 51.Communication
	52.Financial services nec 53.Insurance 54.Business services nec
	55.Recreation and other services 56.PubAdmin/Defence/Health/Education 57.Dwellings

Source: GTAP version 8

[12] nec represents "not elsewhere classified"

Table 3.4 shows the origin of ten sectors that use in this study. The study maps 57 sectors to ten sectors from GTAP version 8 database.

As shown in Table 3.5, the dynamic multi-countries CGE model includes 10 regions, which are Thailand, Singapore, Malaysia, Philippines, Indonesia, Vietnam, Cambodia, Lao PDR, ROASEAN (Myanmar & Brunei), and ROW. The production activities are divided into 9 sectors, including grains & crops, livestock & meat products, mining & extraction, processed food, textiles & clothing, light manufacturing, heavy manufacturing, utilities & construction, and other services.

The model differentiates 3 types of capital which are capital, land, natural resources. Capital can flow freely. Land and natural resource are simply assumed to be completely immobile. There are one type of households and two types of labors which are skilled and unskilled labors. Labor is assumed to be not freely mobile in the model. When there exists certain income gap between two regions, labor migration will happen. There is one government in each region to reflect their income, consumption, saving. Government income comes from various types of taxes. All equations and variables descriptions are showed in Appendix B.

Table 3.5: Regions, production sectors and commodities and primary factors classification

Regions	Sectors and Commodities	Factors
Thailand	Grains and crops	Unskilled labors[13]
Singapore	Livestock and meat products	Skilled labor
Malaysia	Mining and extraction	Capital
Philippines	Processed food	Land
Indonesia	Textiles and clothing	Natural resource
Vietnam	Light manufacturing	
Cambodia	Heavy manufacturing	
Lao PDR	Utilities and construction	
Myanmar and Brunei[14]	Other services	
Rest of the world		

Source: The study's model

[7] Splitting labor by skill level — skilled and unskilled — on the basis of occupational classifications. The International Labor Organization (ILO) classifies skilled labor as a category including administrators, managers, professionals and para-professionals. The unskilled labor category comprises tradesmen, sales staff, clerks, personal service providers, machine operatives, drivers and physical laborers (Narayanan *et al.*, 2012).

[14] Data in GTAP 8 Data Base (Narayanan *et al.*, 2012) combines Myanmar and Brunei and the study uses ROASEAN to represent these two countries.

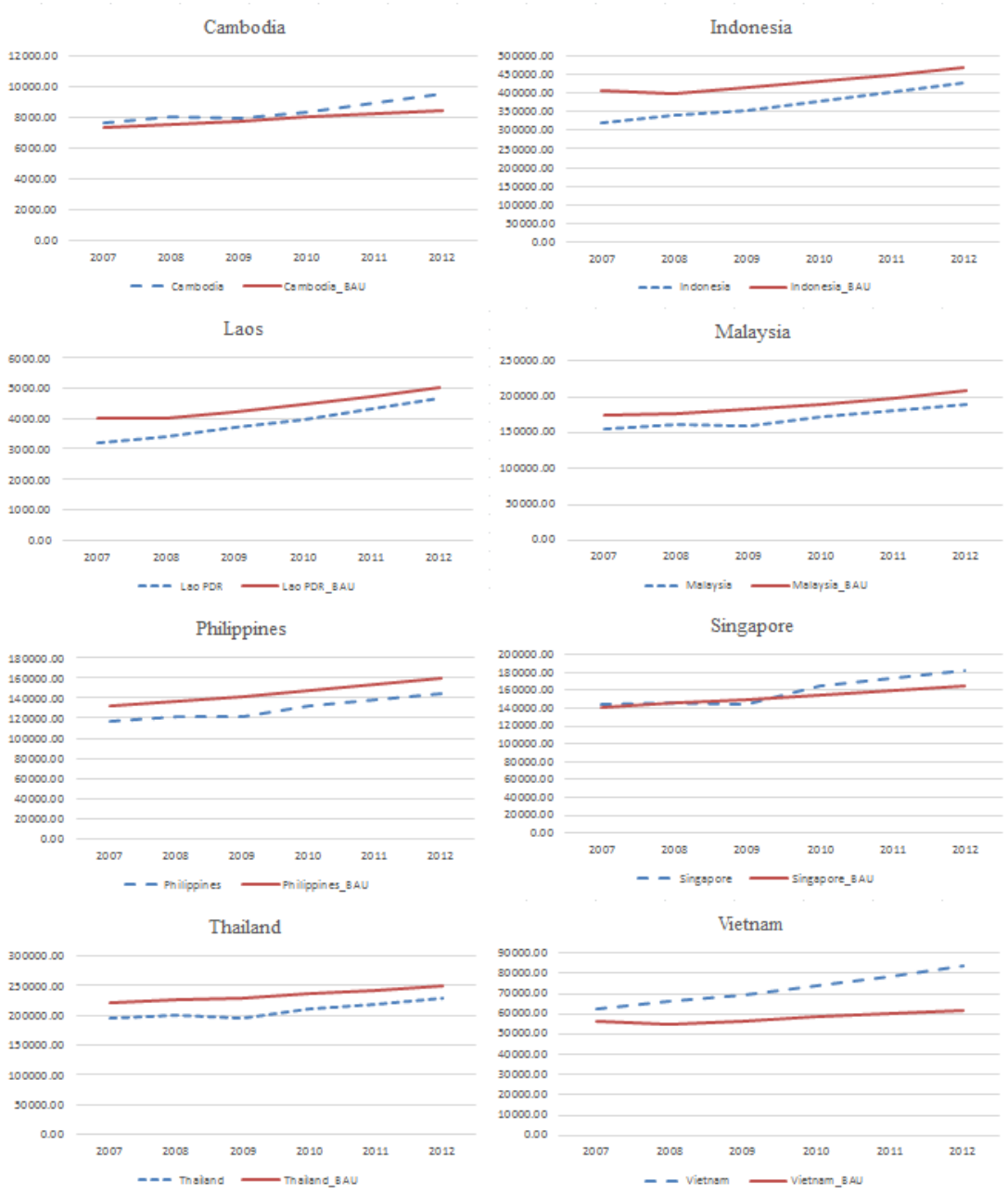
3.6 Tests of model

3.6.1 Model accuracy test

Model accuracy is tested by comparing the real data and the result of business-as-usual (BAU) case from the dynamic multi-countries CGE model. The data consists of GDP, consumption, government spending, investment, and export from 2007 to 2012. For the test of consumption, government spending, investment, and export are in Appendix E2.

Figure 3.3 shows the value of GDP (billion US dollar units) from 2007 to 2012 for Thailand, Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Singapore, and Vietnam. The dashed line is actual data (Appendix F1) and the solid line generates from the CGE model. It can be seen that both lines have the similar trend for every country but the magnitude is a little different. The CGE model overestimated for some countries and underestimated for some countries. This is depending on the exogenous growth variables that used for the input of the model (Table 3.1).

Figure 3.3: GDP of ASEAN countries, 2007-2012 (Actual data vs CGE model) (unit in million US dollar)

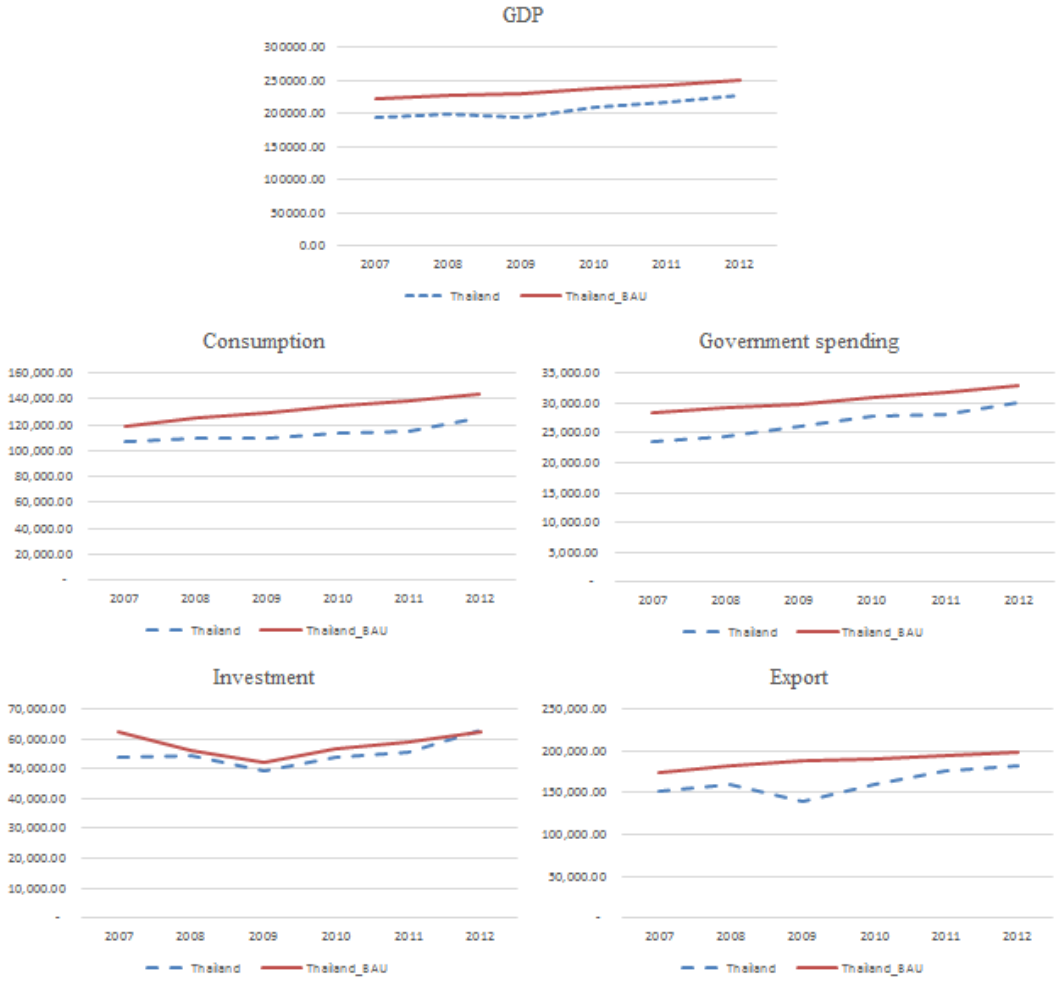


Source: World Bank Database and result from the study's model

Figure 3.4 shows the value of GDP, consumption, government spending, investment, and export (billion US dollar units) from 2007 to 2012 for Thailand. The dashed line is actual data (Appendix F1) and the solid line generates from our CGE model and it can be seen that both lines have the similar trend but the magnitude is a

little bit different. The CGE model overestimated on all macro-economic data for Thailand.

Figure 3.4: Macro-economic data of Thailand, 2007-2012 (Actual data vs CGE model) (unit in million US dollar)



Source: World Bank Database and result from the study's model

3.6.2 Sensitivity test

While CGE models have several advantages, they suffer from an uncertainty in the choice of model elasticities because these parameters may not know precisely and the corollary issue that the choice of elasticities can be critical in determining model outcomes (Mary, Phimister, Roberts, & Santini, 2013). The literature presents growing concerns over the numerical framework applied in the GCE model, with specific questions raised with regard to the influence of the parameters which are used for the

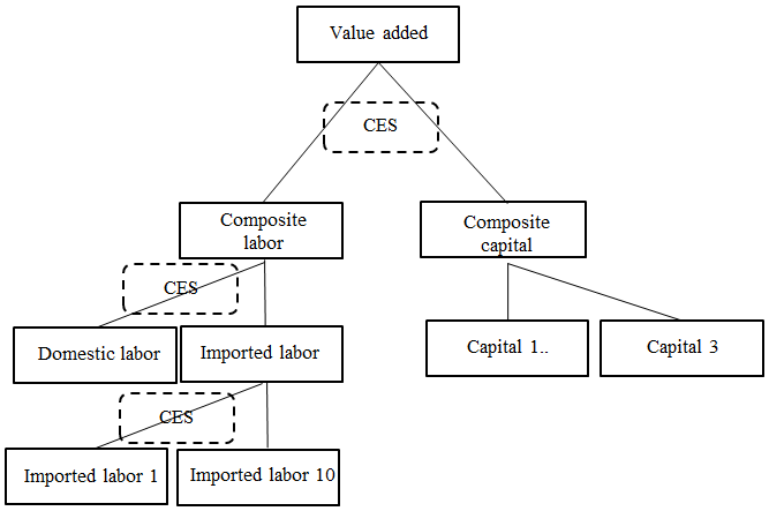
results, and the degree of robustness exhibited by those results where differing parameters are applied. Since there currently exists no more suitable estimates for the parameters used, it becomes especially important to apply sensitivity analysis when using computable models (Domingues & Haddad, 2005).

Sensitivity tests are applied in order to assess the validity of the results obtained from simulations using numerical models. The test provides an analysis of how the variations in model outputs are related to the adjustments in the levels of the various inputs from numerous sources. The robustness of the outputs can thus be evaluated, since the various input parameters can be translated to a range of variables denoting economic output (Hermeling & Mennel, 2008).

Sensitivity testing is a crucial element in assessing the robustness of the results of any GCE model analysis. It is essential to determine whether the chosen parameters and elasticities of the model will allow a stable equilibrium to be established, whereby variables pertaining to labor and GDP are in balance. It is normal to establish the equilibrium of the benchmark scenario. When conducting sensitivity analysis it is important to obtain equilibriums for a selection of parameters, because if the model cannot be solved for parameter values similar to the benchmark values then it will be considered unstable and of limited use.

There are two methods which can be applied in carrying out sensitivity testing. The first is a stochastic approach while the second is a deterministic approach. The stochastic perspective considers the vector of parameters to be a stochastic variable with a particular distribution, so that the equilibriums derived from the model become stochastic variables. If the first moment of these variables can be calculated, the robustness of the results can be determined from the variance. In the deterministic approach, the tuple of basic parameters is assumed to be an element of a given subset comprising all the available possibilities for the parameters. It is then possible to specify the maximum and minimum bounds for the subset of economic outcomes from the model. In Hermeling and Mennel (2008) discussed several types of the sensitivity tests, however this study will use the deterministic sensitivity analysis and the basic one.

Figure 3.5: Nested structure of production



Source: A part of the study's framework

Figure 3.5 illustrates the framework of production technology for models of regional economies. The framework determines the productive process of firms in terms of three optimization levels. The broken lines are used to denote the specified functional forms for each stage. The first level involves substitution between capital and labor. The various inputs and primary factors are subject to the use of a constant elasticity substitution (CES) function. At the second level involves substitution between imported and domestic labors and, on the other sides, substitution between different types of capitals. At the third level involves substitution between labors from different countries of origin.

Production technology which uses CES functions suggests that the Armington assumption has been adopted for product differentiation (Armington, 1969; McDaniel & Balistreri, 2002).

Table 3.6: Sensitivity test by varying elasticities of substitution between labor & capital, between domestic & imported labors, and between imported labors (unit in percentage change)

Sensitivity Test for Thailand									
Elasticities	Labor&Capital (percentage)			Domestic&Imported labors (percentage)			Imported labors (percentage)		
	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4
GDP	0.100	-0.075	-0.360	0.004	-0.004	-0.025	0.001	-0.001	-0.008
Consumption	0.108	-0.080	-0.383	0.004	-0.004	-0.027	0.001	-0.001	-0.008
Employment	0.029	-0.026	-0.153	0.018	-0.017	-0.112	0.004	-0.004	-0.033

Source: Result from the study's model

The study uses the method called sensitivity test to test the robustness of the study's model. Table 3.6 shows the result of sensitivity test by varying three parameters which are elasticity of substitution between labor and capital, elasticity of substitution between domestic and imported labors, and elasticity of substitution between imported labors. The study varies these parameters by multiplying by 0.7, 1.3, and 4.

For example, if elasticity of substitution between labor and capital decreases by 30%, GDP, consumption, and employment of Thailand will increase by 0.100%, 0.108%, and 0.029% respectively comparing to BAU case. On the other hand, if elasticity of substitution between labor and capital decreases by 400% or 4 times, GDP, consumption, and employment of Thailand will decrease by 0.360%, 0.383%, 0.153% respectively comparing to BAU case. Other countries tests are in in Appendix E2.

The result shows the robustness of the model, since GDP, consumption, and employment have not changed much by varying parameters. In addition, the sign of three economic variables have the same direction which positive for multiplied by 0.7 and negative for multiplied by 1.3 and 4. Therefore, the study's model is robust.

3.7 Baseline scenario

Any analysis using a GCE model requires a baseline to be determined first in order to have a point of reference to which the model's scenario outcomes can be compared. This baseline thus serves as a constant between the analyses of various scenario outcomes. One important scenario is known as the 'business as usual' case (BAU), and denotes the result of a scenario in which nothing significantly different

happens to the model (Nana *et al.*, 2009). The model requires a base for its timeframe, which is typically the year of the starting point, which is year 2007 for this study.

The BAU case is first generated by the model. The full specification and equations of the model are described in Appendix B. It is calibrated from the GTAP Version 8 database[15] and the 2007 base year of that dataset is projected for eight years in the baseline using the data from several sources for growth projections including average growths of GDP, labor supply, and saving rate (Table 3.1), and closure rule (Appendix B3) which is as following.

- Government spending growth equals to GDP growth
- Investment growth equals to GDP growth
- Household saving growth equals to GDP growths
- Exchange rate is fixed
- GDP deflator of ROW is a numeraire (Appendix F2)
- Minimum consumption growth equals labor supply growth
- Wage of migrant labor growth equals to inflation growth

[15] Robichaud *et al.* (2013)

3.7.1 ASEAN

Table 3.7: Real GDP and real GDP growth of ASEAN countries (unit in billion US dollar)

	GDP (Billion US Dollar)								
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	7.38	7.71	8.00	8.28	8.58	8.90	9.23	9.57	9.92
Growth rate (percentage)		*4.49*	*3.78*	*3.50*	*3.65*	*3.67*	*3.70*	*3.69*	*3.68*
Indonesia	409.52	430.35	452.13	474.65	498.23	522.91	548.80	576.00	604.62
Growth rate (percentage)		*5.08*	*5.06*	*4.98*	*4.97*	*4.95*	*4.95*	*4.96*	*4.97*
Lao PDR	4.03	4.31	4.60	4.91	5.23	5.57	5.94	6.33	6.74
Growth rate (percentage))		*7.02*	*6.71*	*6.56*	*6.58*	*6.58*	*6.56*	*6.55*	*6.53*
Malaysia	173.55	178.16	184.80	191.37	197.94	205.89	216.21	227.10	238.59
Growth rate (percentage)		*2.65*	*3.73*	*3.55*	*3.43*	*4.02*	*5.01*	*5.04*	*5.06*
Philippines	132.50	138.33	143.82	149.67	156.08	162.92	170.19	177.85	185.93
Growth rate (percentage)		*4.40*	*3.97*	*4.07*	*4.28*	*4.38*	*4.46*	*4.50*	*4.54*
Singapore	140.33	146.60	151.76	157.06	162.63	168.38	174.25	180.32	186.62
Growth rate (percentage)		*4.46*	*3.52*	*3.49*	*3.55*	*3.54*	*3.49*	*3.48*	*3.49*
Thailand	221.91	229.98	235.91	241.49	247.91	254.81	261.94	269.35	277.03
Growth rate (percentage)		*3.64*	*2.58*	*2.36*	*2.66*	*2.78*	*2.80*	*2.83*	*2.85*
Vietnam	56.19	57.41	59.64	61.90	64.22	66.60	69.09	71.69	74.38
Growth rate (percentage)		*2.18*	*3.88*	*3.79*	*3.74*	*3.71*	*3.74*	*3.75*	*3.76*
ROASEAN	26.44	28.07	30.66	33.40	36.36	39.56	43.01	46.71	50.68
Growth rate (percentage))		*6.18*	*9.21*	*8.96*	*8.86*	*8.79*	*8.72*	*8.61*	*8.49*
ROW	50,727.07	51,679.92	52,667.55	53,664.59	54,675.06	55,701.22	56,744.44	57,806.25	58,887.30
Growth rate (percentage)		*1.88*	*1.91*	*1.89*	*1.88*	*1.88*	*1.87*	*1.87*	*1.87*

Source: Result from the study's model

Table 3.7 shows value and growth rate of real GDP of ASEAN countries for BAU case. Indonesia has the highest GDP following by Thailand and Malaysia at year 0 while Lao PDR has the lowest GDP but it has the second highest GDP growth rate after ROASEAN. Although Thailand has high GDP but its growth rate is the lowest comparing to other ASEAN countries, therefore Thailand should find the way to improve its situation. Table 3.8 shows value and growth rate of consumption of ASEAN countries for BAU case. Indonesia has the highest consumption as well as GDP.

Table 3.8: Consumption and consumption growth of ASEAN countries (unit in billion US dollar)

	Value of consumption (Billion US Dollar)								
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	6.14	6.45	6.75	7.04	7.34	7.66	8.00	8.35	8.71
Growth rate (percentage)		*5.13*	*4.53*	*4.27*	*4.38*	*4.37*	*4.38*	*4.35*	*4.32*
Indonesia	257.94	266.45	274.99	283.30	291.50	299.54	307.39	315.00	322.34
Growth rate (percentage)		*3.30*	*3.21*	*3.02*	*2.89*	*2.76*	*2.62*	*2.48*	*2.33*
Lao PDR	2.55	2.74	2.93	3.13	3.34	3.57	3.82	4.07	4.35
Growth rate (percentage)		*7.30*	*6.95*	*6.81*	*6.83*	*6.82*	*6.80*	*6.80*	*6.79*
Malaysia	73.57	78.12	83.67	89.27	94.93	101.42	109.33	117.71	126.59
Growth rate (percentage)		*6.18*	*7.11*	*6.69*	*6.34*	*6.83*	*7.80*	*7.67*	*7.54*
Philippines	95.12	100.14	104.94	110.05	115.62	121.56	127.88	134.55	141.60
Growth rate (percentage)		*5.28*	*4.79*	*4.87*	*5.06*	*5.14*	*5.20*	*5.22*	*5.24*
Singapore	63.43	66.23	68.41	70.64	72.99	75.40	77.85	80.37	82.98
Growth rate (percentage)		*4.42*	*3.28*	*3.26*	*3.32*	*3.31*	*3.25*	*3.24*	*3.25*
Thailand	119.30	125.10	129.72	134.15	139.12	144.43	149.93	155.64	161.58
Growth rate (percentage)		*4.87*	*3.69*	*3.42*	*3.71*	*3.81*	*3.81*	*3.81*	*3.82*
Vietnam	41.31	42.42	44.08	45.79	47.55	49.37	51.28	53.27	55.35
Growth rate (percentage)		*2.69*	*3.92*	*3.87*	*3.84*	*3.83*	*3.86*	*3.89*	*3.91*
ROASEAN	15.26	15.86	16.91	17.96	19.02	20.09	21.15	22.19	23.19
Growth rate (percentage)		*3.93*	*6.64*	*6.22*	*5.91*	*5.62*	*5.30*	*4.92*	*4.50*
ROW	31,007.67	31,585.92	32,197.19	32,815.60	33,442.96	34,080.41	34,728.62	35,388.43	36,060.20
Growth rate (percentage)		*1.86*	*1.94*	*1.92*	*1.91*	*1.91*	*1.90*	*1.90*	*1.90*

Source: Result from the study's model

Table 3.9: Export and export growth of ASEAN countries (unit in billion US dollar)

Value of export (Billion US Dollar)									
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	5.70	5.91	6.15	6.41	6.67	6.94	7.22	7.51	7.81
Growth rate (percentage)		*3.65*	*4.10*	*4.24*	*4.03*	*4.04*	*4.02*	*4.01*	*4.00*
Indonesia	126.37	143.16	149.75	156.79	164.35	172.44	181.13	190.46	200.48
Growth rate (percentage)		*13.29*	*4.60*	*4.70*	*4.82*	*4.92*	*5.04*	*5.15*	*5.26*
Lao PDR	1.46	1.64	1.77	1.91	2.06	2.22	2.40	2.59	2.80
Growth rate (percentage)		*11.99*	*7.81*	*7.96*	*7.94*	*7.96*	*7.96*	*7.97*	*7.98*
Malaysia	193.51	199.42	207.78	215.22	220.93	228.37	241.65	255.80	270.82
Growth rate (percentage)		*3.06*	*4.19*	*3.58*	*2.66*	*3.36*	*5.82*	*5.86*	*5.87*
Philippines	71.68	74.13	77.09	79.51	82.68	86.05	90.00	94.14	98.49
Growth rate (percentage)		*3.42*	*3.99*	*3.14*	*3.99*	*4.08*	*4.59*	*4.60*	*4.62*
Singapore	204.33	213.09	222.47	232.61	243.35	254.79	266.70	279.21	292.30
Growth rate (percentage)		*4.28*	*4.41*	*4.55*	*4.62*	*4.70*	*4.67*	*4.69*	*4.69*
Thailand	174.69	181.93	188.14	190.40	194.73	200.06	205.45	210.93	216.47
Growth rate (percentage)		*4.14*	*3.41*	*1.20*	*2.27*	*2.74*	*2.70*	*2.66*	*2.63*
Vietnam	52.67	57.75	60.39	63.20	66.16	69.26	72.50	75.91	79.48
Growth rate (percentage)		*9.63*	*4.58*	*4.65*	*4.68*	*4.69*	*4.68*	*4.70*	*4.71*
ROASEAN	12.30	13.78	15.04	16.49	18.14	20.02	22.15	24.55	27.26
Growth rate (percentage)		*11.97*	*9.19*	*9.66*	*9.98*	*10.37*	*10.63*	*10.84*	*11.02*
ROW	544.95	550.94	563.98	582.25	602.03	622.26	639.61	657.51	675.95
Growth rate (percentage)		*1.10*	*2.37*	*3.24*	*3.40*	*3.36*	*2.79*	*2.80*	*2.81*

Source: Result from the study's model

Table 3.9 shows value and growth rate of export of ASEAN countries for BAU case. Singapore has the highest export following by Malaysia and Thailand.

3.7.2 Thailand

Table 3.10: Sectoral export and sectoral export growth of Thailand (unit in billion US dollar)

	Value of sectoral export (Billion US Dollar)								
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
All	174.69	181.93	188.14	190.40	194.73	200.06	205.45	210.93	216.47
Growth rate (percentage)		*4.14*	*3.41*	*1.20*	*2.27*	*2.74*	*2.70*	*2.66*	*2.63*
Grains&Crops	5.22	5.28	5.33	5.31	5.35	5.42	5.49	5.57	5.65
Growth rate (percentage)		*1.15*	*0.81*	*-0.34*	*0.84*	*1.28*	*1.33*	*1.38*	*1.38*
LiveStk&Meat	1.32	1.35	1.37	1.37	1.39	1.42	1.44	1.47	1.49
Growth rate (percentage)		*2.45*	*1.89*	*-0.19*	*1.29*	*1.83*	*1.87*	*1.84*	*1.79*
Mining&Extractn	1.03	1.00	1.00	1.00	0.99	0.99	0.99	0.99	1.00
Growth rate (percentage)		*-2.67*	*-0.11*	*-0.36*	*-0.18*	*-0.04*	*0.04*	*0.12*	*0.15*
Procfood	12.05	12.38	12.70	12.81	13.04	13.31	13.57	13.84	14.10
Growth rate (percentage)		*2.73*	*2.62*	*0.85*	*1.76*	*2.07*	*2.00*	*1.96*	*1.91*
Textiles&Clothing	7.81	8.05	8.32	8.38	8.54	8.74	8.96	9.18	9.41
Growth rate (percentage)		*3.15*	*3.32*	*0.74*	*1.88*	*2.40*	*2.51*	*2.47*	*2.40*
LightMnfc	10.82	11.15	11.52	11.59	11.79	12.06	12.35	12.63	12.90
Growth rate (percentage)		*3.02*	*3.30*	*0.60*	*1.78*	*2.29*	*2.34*	*2.27*	*2.20*
HeavyMnfc	112.73	118.17	122.41	123.94	126.92	130.56	134.15	137.76	141.38
Growth rate (Percentage)		*4.82*	*3.58*	*1.26*	*2.40*	*2.86*	*2.75*	*2.69*	*2.63*
Util&Constuct	0.64	0.67	0.69	0.69	0.70	0.71	0.72	0.73	0.74
Growth rate (percentage)		*5.16*	*2.43*	*-0.21*	*1.31*	*1.81*	*1.54*	*1.50*	*1.45*
OthServices	23.07	23.88	24.80	25.31	26.01	26.85	27.77	28.75	29.80
Growth rate (percentage)		*3.48*	*3.88*	*2.07*	*2.73*	*3.23*	*3.45*	*3.54*	*3.63*

Source: Result from the study's model

Table 3.10 shows value and growth rate of sectoral export of Thailand for BAU case. Heavy manufacturing sector has the highest export value which far higher than the second one. Table 3.11 shows value and growth rate of sectoral import of Thailand for BAU case. Heavy manufacturing sector has the highest import value which far higher than the second one.

Table 3.11: Sectoral import and sectoral import growth of Thailand (unit in billion US dollar)

	Value of sectoral import (Billion US Dollar)								
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
All	141.71	143.83	145.77	150.88	155.23	159.13	163.07	167.12	171.27
Growth rate (percentage)		*1.50*	*1.34*	*3.51*	*2.88*	*2.51*	*2.48*	*2.48*	*2.49*
Grains&Crops	1.71	1.78	1.84	1.92	1.99	2.06	2.13	2.19	2.26
Growth rate (percentage)		*4.05*	*3.84*	*4.32*	*3.68*	*3.35*	*3.17*	*3.10*	*3.06*
LiveStk&Meat	0.40	0.41	0.42	0.44	0.46	0.48	0.49	0.51	0.52
Growth rate (percentage)		*3.03*	*3.06*	*5.01*	*3.78*	*3.30*	*3.31*	*3.24*	*3.22*
Mining&Extractn	22.38	23.31	24.08	24.81	25.66	26.56	27.45	28.36	29.29
Growth rate (percentage)		*4.13*	*3.31*	*3.05*	*3.42*	*3.48*	*3.36*	*3.31*	*3.28*
Procfood	4.20	4.34	4.46	4.63	4.79	4.95	5.11	5.27	5.44
Growth rate (percentage)		*3.32*	*2.85*	*3.73*	*3.47*	*3.31*	*3.27*	*3.25*	*3.24*
Textiles&Clothing	2.37	2.43	2.48	2.56	2.64	2.72	2.79	2.87	2.94
Growth rate (percentage)		*2.39*	*2.11*	*3.42*	*3.05*	*2.82*	*2.69*	*2.70*	*2.71*
LightMnfc	4.76	4.84	4.90	5.11	5.27	5.42	5.58	5.74	5.91
Growth rate (percentage)		*1.52*	*1.36*	*4.20*	*3.25*	*2.81*	*2.86*	*2.92*	*2.97*
HeavyMnfc	83.89	84.54	85.22	88.35	90.80	92.89	95.04	97.26	99.56
Growth rate (percentage)		*0.78*	*0.81*	*3.68*	*2.77*	*2.30*	*2.32*	*2.34*	*2.36*
Util	1.20	1.15	1.12	1.19	1.23	1.24	1.26	1.28	1.30
Growth rate (percentage)		*-4.71*	*-2.50*	*6.58*	*2.94*	*1.35*	*1.58*	*1.65*	*1.70*
OthServices	20.80	21.06	21.24	21.86	22.38	22.82	23.23	23.64	24.05
Growth rate (percentage)		*1.21*	*0.89*	*2.90*	*2.38*	*1.97*	*1.80*	*1.76*	*1.71*

Source: Result from the study's model

Table 3.12: Sectoral output and sectoral output growth of Thailand (unit in billion US dollar)

	Value of sectoral output (Billion US Dollar)								
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
All	548.73	566.86	582.41	596.67	613.57	631.66	650.09	668.96	688.24
Growth rate (percentage)		*3.30*	*2.74*	*2.45*	*2.83*	*2.95*	*2.92*	*2.90*	*2.88*
Grains&Crops	24.29	25.12	25.73	26.15	26.77	27.47	28.18	28.91	29.66
Growth rate (percentage)		*3.40*	*2.43*	*1.62*	*2.38*	*2.62*	*2.60*	*2.60*	*2.57*
LiveStk&Meat	9.98	10.33	10.62	10.85	11.16	11.50	11.84	12.19	12.55
Growth rate (percentage)		*3.51*	*2.80*	*2.17*	*2.84*	*3.04*	*3.00*	*2.97*	*2.93*
Mining&Extractn	14.62	15.04	15.21	15.32	15.52	15.74	15.96	16.18	16.38
Growth rate (percentage)		*2.89*	*1.12*	*0.75*	*1.29*	*1.44*	*1.40*	*1.35*	*1.27*
Procfood	27.50	28.52	29.37	29.89	30.64	31.48	32.32	33.17	34.03
Growth rate (percentage)		*3.71*	*2.98*	*1.79*	*2.51*	*2.73*	*2.67*	*2.63*	*2.59*
Textiles&Clothing	22.06	22.89	23.68	24.08	24.71	25.44	26.21	26.98	27.77
Growth rate (percentage)		*3.75*	*3.45*	*1.73*	*2.60*	*2.96*	*3.01*	*2.96*	*2.91*
LightMnfc	26.74	27.57	28.39	28.91	29.64	30.45	31.29	32.13	32.98
Growth rate (percentage)		*3.08*	*2.97*	*1.86*	*2.51*	*2.75*	*2.74*	*2.69*	*2.64*
HeavyMnfc	214.31	223.18	229.95	234.37	240.59	247.56	254.45	261.38	268.33
Growth rate (percentage)		*4.14*	*3.03*	*1.92*	*2.66*	*2.90*	*2.78*	*2.72*	*2.66*
Util&Constuct	40.20	39.72	39.29	41.07	42.20	42.97	43.73	44.50	45.28
Growth rate (percentage)		*-1.21*	*-1.06*	*4.52*	*2.76*	*1.83*	*1.76*	*1.76*	*1.76*
OthServices	169.03	174.50	180.18	186.03	192.33	199.04	206.11	213.51	221.26
Growth rate (percentage)		*3.24*	*3.25*	*3.24*	*3.39*	*3.49*	*3.55*	*3.59*	*3.63*

Source: Result from the study's model

Table 3.12 shows value and growth rate of sectoral output of Thailand for BAU case. Heavy manufacturing sector has the highest output as well as import value.

Table 3.13: Sectoral employment and sectoral employment growth of Thailand (unit in billion US dollar)

	Value of sectoral employment (Billion US Dollar)								
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
All	78.80	80.16	81.19	81.79	82.57	83.46	84.28	85.00	85.66
Growth rate (percentage)		*1.73*	*1.29*	*0.73*	*0.96*	*1.07*	*0.98*	*0.85*	*0.78*
Grains&Crops	4.80	4.91	5.01	5.03	5.10	5.19	5.27	5.35	5.42
Growth rate (percentage)		*2.32*	*1.86*	*0.59*	*1.37*	*1.66*	*1.60*	*1.48*	*1.39*
LiveStk&Meat	1.13	1.16	1.18	1.20	1.22	1.24	1.27	1.29	1.31
Growth rate (percentage)		*2.50*	*2.25*	*1.40*	*1.77*	*1.94*	*1.93*	*1.84*	*1.78*
Mining&Extractn	1.90	1.88	1.90	1.90	1.90	1.91	1.92	1.92	1.92
Growth rate (percentage)		*-1.10*	*1.04*	*-0.29*	*0.29*	*0.45*	*0.28*	*0.08*	*-0.13*
Procfood	2.05	2.10	2.15	2.13	2.14	2.16	2.18	2.20	2.22
Growth rate (percentage)		*2.78*	*2.05*	*-0.80*	*0.32*	*0.94*	*0.99*	*1.02*	*1.08*
Textiles&Clothing	2.47	2.54	2.63	2.61	2.63	2.67	2.71	2.76	2.80
Growth rate (percentage)		*3.06*	*3.44*	*-0.73*	*0.67*	*1.49*	*1.73*	*1.62*	*1.56*
LightMnfc	3.10	3.14	3.21	3.21	3.23	3.27	3.31	3.35	3.39
Growth rate (percentage)		*1.12*	*2.35*	*-0.03*	*0.67*	*1.12*	*1.23*	*1.14*	*1.11*
HeavyMnfc	15.46	16.13	16.44	16.35	16.43	16.62	16.78	16.94	17.11
Growth rate (percentage)		*4.31*	*1.94*	*-0.57*	*0.52*	*1.13*	*0.98*	*0.96*	*1.00*
Util&Constuct	3.99	3.55	3.27	3.62	3.72	3.69	3.67	3.66	3.65
Growth rate (percentage)		*-11.10*	*-7.94*	*10.82*	*2.73*	*-0.65*	*-0.60*	*-0.44*	*-0.25*
OthServices	43.89	44.75	45.41	45.73	46.20	46.71	47.17	47.53	47.83
Growth rate (percentage)		*1.94*	*1.47*	*0.72*	*1.01*	*1.10*	*0.98*	*0.78*	*0.63*

Source: Result from the study's model

Table 3.13 shows value and growth rate of sectoral employment of Thailand for BAU case. Value share of agricultural sector is 6.09% (4.80/78.8) while the employment share of agricultural sector is 39.6% (Table 2.6).

Table 3.14: Sectoral employment of Thai labor (unit in billion US dollar)

Value of sectoral employment of domestic labor (Billion US Dollar)										
Type of labor	Sectors	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Unskilled	Total	52.361	53.135	52.891	53.423	53.854	54.123	54.682	54.893	55.193
	Grains&Crops	4.485	4.493	4.556	4.586	4.647	4.718	4.794	4.860	4.925
	LiveStk&Meat	1.021	1.031	1.046	1.062	1.080	1.098	1.120	1.138	1.157
	Mining&Extractn	1.596	1.557	1.568	1.564	1.568	1.574	1.578	1.578	1.576
	Procfood	1.708	1.644	1.649	1.641	1.644	1.650	1.667	1.676	1.690
	Textiles&Clothing	2.213	2.070	2.102	2.093	2.103	2.122	2.159	2.183	2.211
	LightMnfc	2.666	2.566	2.578	2.585	2.598	2.611	2.645	2.661	2.684
	HeavyMnfc	12.659	12.354	12.361	12.330	12.374	12.438	12.565	12.620	12.711
	Util&Constuct	1.681	2.558	2.308	2.567	2.633	2.598	2.584	2.558	2.543
	OthServices	24.333	24.862	24.724	24.997	25.207	25.314	25.570	25.618	25.695
Skilled	Total	21.773	22.067	21.924	22.148	22.322	22.417	22.651	22.728	22.849
	Grains&Crops	0.066	0.066	0.067	0.068	0.069	0.070	0.071	0.072	0.073
	LiveStk&Meat	0.045	0.045	0.046	0.047	0.048	0.048	0.049	0.050	0.051
	Mining&Extractn	0.194	0.189	0.190	0.190	0.190	0.191	0.191	0.191	0.191
	Procfood	0.343	0.327	0.329	0.326	0.327	0.328	0.332	0.334	0.337
	Textiles&Clothing	0.342	0.317	0.322	0.320	0.322	0.325	0.331	0.335	0.340
	LightMnfc	0.399	0.380	0.382	0.383	0.385	0.387	0.392	0.395	0.399
	HeavyMnfc	2.880	2.784	2.788	2.776	2.786	2.801	2.832	2.847	2.873
	Util&Constuct	0.515	0.775	0.700	0.777	0.797	0.787	0.783	0.776	0.773
	OthServices	16.989	17.182	17.099	17.261	17.399	17.481	17.671	17.727	17.812
	Grand total	74.134	75.202	74.814	75.572	76.176	76.540	77.333	77.621	78.042

Source: Result from the study's model

Table 3.14 shows value of sectoral employment of domestic labor for BAU case. Every sector employed more domestic unskilled labors than skilled labor.

Table 3.15: Sectoral employment of migrant labor (unit in billion US dollar)

Value of sectoral employment of migrant labor (Billion US Dollar)										
Type of labor	Sectors	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Unskilled	Total	3.331	3.573	4.508	4.392	4.518	4.885	4.905	5.220	5.399
	Grains&Crops	0.345	0.351	0.376	0.376	0.383	0.395	0.401	0.412	0.420
	LiveStk&Meat	0.075	0.077	0.087	0.087	0.089	0.094	0.095	0.099	0.102
	Mining&Extractn	0.125	0.123	0.129	0.128	0.129	0.131	0.131	0.133	0.133
	Procfood	0.109	0.111	0.140	0.135	0.138	0.148	0.149	0.158	0.164
	Textiles&Clothing	0.138	0.137	0.180	0.172	0.177	0.193	0.195	0.210	0.219
	LightMnfc	0.166	0.170	0.220	0.213	0.218	0.237	0.239	0.256	0.266
	HeavyMnfc	0.788	0.818	1.056	1.014	1.040	1.130	1.134	1.212	1.258
	Util&Constuct	0.102	0.167	0.198	0.211	0.222	0.238	0.235	0.249	0.256
	OthServices	1.483	1.619	2.120	2.056	2.123	2.319	2.326	2.492	2.582
Skilled	Total	1.318	1.445	1.875	1.823	1.881	2.049	2.054	2.196	2.274
	Grains&Crops	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.006
	LiveStk&Meat	0.003	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.005
	Mining&Extractn	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016
	Procfood	0.022	0.022	0.028	0.027	0.027	0.029	0.030	0.031	0.033
	Textiles&Clothing	0.021	0.021	0.027	0.026	0.027	0.030	0.030	0.032	0.033
	LightMnfc	0.024	0.025	0.033	0.032	0.032	0.035	0.035	0.038	0.039
	HeavyMnfc	0.177	0.184	0.238	0.228	0.234	0.255	0.255	0.273	0.283
	Util&Constuct	0.031	0.050	0.060	0.064	0.067	0.072	0.071	0.075	0.077
	OthServices	1.019	1.119	1.464	1.421	1.467	1.602	1.607	1.720	1.781
	Grand total	4.648	5.018	6.382	6.214	6.399	6.934	6.960	7.416	7.673

Source: Result from the study's model

Table 3.15 shows value of sectoral employment of migrant labor for BAU case. Every sector employed more domestic unskilled labors than skilled labor. Many jobs in agriculture are currently filled by low wage labor who migrated from neighboring countries, as a majority of them (approximately 40%) are employed in agriculture and fishery (Pholphirul, 2012). Demand for foreign migrants has therefore played a very important role in sustaining economic activities in the agriculture and fishery sectors.

Table 3.16: Migrant labor by country in Thailand (unit in billion US dollar)

Value of employment of migrant labor (Billion US Dollar)										
Type of labor	Sectors	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Unskilled	Total	3.3425	3.5834	4.5080	4.3920	4.5199	4.8862	4.9067	5.2200	5.3996
	Cambodia	0.6855	0.5504	0.8821	0.8428	0.8472	0.9139	0.9497	0.9819	0.9895
	Indonesia	0.0007	0.0008	0.0008	0.0008	0.0009	0.0009	0.0009	0.0009	0.0010
	Lao PDR	0.9970	1.0541	1.1765	1.0928	1.0967	1.2003	1.1898	1.3177	1.4117
	Malaysia	0.0014	0.0011	0.0018	0.0017	0.0017	0.0018	0.0019	0.0020	0.0020
	Philippines	0.0015	0.0015	0.0016	0.0017	0.0017	0.0018	0.0019	0.0019	0.0020
	Singapore	0.0009	0.0009	0.0009	0.0010	0.0009	0.0010	0.0011	0.0012	0.0012
	Vietnam	0.0072	0.0061	0.0079	0.0081	0.0069	0.0085	0.0093	0.0108	0.0111
	ROASEAN	1.5003	1.8151	2.2713	2.2696	2.3895	2.5753	2.5574	2.7049	2.7766
	ROW	0.1481	0.1536	0.1652	0.1736	0.1745	0.1827	0.1948	0.1989	0.2047
Skilled	Total	1.3231	1.4498	1.8751	1.8230	1.8816	2.0497	2.0550	2.1964	2.2737
	Cambodia	0.2744	0.2154	0.3683	0.3503	0.3521	0.3827	0.3987	0.4127	0.4150
	Indonesia	0.0003	0.0003	0.0003	0.0003	0.0004	0.0004	0.0004	0.0004	0.0004
	Lao PDR	0.4030	0.4342	0.4902	0.4517	0.4532	0.5007	0.4947	0.5532	0.5955
	Malaysia	0.0005	0.0004	0.0007	0.0007	0.0007	0.0008	0.0008	0.0008	0.0008
	Philippines	0.0006	0.0006	0.0006	0.0007	0.0007	0.0008	0.0008	0.0008	0.0008
	Singapore	0.0003	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0005	0.0005
	Vietnam	0.0029	0.0024	0.0032	0.0033	0.0027	0.0035	0.0039	0.0046	0.0047
	ROASEAN	0.5813	0.7331	0.9430	0.9433	0.9988	1.0842	1.0735	1.1399	1.1699
	ROW	0.0598	0.0630	0.0682	0.0723	0.0726	0.0764	0.0818	0.0835	0.0860
	Grand total	4.6656	5.0333	6.3831	6.2149	6.4015	6.9359	6.9617	7.4165	7.6733

Source: Result from the study's model

Table 3.16 shows value of migrant labor by origin for BAU case. Most of migrant labors in Thailand are from ROASEAN following by Lao PDR and Cambodia. The main factors which influence the trend for migrant labors to move to Thailand are the income gap between Thailand and its neighbors, the downturn in the growth of the Thai workforce and the enhanced infrastructure allowing easier movement between the nations of the Greater Mekong Sub-region. Moreover, a large demand for low-skilled labors in labor-intensive production also attracts foreign laborers to come across the borders and work in Thailand (Pholphirul, 2012).

This chapter uses the dynamic multi-countries CGE model simulate the BAU scenario of ASEAN economy, and Thai economy and employment. Although AEC positively affects economy of every ASEAN country, there are some sectors gain and some sectors lose from AEC which will show in next chapter. In addition, Findings in this chapter will be the BAU scenario for the next chapter.

Chapter 4

The Effect of AEC on Economy and Employment in Thailand

The advent of AEC is expected to address current obstacles to cross-border trade, such as zero tariff, limitations upon foreign investment, while also providing a degree of trade policy harmonization across the region. This should in turn result in a significant effect on Thai economy and employment because the environment of economic activities and competitions in the region will change.

Thailand also faces some challenged both outside and inside country including challenged by countries with certain comparative advantages and by the issue of aging society. Therefore, Thailand should prepare for those effects by improving its competitive advantage and preventing the future threats. Thus, the overall long-term development policy in line with these challenges should be strongly promoted. The study measures and quantifies the effect in to different economic aspects in order to precisely choose the appropriated policies for Thailand in the long run.

Estimating the effects of AEC on economy and employment in Thailand is a top priority before recommend appropriate policy to improve competitive advantage and prevent the future threats. This chapter estimates macro and sectoral impacts of AEC on economy, output, and employment in Thailand in order to narrow the potential sector which have competitive advantage. In addition, the chapter also suggests improved productivity of labor could compensate the effect of aging society.

4.1 Background

The main objective of AEC is to integrate region economies to become a single market and production base. The key agreements are allowing free flow of services, investment, capital, and skilled labor within ASEAN members (ASEAN, 2008).

Removing such barriers reduce trade costs leading to improve the competitiveness of members and increase trade in the region (Petri *et al.* 2012).

Benefits of economic integration are depending on static and dynamic effects (Siah, Choong, & Yusop, 2009). The static effects are calculated in terms of growing the efficiency of production and consumer welfare. The static effects are generally referred to one time changes in the allocation of resources (Ramasamy 1995). The dynamic effects of economic integration, causing the total economic growth rate of member countries in the long term.

Ramasamy (1995) estimated the effect of resource allocation among ASEAN members and found that there would be a net gain in welfare for Indonesia, Philippines, and Thailand and net loss for Malaysia and Singapore. He concluded that his work estimated only static effects or measuring only the short term but it was possible that the positive dynamic effects (or in the long term) of enlarged competition, economies of scale and the profits of intra-industry trade outlying compensate the short term effects.

Various researches studied the interrelationship between macroeconomic conditions and demand-side policy by using CGE model (Carneiro & Arbache, 2003; Akapaiboon, 2010; Raihan, 2010). Akapaiboon (2010), Carneiro and Arbache (2003), and Raihan (2010) investigated the effect of trade liberalization, representing by removing tariff. The simulation results showed that trade liberalization has a positive effect on economic welfare in Thailand, Brazil and Bangladesh. Akapaiboon (2010) suggested that the manufacturing sector's productivity grows subsequently trade liberalization, although the production of the agricultural segment deceases. The reason was because after trade reform there was a shift of labor from agricultural sectors to the growing manufacturing and service sectors. At the micro level, household income improves essentially because of a rise in unskilled and skilled wages. Moreover, Carneiro and Arbache (2003) explored the impacts of export promotion and productivity shocks on the economy. For the export promotion policy shock, they imposed a 20% increase in export leading to local inflation rates drop by 0.26% and real GDP increases by 0.53%. For the productivity shock, they levied a 10% increase in the movement parameter of the production function leading to more effectiveness

leads to lower prices by reducing the inflation rate by 7.7% and real GDP rises by approximately 10%.

For research studied the interrelationship between macroeconomic conditions and supply-side policy by using CGE model (Razack, Devadoss, & Holland, 2009). Razack *et al.* (2009) established a CGE model for India and included Harris-Todaro economic characteristics of labor migration. Harris-Todaro migration equilibrium condition claims that the wages in the agricultural sector is equivalent to the manufacturing wage times the probability of being employed in the manufacturing sector (Todaro, 1969). In equilibrium, rural wage must equal the expected wage in the urban sector. By applying the model, Razack *et al.* (2009) are able to analyze the effects of agricultural production subsidy policies. The results showed that agricultural production subsidy raises agricultural production, decreases unemployment, increases the wage rate in the agriculture sector, escalates the consumption among the rural and urban households, and improves the rental rate for capital in agricultural sector.

Another research perspective studied economic integration directly affected to region welfare (Plummer & Yue, 2009). Petri *et al.* (2012) estimated the AEC economic impacts by using CGE model and they found that AEC increased ASEAN welfare by 5.3% or 69 billion US dollar. Although these were not specifically in their model, they suggested other positive impacts such as lower cost of capital due to freer movements of capital and improved financial systems, gains from freer movement of skilled labor, and greater macroeconomic stability due to the macroeconomic policies necessary to support the AEC.

4.2 Methodology

This chapter aims to investigate the effect of AEC on Thai economy and employment due to AEC. There were variety of model uses in order to explore the impact of economic integration. This chapter uses the dynamic multi-countries CGE model. This is because, firstly, the CGE model is widely used tool to examine the impacts of shocks on economy in industry or country levels because the GCE model lies in its ability to assess the complex outcomes. Secondly, the CGE model is suited to investigate and to test the relationships between all agents, sectors, and other economies

by consisted of equations describing the interaction of whole economy caused by various economic shocks including attempting economic integration (Nana *et al.*, 2009).

This chapter uses a dynamic multi-countries CGE model to investigate the impact of AEC on economy and employment in Thailand. The chapter model sets each scenario (or exogenous shock) according to elements of economic integration from AEC including zero import and export taxes, improve investment climate, trade cost reduce and last scenario is to combine these three elements to represent economic integration for AEC.

Model structure in this chapter contains 8 sets of equation, which are production, income and saving, producer supplies of products and international trade, prices, equilibrium, gross domestic product, dynamics, Warlas' law (Appendix G1), closure rule (Appendix G3). The dynamic multi-countries CGE model used in this chapter is based on a global general equilibrium model developed by Robichaud *et al.* (2013). The complete list of equations, sets, variables and parameters are in Appendix B.

The full specification and equations of the model are described in Appendix B. It is calibrated from the GTAP Version 8 database[16] and the 2007 base year of that dataset is projected for eight years in the baseline using the data from several sources for growth projections as shown in Table 3.1.

There are basic assumptions for the CGE model. Prices will be set at market-clearing levels, businesses will seek to maximize their profits, and customers will aim to maximize their utility. Such an economy is expected to reach equilibrium when supply and demand are adjusted in response to relative costs of production to the point where they are equal in each market. The production structure of businesses is assumed to encompass zero pure profits.

Closure rules (Appendix G3) and exogenous growth variables are typical assumptions for this study. Difference in these assumptions can affect empirical simulation results. Closure rules are as following.

[16] Robichaud *et al.* (2013)

- Government spending growth equals to GDP growth
- Investment growth equals to GDP growth
- Household saving growth equals to GDP growths
- Exchange rate is fixed
- GDP deflator of ROW is a numeraire (Appendix G2)
- Minimum consumption growth equals labor supply growth
- Wage of migrant labor growth equals to inflation growth

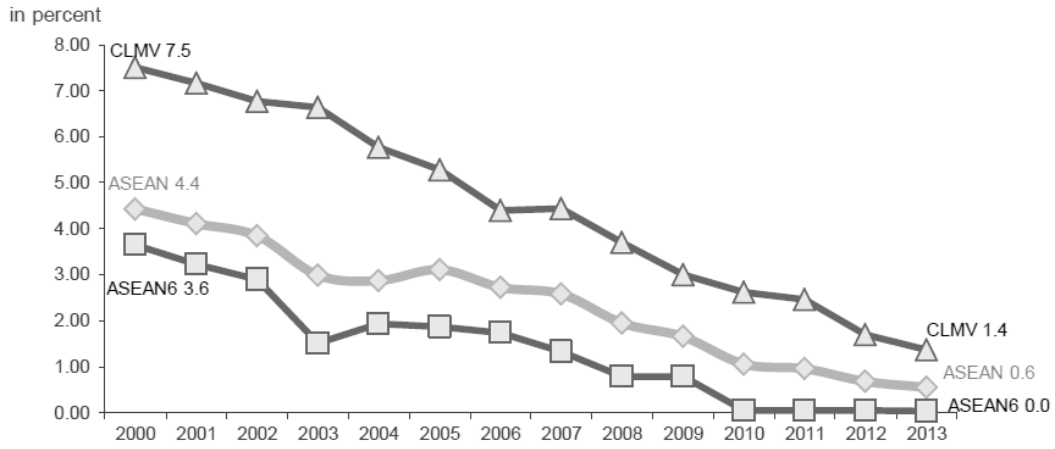
4.2.1 Scenario setup

The study is modeling the effect of 4 scenarios on ASEAN and Thai economies. The study sets each scenario (or exogenous shock) according to elements of economic integration from AEC including zero import and export taxes, improve investment climate, trade cost reduce and last scenario is to combine these three elements to represent economic integration for AEC.

4.2.1.1 Scenario A: Zero tariff

Economic integration starts with the FTA with remove quantitative restriction or tariff between members but each country remains its own tariff against non-members (Balassa, 1962). Thus, the first step of AEC would begin with lowering tariff between members which leads to increase the volume of trade (European Bank, 2012). The policy of AFTA was to remove all existing tariffs on goods, and this aim was given further support by the agreements of AEC which can speed this process by reducing the number of industries and product categories which carry exemptions (Petri *et al.*, 2012).

Figure 4.1: Trend of the intra-ASEAN tariff rate, 2000-2013 (unit in percentage)



Source: ASEAN Secretariat (2014)

Figure 4.1 shows trend of intra-ASEAN tariff rate from 2000 to 2013. The average intra-ASEAN tariff in ASEAN 6 (Brunei, Indonesia, Malaysia, Philippines, Singapore, and Thailand) has gone down to near zero since 2010 and ASEAN as a whole was about 1% while average tariff rate of CLMV countries has continued declined and it was 1.4% in 2013.

This study reduces tariff to zero for all goods since in the near future AEC would encourage removing intra-ASEAN tariff. The simulation in this section aims to investigate the change in the removal of import and export taxes which are bounded to remove due to the international agreement on trade. The study aims to deliver a comprehensive result from AEC which generally comprises of lowering barriers and facilitating investment and trade. Therefore, the study model will implement more shocks for investment and trade costs.

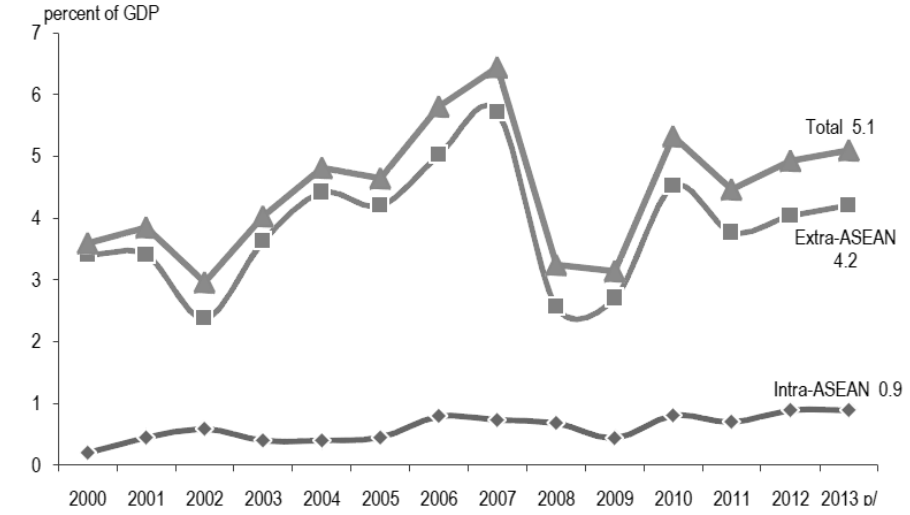
4.2.1.2 Scenario B: Improve investment climate

There was evidence of increased FDI during transition of EU integration. Bevan and Estrin (2004) found that EU announcements about accession prospects of each member positively increased FDI inflows to that member country. The benefits of FDI are mainly return to FDI-invested companies by the form of profits from investment. The host country would benefit as a result of a higher tax, transfer of technological

knowledge, promote technical innovation, greater international connectivity, investments in human capital, and higher wages, which are often introduced by foreign businesses (Bevan & Estrin, 2004; Petri, Plummer, & Zhai, 2012). In addition, Hanson (2003) reported that NAFTA appeared to have benefit to Mexico by raising investor confidence in the country resulted to FDI increased. Before NAFTA, from 1980 to 1994, Mexico had average FDI 1.3% of its GDP while, under NAFTA, from 1995 to 2000, average FDI was 2.8% of GDP.

Furthermore, producers within a regional integration group can benefit from increased market size which economies of scale become possible (Baldwin & Venables, 1995). The large market will create a high degree of specialization of production and affect factor prices in member countries, thus it would possible to attract more the flow of investment into industries which have a comparative cost advantage which will raise the demand for capital (Robson, 1968; European Bank, 2012). Capital will flow to the regional integration countries from ROW (Baldwin & Venables, 1995). Moreover, regional economic integration would encourage member countries to strengthen their political institutions. Cross-country synchronization would lead to member countries revise laws and regulations, in turn promoting business environment improvement (European Bank, 2012). Petri *et al.* (2012) estimated host-economy benefits amount to an annual 5% return on FDI stocks.

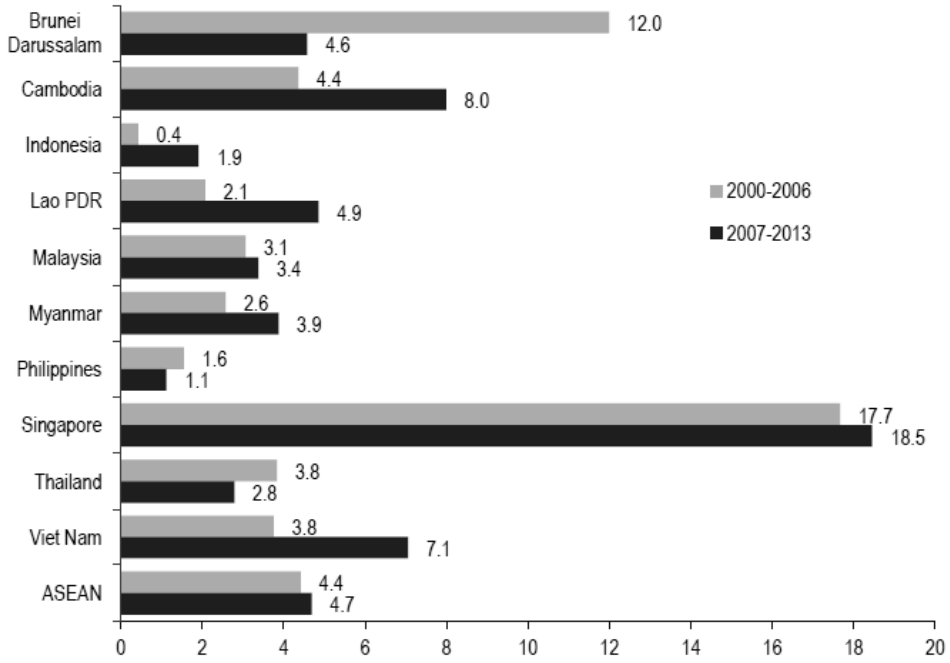
Figure 4.2: FDI inflows share to GDP, 2000-2013 (unit in percent of GDP)



Source: ASEAN Secretariat (2014)

Figure 4.2 shows inflow of FDI to ASEAN countries as percentage of ASEAN GDP from 2000 to 2013. As a percentage of GDP, FDI inflows from extra-ASEAN account for 4.2% and from intra-ASEAN account for 0.9%. The highest recorded of total net FDI inflow was 6.5% in 2007. Moreover, Figure 4.3 shows FDI inflows share to GDP by ASEAN members. Thailand and Philippines have less FDI inflows during 2007-2013 than 2000-2006 while other member countries have more FDI inflows during 2007-2013 than 2000-2006.

Figure 4.3: FDI inflows share to GDP, by ASEAN member states (unit in percent of GDP)



Source: ASEAN Secretariat (2014)

According to AEC Blueprint (ASEAN, 2008), one of AEC objectives is to encourage more investment by removing restrictions on service trade, allowing at least 70% equity participation, implementing intellectual property rights action plan. These all actions should improve investment climate in the region. Thus, ASEAN would attract more FDI after AEC. Improvements in investment climate are modeled as an external shock to the CGE model. The method requires the likely increase in FDI as a result of the improved investment climate to be estimated for each ASEAN economy. These estimates can then be applied within the GCE model, where the results of the

increased investment can be assessed in terms of production and export increases, and higher capital stock values.

According to Petri *et al.* (2012), it would be possible to estimate the potential to improve FDI flows to the ASEAN region through two approaches. The first approach is to make a simple comparison between the ASEAN region and the world's leading economies in terms of FDI levels. The second approach would be more complicated and involves the creation of a model of the FDI inflows which responds appropriately to variations in the characteristics which would be expected to be influenced by the advent of AEC. These factors would include openness to trade and investment and banking efficiency.

Table 4.1: *Effect of the AEC on FDI stocks (unit in million US dollar)*

	(Million US Dollar)	
	GDP[17]	FDI Stock[18]
ASEAN	2,478,002	1,264,296
Brunei Darussalam	17,257	14,890
Cambodia	16,709	7,889
Indonesia	888,538	211,900
Lao PDR	11,772	3,150
Malaysia	326,933	151,039
Myanmar	64,330	7,707
Philippines	284,582	25,851
Singapore	307,872	598,365
Thailand	373,804	185,689
Vietnam	186,205	57,816

Source: World Bank and United Nations Conference on Trade and Development (UNCTAD)

Petri *et al.* (2012) used the first approach by comparing the number of top 3 years of FDI/GDP in the past and the 75th percentile of the global distribution of FDI/GDP ratios with the actual ASEAN's FDI stocks. The differences are significant which ranging from 28% to 63% of baseline FDI stocks, relative to actual 2006 FDI

[17] GDP data of 2014 is obtained from http://data.worldbank.org/data-catalog/GDP-ranking-table

[18] FDI stock of 2012 is obtained from http://unctad.org/en/Pages/DIAE/FDI%20Statistics/FDI-Statistics-Bilateral.aspx

stocks. Then, they estimated the benefits of FDI to host economy and reported an annual 5% return on FDI stock which is equivalent to the amount of 1% of annual ASEAN GDP. This amount used as their external shock of FDI improvement according to AEC. This study will follow the estimation step from Petri *et al.* (2012).

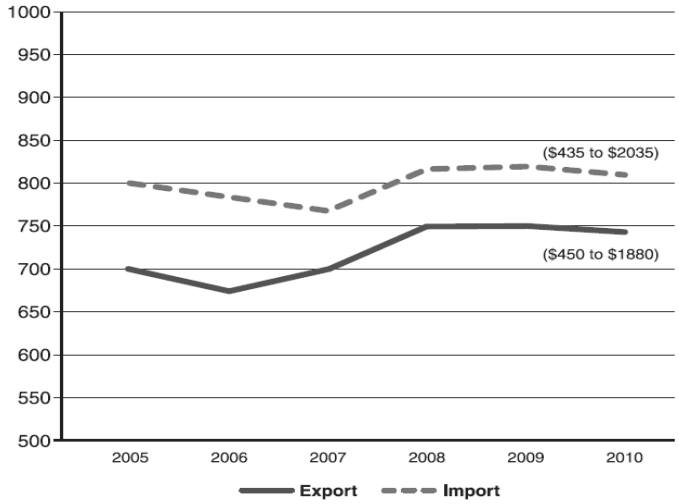
This study will follow Petri *et al.* (2012)'s method to estimate the FDI inflows under AEC. Accroding to Table 4.1, the differences between baseline FDI stocks and the number of top 3 years of FDI are ranging from 28% to 63% of baseline FDI stocks and this would equal to a range of 354 - 797 billion US dollars of additional FDI stocks. According to Petri *et al.* (2012), the host economy would benefit amount to an annual 5% return on FDI stocks. Therefore, the benefits associated with the FDI increases calculated with Table 4.1 would amount to the annual 18 - 40 billion US dollars range, or in the range of 0.7 - 1.6% of annual ASEAN GDP. This study will assume FDI inflows to each ASEAN country by 1% of its BAU GDP as similar to Petri *et al.* (2012) calculation.

4.2.1.3 Scenario C: Reduce trade costs

Trade costs defines as all costs in getting goods to final consumers such as transportation costs, comprising both time and freight cost, and policy barrier, comprising both tariff and non-tariff barriers (Anderson & Wincoop, 2004). Normally, trade costs are reported in terms of ad-valorem tax equivalent.

Baldwin and Venables (1995) suggested that trade cost is one element that responded from economic integration. In other words, lower trade barrier due to economic integration leads to the decline in trade cost. AEC could lower trade cost among members by improving transportation network and fasten the administrative trading process. Firstly, cost savings achieves through coordinated construction of transport facilities such as regionally integrated railway and highway networks (Balassa & Stoutjesdijk, 1975). Secondly, cost savings reflects from the elimination of administrative burdens as customs checks are removed from internal borders, this should reduce transaction costs as well as enhance country competitiveness (European Bank, 2012). In Petri *et al.* (2012) model, they assumed trade costs reduced by 5% of the value of trade as a result of the AEC while they claimed that other studies have larger estimation. Reducing trade cost aims to facilitate trade within ASEAN.

Figure 4.4: Cost of import and export in ASEAN, 2005-2010[19] *(unit in US dollar per container)*



Source: ASEAN Secretariat (2012)

Figure 4.4 shows the average per-container cost across ASEAN of import and export from 2005 to 2010. The average cost of import fluctuated around US$800 per container while export costs which fluctuated around an average of US$719 per container. The variation in the cost of import and export over the period was large. For example, in 2010 import costs ranged from a low around US$435 to a high of US$2035 per container, and exports costs varied from a low around US$450 to US$1880. These variations may reflect natural geographical differences with land-locked countries likely to experience higher trading costs (ASEAN Secretariat, 2012).

Moreover, there has been little improvement in per-container trade costs since 2005. This indicates significant barriers to trade remain, in particular a lack of adequate physical infrastructure in the region. Therefore, AEC could encourage members to bring about reductions in the trade cost such as regionally integrated railway and highway networks.

Moreover, the AEC builds on AFTA but drive further beyond tariffs to non-tariff barriers. However, data on non-tariff barriers are difficult to obtain (Bora, Kuwahara, & Laird, 2002; Petri, Plummer, & Zhai, 2012; UNCTAD, 2013). There are

[19] Note: Costs shown are simple average (Min and Max in parentheses)

various means of imposing non-tariff barriers, such as particularly rigorous specification standards for products, the need to obtain licenses, quota limits for imports and legislation to prevent dumping. The effects of these measures can be assessed by using a model to predict the expected trade levels and then comparing this with actual levels under the assumption that the difference can be attributed to the trade barriers, or by gathering opinions on the effects through the use of surveys (Petri *et al.*, 2012).

Table 4.2 Market access overall trade restrictiveness index, 2012

	Indonesia	Cambodia	Lao PDR	Malaysia	Philippines	ROASEAN	Singapore	Thailand	Vietnam
MAOTRI[20]	13.2%	23.5%	9.7%	7.3%	14.2%	8.6%	6.2%	11.1%	13.9%

Source: World Bank[21]

Table 4.2 shows the market access overall trade restrictiveness index (MAOTRI) which are estimated by the World Bank. It represents the uniform tariff equivalent of the partner country's tariff and non-tariff barriers which express barriers as tariff equivalents. This index can be use as the removal of non-tariff barrier, including regulatory barriers such as diverging standards and testing requirements. According to Table 4.2, the MAOTRI for ASEAN countries are equal to 12%. Thus, this average number could represent the highest limit of the amount of trade cost reduction. These levels would likely to decrease as a result of the policies implemented across the ASEAN region through AEC and the WTO to liberalize trade. In the absence of detailed information for trade costs which include transportation costs and non-tariff barriers, this study assumes a reduction in trade costs of 5% of trade values as similar to Petri *et al.* (2012).

[20] Market access overall trade restrictiveness index (MAOTRI) captures the tariff and non-tariff barriers imposed by the trading partners of each country on its export bundle (World Bank). In other word, MAOTRI measures the uniform tariff equivalent of the partner country's tariff and non-tariff barriers that would generate the same level of export value for the country.

[21] http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:22574446~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html

4.2.1.4 Scenario D: Combining A, B and C to represent AEC

Lower tariff trade barriers should increase the volume of trade (zero tariff). The effects would mainly reflect from the lower price of imported goods relative to domestic goods, thus stimulate the volume of trade between partners. Lower trade barrier reduces cost of international trade which reflects from the elimination of administrative barriers as customs checks are removed from internal borders. This should reduce transaction costs of trade and enhance country competitiveness (reduce trade costs).

When trade volumes rise, this will have an effect upon the pricing and cost structures within the economy and may lead to changes in resource allocation, with a concomitant improvement in production efficiency. One way to take advantage of this is for neighboring countries to collaborate in production to benefit from each other's comparative advantages. These producers will also enjoy access to a larger integrated market, and can also take advantage of economies of scale. Specialization becomes more feasible in a larger economy, causing additional investment flows into those countries which offer cost advantages through their specializations. The need to harmonize and integrate across the region can also lead to countries developing their political institutions as their economies progress. Cross-border synchronization would be accomplished though the revision and harmonization of regulations which would stabilize and simplify the business climate for the benefit of the wider economy.

Table 4.3: Scenario of the chapter

Scenario	Name	Description	Source
A	Zero tariff	The conclusion of the terms of the AFTA agreement which seeks to eliminate all remaining tariffs within ASEAN. They are modeled by set import and export taxes between ASEAN countries equal to 0%.	(European Bank, 2012) (Petri *et al.*, 2012)
B	Improve investment climate	Improve the investment climate. They are modeled by increased FDI inflows to each ASEAN country by 1% of its GDP	(Baldwin & Venables, 1995) (Bevan & Estrin, 2004) (Petri *et al.*, 2012)
C	Reduce trade costs	Lower trade barrier reduces cost of international trade which reflects from the elimination of administrative burden and customs processes and procedures. Since the details of these barriers are neither clear nor available, the model assumes a reduction in trade costs of 5% of trade values.	(Baldwin & Venables, 1995) (Anderson & Wincoop, 2004) (European Bank, 2012) (Petri *et al.*, 2012)
D	AEC	Combine scenario A, B, and C to represent AEC.	

Source: The study's scenarios

This scenario is to determine the effects of the AEC by combining scenario A, B, and C. This condition is estimated with an aim to estimate the effects of AEC on all member countries, especially Thailand. This scenario has the goal to generate the lower bound estimation. Table 4.3 concludes all scenario's shocks, description, and sources.

4.3 Results

This results section consists of 3 mains parts. First part is the results of each scenario which will simulate the effect of each scenario on ASEAN and Thai economies. Second part is the results analysis which will discuss the effect of AEC on Thai economy and the third part is policy suggestions for the benefit of long term growth.

4.3.1 Results of scenario

The results of each scenario will show the effect of macro indicators on ASEAN countries and the effect of both macro indicator and labor market on Thailand in sectoral level.

4.3.1.1 Scenario A: Zero tariff

Completion of the AFTA agreement, the study shocks the CGE model by reducing import and export taxes to zero.

4.3.1.1.1 Effects on ASEAN

Table 4.4: Percentage change of GDP from BAU (Scenario A)

	Change in GDP from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	4.53	4.03	3.52	2.98	2.41	1.79	1.11	0.35
Indonesia	0.27	0.24	0.22	0.20	0.18	0.16	0.15	0.13
Lao PDR	1.77	1.60	1.44	1.28	1.12	0.97	0.83	0.68
Malaysia	0.93	0.91	0.89	0.87	0.84	0.82	0.80	0.78
Philippines	0.70	0.63	0.55	0.47	0.39	0.30	0.21	0.11
Singapore	1.08	1.03	1.09	1.13	1.14	1.14	1.14	1.13
Thailand	***1.01***	***0.99***	***0.95***	***0.91***	***0.87***	***0.83***	***0.78***	***0.72***
Vietnam	1.86	1.95	2.01	2.05	2.09	2.12	2.15	2.18
ROASEAN	1.27	1.08	0.87	0.66	0.46	0.29	0.14	0.04
ROW	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01

Source: Result from the study's model

Table 4.4 shows the percentage change from BAU case of real GDP for scenario A. Zero tariff has most positive impacted to Cambodia and Vietnam approximately 4% and 2% of GDP respectively at the first year. This is because the gain from consumption (Table 4.5) which is partly from import after reduce tariff to zero. However, every country except Singapore and Vietnam tends to lose its gain over time because consumption continuously declined due to the decline of labor income (Table AC.1, Appendix C1).

Table 4.5: Percentage change of consumption from BAU (Scenario A)

	Change in consumption from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	3.70	3.27	2.84	2.39	1.94	1.47	0.97	0.44
Indonesia	0.27	0.24	0.22	0.20	0.18	0.16	0.14	0.12
Lao PDR	1.63	1.45	1.28	1.11	0.95	0.79	0.64	0.49
Malaysia	1.05	1.02	1.00	0.97	0.93	0.90	0.88	0.85
Philippines	0.74	0.66	0.58	0.49	0.40	0.31	0.22	0.11
Singapore	1.29	1.24	1.30	1.35	1.36	1.37	1.36	1.35
Thailand	***1.08***	***1.05***	***1.01***	***0.96***	***0.92***	***0.88***	***0.83***	***0.77***
Vietnam	1.53	1.60	1.64	1.67	1.69	1.71	1.72	1.73
ROASEAN	1.25	1.05	0.83	0.61	0.40	0.21	0.04	-0.09
ROW	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01

Source: Result from the study's model

Table 4.5 shows the percentage change from BAU case of consumption for scenario A. Zero tariff has a positive impact to consumption in every country except ROW, however, the positive impact tends to decrease over time except Singapore and Vietnam. Although labor income has increased from zero tariff, it decreases over time which leads to the decline in consumption. Only Singapore and Vietnam can maintain the positive gain of labor income.

Table 4.6: Percentage change of export from BAU (Scenario A)

	Change in export from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	1.70	1.31	0.88	0.42	-0.06	-0.55	-1.06	-1.59
Indonesia	0.82	0.79	0.76	0.73	0.70	0.67	0.64	0.62
Lao PDR	2.19	2.26	2.26	2.22	2.14	2.04	1.92	1.78
Malaysia	0.54	0.51	0.48	0.46	0.42	0.37	0.32	0.26
Philippines	0.90	0.88	0.85	0.81	0.76	0.69	0.61	0.52
Singapore	0.47	0.49	0.63	0.75	0.82	0.90	0.96	1.02
Thailand	***1.00***	***0.91***	***0.85***	***0.77***	***0.68***	***0.58***	***0.47***	***0.35***
Vietnam	0.53	0.32	0.14	-0.02	-0.16	-0.29	-0.40	-0.51
ROASEAN	0.79	0.54	0.27	0.00	-0.27	-0.53	-0.76	-0.96
ROW	-0.43	-0.47	-0.49	-0.51	-0.54	-0.57	-0.60	-0.64

Source: Result from the study's model

Table 4.6 shows the percentage change from BAU case of export for scenario A. Zero tariff enhances the export to all ASEAN countries, however the gain declines

over time changes to negative for Cambodia, Vietnam, and ROASEAN because the decline of output in those countries leads to less export.

4.3.1.1.2 Effects on Thailand

Table 4.7: Percentage change of sectoral export from BAU for Thailand (Scenario A)

	Change in sectoral export from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	3.17	3.45	3.64	3.79	3.87	3.84	3.75	3.59
LiveStk&Meat	-0.49	-0.73	-0.92	-1.12	-1.32	-1.53	-1.75	-1.99
Mining&Extractn	0.82	0.59	0.34	0.06	-0.23	-0.52	-0.83	-1.13
Procfood	1.51	1.45	1.41	1.35	1.27	1.19	1.07	0.94
Textiles&Clothing	-0.16	-0.37	-0.52	-0.71	-0.91	-1.12	-1.34	-1.58
LightMnfc	0.17	-0.05	-0.20	-0.39	-0.59	-0.79	-0.99	-1.19
HeavyMnfc	1.34	1.22	1.14	1.04	0.92	0.80	0.66	0.51
Util&Constuct	-0.05	-0.26	-0.43	-0.64	-0.85	-1.05	-1.24	-1.44
OthServices	-0.53	-0.47	-0.36	-0.26	-0.17	-0.06	0.06	0.20

Source: Result from the study's model

Table 4.7 shows the percentage change from BAU case of sectoral export for scenario A for Thailand. Zero tariff increases total Thai export but there are some sectors gain and some sectors lose. Thailand exports more grains & crops, processed food, and heavy manufacturing but exports less livestock & meat products, mining & extraction, textiles & clothing, light manufacturing, utilities & construction, and other services.

Table 4.8: Percentage change of sectoral import from BAU for Thailand (Scenario A)

	Change in sectoral import from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	5.80	5.69	5.63	5.61	5.62	5.66	5.73	5.83
LiveStk&Meat	2.12	2.27	2.36	2.47	2.59	2.71	2.84	2.97
Mining&Extractn	0.30	0.24	0.18	0.12	0.05	-0.03	-0.12	-0.23
Procfood	5.49	5.54	5.54	5.56	5.60	5.67	5.73	5.79
Textiles&Clothing	2.89	2.98	3.03	3.08	3.15	3.22	3.28	3.35
LightMnfc	3.21	3.32	3.34	3.39	3.44	3.50	3.55	3.60
HeavyMnfc	1.22	1.16	1.09	1.01	0.94	0.86	0.77	0.67
Util&Constuct	-1.13	-1.24	-1.30	-1.37	-1.47	-1.60	-1.75	-1.91
OthServices	0.63	0.53	0.38	0.24	0.11	-0.04	-0.20	-0.37

Source: Result from the study's model

Table 4.8 shows the percentage change from BAU case of sectoral import for scenario A for Thailand. Zero tariff increases total Thai import, only utilities & construction has less import and decreases over time. This is because consumption demand increase due to increase in labor income.

Table 4.9: Percentage change of sectoral output from BAU for Thailand (Scenario A)

	Change in sectoral output from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	0.42	0.46	0.43	0.39	0.31	0.18	0.02	-0.19
LiveStk&Meat	0.03	-0.14	-0.29	-0.45	-0.61	-0.77	-0.95	-1.14
Mining&Extractn	-0.09	-0.40	-0.72	-1.07	-1.43	-1.81	-2.21	-2.62
Procfood	0.36	0.27	0.18	0.07	-0.04	-0.17	-0.33	-0.51
Textiles&Clothing	-0.18	-0.38	-0.54	-0.73	-0.92	-1.13	-1.35	-1.58
LightMnfc	-0.41	-0.63	-0.81	-1.01	-1.22	-1.42	-1.64	-1.87
HeavyMnfc	0.24	0.09	-0.05	-0.21	-0.37	-0.55	-0.74	-0.95
Util&Constuct	-1.04	-1.31	-1.49	-1.72	-1.97	-2.23	-2.50	-2.78
OthServices	-0.03	-0.06	-0.08	-0.10	-0.12	-0.14	-0.17	-0.19

Source: Result from the study's model

Table 4.9 shows the percentage change BAU case of sectoral output from for scenario A for Thailand. Zero tariff increases the volume of output production for first year and it tends to have negative impact from second year. This is because Thailand

changes to import goods rather than produce. In addition, grains & crops, which is labor intensive sector, have the smallest negative impact for year 8.

Table 4.10: Percentage change of sectoral employment from BAU for Thailand (Scenario A)

	Change in sectoral employment from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	1.00	1.00	0.98	0.95	0.89	0.80	0.68	0.55
LiveStk&Meat	0.08	0.10	0.12	0.14	0.14	0.15	0.15	0.14
Mining&Extractn	-0.36	-0.64	-0.91	-1.21	-1.53	-1.86	-2.22	-2.59
Procfood	1.30	1.42	1.60	1.75	1.88	2.02	2.15	2.29
Textiles&Clothing	-0.52	-0.50	-0.37	-0.27	-0.20	-0.11	-0.01	0.09
LightMnfc	-1.19	-1.14	-1.01	-0.90	-0.80	-0.67	-0.54	-0.40
HeavyMnfc	0.84	0.88	1.00	1.10	1.20	1.33	1.47	1.63
Util&Constuct	-3.15	-3.17	-2.95	-2.76	-2.64	-2.54	-2.47	-2.39
OthServices	-0.07	-0.14	-0.18	-0.23	-0.29	-0.34	-0.40	-0.46

Source: Result from the study's model

Table 4.10 shows the percentage change from BAU case of sectoral employment for scenario A for Thailand. Employment tends to neutral to zero tariff, however there is reallocated of labor in each sector. Grains & crops, livestock & meat products, processed food, and heavy manufacturing sectors employ more labor while other sectors sector employs less labor. Utilities & construction sector employs less labor meaning Thailand ships this job to other countries or Thailand uses more capital in this sector instead.

Table 4.11: Percentage change of sectoral employment of domestic labor from BAU for Thailand (Scenario A)

Change in sectoral employment of domestic labor from BAU (percentage)									
Type of labor	Sector	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Unskilled	Grains&Crops	0.95	0.96	0.94	0.91	0.86	0.77	0.66	0.53
	LiveStk&Meat	0.00	0.02	0.06	0.08	0.08	0.10	0.10	0.10
	Mining&Extractn	-0.40	-0.67	-0.93	-1.23	-1.55	-1.89	-2.24	-2.61
	Procfood	1.13	1.24	1.43	1.59	1.72	1.87	2.01	2.16
	Textiles&Clothing	-0.69	-0.70	-0.55	-0.45	-0.38	-0.27	-0.17	-0.05
	LightMnfc	-1.37	-1.34	-1.20	-1.08	-0.97	-0.83	-0.69	-0.53
	HeavyMnfc	0.65	0.67	0.80	0.91	1.02	1.16	1.30	1.48
	Util&Constuct	-3.35	-3.39	-3.16	-2.97	-2.85	-2.74	-2.66	-2.57
	OthServices	-0.30	-0.40	-0.43	-0.49	-0.55	-0.60	-0.66	-0.71
Skilled	Grains&Crops	0.98	1.00	0.99	0.97	0.92	0.84	0.74	0.61
	LiveStk&Meat	0.06	0.09	0.14	0.17	0.20	0.22	0.24	0.26
	Mining&Extractn	-0.37	-0.64	-0.90	-1.19	-1.51	-1.84	-2.18	-2.55
	Procfood	1.26	1.39	1.61	1.80	1.97	2.14	2.32	2.50
	Textiles&Clothing	-0.56	-0.53	-0.35	-0.21	-0.10	0.04	0.18	0.33
	LightMnfc	-1.23	-1.17	-0.99	-0.84	-0.70	-0.53	-0.35	-0.16
	HeavyMnfc	0.79	0.84	1.01	1.15	1.29	1.47	1.65	1.86
	Util&Constuct	-3.20	-3.21	-2.94	-2.72	-2.56	-2.42	-2.30	-2.17
	OthServices	-0.15	-0.22	-0.21	-0.23	-0.26	-0.27	-0.29	-0.30

Source: Result from the study's model

Table 4.11 shows the percentage change from BAU case of sectoral employment of domestic labor for scenario A for Thailand. Every sector employs less Thai labors for both skilled and unskilled labors while employ more migrant labors for both skilled and unskilled labors (Table 4.12). Every sector employs less Thai skilled and unskilled labors in quite same proportion.

Table 4.12: Percentage change of sectoral employment of migrant labor from BAU for Thailand (Scenario A)

Change in sectoral employment of migrant labor from BAU (percentage)									
Type of labor	Sector	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Unskilled	Grains&Crops	1.48	1.47	1.40	1.34	1.25	1.12	0.96	0.78
	LiveStk&Meat	0.98	0.97	0.92	0.87	0.81	0.74	0.66	0.57
	Mining&Extractn	-0.02	-0.31	-0.60	-0.93	-1.28	-1.64	-2.03	-2.43
	Procfood	3.27	3.34	3.34	3.34	3.34	3.31	3.26	3.20
	Textiles&Clothing	1.67	1.62	1.56	1.49	1.41	1.32	1.21	1.09
	LightMnfc	0.98	0.97	0.90	0.85	0.81	0.75	0.68	0.61
	HeavyMnfc	3.05	3.02	2.94	2.88	2.83	2.77	2.71	2.64
	Util&Constuct	-0.86	-0.94	-0.93	-0.92	-0.96	-1.06	-1.20	-1.36
	OthServices	2.26	2.12	1.85	1.61	1.38	1.11	0.83	0.52
Skilled	Grains&Crops	1.46	1.45	1.38	1.32	1.22	1.09	0.93	0.74
	LiveStk&Meat	0.96	0.94	0.88	0.83	0.76	0.69	0.60	0.50
	Mining&Extractn	-0.03	-0.32	-0.62	-0.95	-1.30	-1.66	-2.05	-2.46
	Procfood	3.21	3.27	3.26	3.25	3.23	3.18	3.12	3.04
	Textiles&Clothing	1.60	1.55	1.47	1.38	1.29	1.18	1.06	0.93
	LightMnfc	0.91	0.89	0.81	0.74	0.69	0.61	0.53	0.44
	HeavyMnfc	2.99	2.95	2.85	2.77	2.70	2.63	2.55	2.47
	Util&Constuct	-0.93	-1.02	-1.03	-1.04	-1.09	-1.21	-1.36	-1.54
	OthServices	2.19	2.03	1.75	1.49	1.25	0.97	0.67	0.34

Source: Result from the study's model

Table 4.12 shows the percentage change from BAU case of sectoral employment of migrant labor for scenario A for Thailand. Most sectors employ more migrant labors especially processed food sector.

4.3.1.2 Scenario B: Improve investment climate

Improve the investment climate is modeled by increasing FDI inflows to each ASEAN country by 1% of its BAU GDP and assuming that FDI are from ROW.

4.3.1.2.1 Effects on ASEAN

Table 4.13: Percentage change of GDP from BAU (Scenario B)

	Change in GDP from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	-0.07	0.11	0.29	0.45	0.61	0.77	0.93	1.09
Indonesia	-0.03	0.17	0.35	0.51	0.66	0.79	0.90	1.00
Lao PDR	-0.03	0.18	0.38	0.55	0.70	0.85	0.98	1.10
Malaysia	-0.16	-0.04	0.09	0.21	0.31	0.38	0.45	0.50
Philippines	0.03	0.18	0.33	0.47	0.61	0.74	0.87	1.01
Singapore	0.10	0.11	0.14	0.17	0.18	0.20	0.21	0.21
Thailand	***-0.02***	***0.07***	***0.18***	***0.27***	***0.37***	***0.46***	***0.56***	***0.67***
Vietnam	0.07	0.11	0.14	0.17	0.20	0.22	0.25	0.27
ROASEAN	-0.19	0.10	0.37	0.62	0.83	0.98	1.08	1.12
ROW	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01

Source: Result from the study's model

Table 4.13 shows the percentage change from BAU case of real GDP for scenario B. Improve investment climate has a positive effect to all ASEAN countries. This is because more capital (from FDI) leads to higher output level which increases demand of labor, thus wage increase. This effect boosted consumption (Table 4.14) and export (Table 4.15) over time, thus it leads to higher GDP.

Table 4.14: Percentage change of consumption from BAU (Scenario B)

	Change in Consumption from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	-0.06	0.10	0.25	0.38	0.52	0.65	0.77	0.90
Indonesia	-0.02	0.18	0.36	0.53	0.68	0.81	0.93	1.04
Lao PDR	-0.05	0.16	0.35	0.52	0.67	0.81	0.94	1.05
Malaysia	-0.17	-0.04	0.10	0.24	0.35	0.43	0.50	0.56
Philippines	0.03	0.18	0.34	0.48	0.62	0.76	0.89	1.03
Singapore	0.11	0.12	0.15	0.18	0.19	0.21	0.22	0.22
Thailand	***-0.03***	***0.06***	***0.18***	***0.28***	***0.38***	***0.48***	***0.58***	***0.68***
Vietnam	0.06	0.09	0.12	0.14	0.16	0.18	0.19	0.21
ROASEAN	-0.19	0.11	0.39	0.65	0.88	1.07	1.21	1.29
ROW	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01

Source: Result from the study's model

Table 4.14 shows the percentage change from BAU case of consumption for scenario B. Improve investment climate has a positive effect on all ASEAN countries due to higher labor income (Table AC.7, Appendix C2). However, at the beginning, consumption declines in some countries because labor income could not overcome the increase in inflation.

Table 4.15: Percentage change of export from BAU (Scenario B)

	Change in Export from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	-0.42	-0.30	-0.16	-0.02	0.12	0.26	0.41	0.55
Indonesia	-1.50	-1.21	-0.93	-0.65	-0.37	-0.10	0.16	0.41
Lao PDR	-1.32	-1.24	-1.10	-0.93	-0.75	-0.56	-0.37	-0.19
Malaysia	-0.41	-0.23	-0.05	0.13	0.29	0.41	0.53	0.62
Philippines	-0.87	-0.66	-0.44	-0.22	0.00	0.21	0.41	0.62
Singapore	-0.21	-0.09	0.05	0.18	0.29	0.40	0.50	0.59
Thailand	***-0.57***	***-0.36***	***-0.14***	***0.07***	***0.28***	***0.48***	***0.68***	***0.89***
Vietnam	-0.43	-0.28	-0.15	-0.03	0.07	0.17	0.25	0.33
ROASEAN	-0.65	-0.22	0.20	0.60	0.99	1.34	1.63	1.85
ROW	0.93	0.97	1.01	1.04	1.07	1.10	1.13	1.15

Source: Result from the study's model

Table 4.15 shows the percentage change from BAU case of export for scenario B. The improve investment climate has a negative impact on export at the beginning due to lower local product price but export will recover and gain over time because the price of export product will be higher.

4.3.1.2.2 Effects on Thailand

Table 4.16: Percentage change of sectoral export from BAU for Thailand (Scenario B)

	Change in Sectoral export from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	-0.27	0.14	0.52	0.85	1.16	1.47	1.78	2.11
LiveStk&Meat	-0.60	-0.14	0.27	0.63	0.93	1.22	1.51	1.79
Mining&Extractn	-0.10	-0.06	0.08	0.25	0.46	0.71	1.00	1.31
Procfood	-0.32	-0.05	0.23	0.48	0.73	0.97	1.22	1.47
Textiles&Clothing	-0.69	-0.45	-0.17	0.09	0.36	0.63	0.90	1.18
LightMnfc	-0.68	-0.46	-0.22	0.01	0.22	0.44	0.66	0.87
HeavyMnfc	-0.57	-0.32	-0.04	0.23	0.48	0.74	1.00	1.27
Util&Constuct	-0.70	-0.32	-0.03	0.30	0.62	0.90	1.17	1.42
OthServices	-0.70	-0.82	-0.95	-1.07	-1.19	-1.32	-1.45	-1.59

Source: Result from the study's model

Table 4.16 shows the percentage change from BAU case of sectoral export for scenario B for Thailand. Every sector has a positive effect from improve investment climate in the long run except other services sector. This is because more capital (from FDI) leads to higher output level which increases demand for export.

Table 4.17: Percentage change of sectoral import from BAU for Thailand (Scenario B)

	Change in sectoral import from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	0.32	0.18	0.09	0.02	-0.04	-0.09	-0.14	-0.19
LiveStk&Meat	0.62	0.42	0.26	0.13	0.02	-0.07	-0.16	-0.24
Mining&Extractn	0.11	0.37	0.60	0.82	1.03	1.23	1.42	1.62
Procfood	0.32	0.35	0.40	0.44	0.49	0.54	0.59	0.65
Textiles&Clothing	0.49	0.49	0.50	0.50	0.51	0.52	0.53	0.54
LightMnfc	0.89	0.92	0.95	0.99	1.03	1.08	1.13	1.19
HeavyMnfc	0.94	1.08	1.18	1.29	1.40	1.52	1.65	1.77
Util&Constuct	2.63	2.74	2.62	2.57	2.59	2.64	2.70	2.76
OthServices	0.82	1.00	1.18	1.36	1.55	1.73	1.93	2.13

Source: Result from the study's model

Table 4.17 shows the percentage change from BAU case of sectoral import for scenario B for Thailand. Improve investment climate increases every sector import,

especially utilities & construction sector. This is because higher output (Table 4.18) leads to demand of imported Intermediate goods.

Table 4.18: Percentage change of sectoral output from BAU for Thailand (Scenario B)

	Change in sectoral output from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	-0.11	0.25	0.59	0.88	1.16	1.43	1.71	2.00
LiveStk&Meat	-0.08	0.24	0.54	0.81	1.05	1.28	1.51	1.74
Mining&Extractn	-0.05	0.24	0.59	0.95	1.33	1.73	2.14	2.58
Procfood	-0.19	0.09	0.37	0.63	0.87	1.12	1.37	1.62
Textiles&Clothing	-0.43	-0.19	0.09	0.35	0.61	0.88	1.15	1.43
LightMnfc	-0.21	0.02	0.26	0.49	0.72	0.94	1.16	1.39
HeavyMnfc	-0.18	0.10	0.40	0.69	0.97	1.26	1.55	1.84
Util&Constuct	1.81	2.23	2.37	2.61	2.89	3.16	3.42	3.68
OthServices	0.00	0.04	0.08	0.12	0.15	0.19	0.22	0.25

Source: Result from the study's model

Table 4.18 shows the percentage change from BAU case of sectoral output for scenario B for Thailand. Improve investment climate increases every sector output except other services sector. This is because more capital (from FDI) leads to higher output level. In addition, the growth of the manufacturing sectors will depend on improvements in the investment climate because manufacturing sectors are relatively capital intensive sectors, thus increased FDI will reduce capital costs (Petri *et al.*, 2012).

Table 4.19: Percentage change of sectoral employment from BAU for Thailand (Scenario B)

	Change in sectoral employment from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	-0.25	-0.05	0.15	0.33	0.50	0.68	0.85	1.03
LiveStk&Meat	-0.20	-0.20	-0.19	-0.18	-0.18	-0.16	-0.15	-0.13
Mining&Extractn	-0.21	0.04	0.36	0.67	1.01	1.36	1.72	2.11
Procfood	-0.67	-0.85	-1.04	-1.23	-1.42	-1.61	-1.80	-1.99
Textiles&Clothing	-1.22	-1.28	-1.35	-1.41	-1.49	-1.57	-1.68	-1.79
LightMnfc	-0.61	-0.80	-0.99	-1.17	-1.37	-1.57	-1.78	-2.00
HeavyMnfc	-0.64	-0.81	-0.98	-1.14	-1.30	-1.47	-1.65	-1.83
Util&Constuct	5.59	5.28	4.22	3.46	2.89	2.40	1.95	1.54
OthServices	-0.01	0.09	0.18	0.28	0.37	0.46	0.54	0.62

Source: Result from the study's model

Table 4.19 shows the percentage change from BAU case of sectoral employment for scenario B for Thailand. Employment tends to neutral to improve investment climate, however there were reallocated in each sector. Utilities & construction sector employs more labor while grains & crops, mining & extraction, and other services sectors employ more labor after first or second years while the rest employ less labor.

Table 4.20: Percentage change of sectoral employment of domestic labor from BAU for Thailand (Scenario B)

Change in sectoral employment of domestic labor from BAU (percentage)									
Type of labor	Sector	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Unskilled	Grains&Crops	-0.28	-0.08	0.12	0.30	0.46	0.63	0.80	0.98
	LiveStk&Meat	-0.24	-0.25	-0.25	-0.25	-0.25	-0.24	-0.24	-0.23
	Mining&Extractn	-0.23	0.03	0.33	0.65	0.98	1.33	1.69	2.07
	Procfood	-0.75	-0.94	-1.15	-1.35	-1.56	-1.76	-1.97	-2.18
	Textiles&Clothing	-1.30	-1.39	-1.47	-1.55	-1.66	-1.76	-1.89	-2.02
	LightMnfc	-0.69	-0.91	-1.12	-1.32	-1.54	-1.75	-2.00	-2.24
	HeavyMnfc	-0.72	-0.92	-1.10	-1.27	-1.46	-1.64	-1.84	-2.04
	Util&Constuct	5.50	5.16	4.09	3.32	2.73	2.23	1.75	1.31
	OthServices	-0.08	0.00	0.10	0.19	0.26	0.35	0.41	0.48
Skilled	Grains&Crops	-0.30	-0.11	0.07	0.24	0.39	0.55	0.71	0.88
	LiveStk&Meat	-0.28	-0.32	-0.34	-0.35	-0.38	-0.39	-0.40	-0.42
	Mining&Extractn	-0.25	0.00	0.30	0.61	0.93	1.27	1.63	2.00
	Procfood	-0.83	-1.08	-1.33	-1.57	-1.83	-2.07	-2.33	-2.58
	Textiles&Clothing	-1.39	-1.55	-1.67	-1.80	-1.96	-2.11	-2.30	-2.48
	LightMnfc	-0.79	-1.06	-1.32	-1.57	-1.84	-2.11	-2.40	-2.69
	HeavyMnfc	-0.81	-1.07	-1.30	-1.53	-1.76	-1.99	-2.24	-2.50
	Util&Constuct	5.40	4.99	3.86	3.03	2.38	1.83	1.29	0.80
	OthServices	-0.18	-0.16	-0.12	-0.09	-0.07	-0.04	-0.04	-0.03

Source: Result from the study's model

Table 4.20 shows the percentage change from BAU case of sectoral employment of domestic labor for scenario B for Thailand. Every sector employs less Thai labors for both skilled and unskilled while employs more migrant labors for both skilled and unskilled (Table 4.21). Every sector employs less Thai skilled and unskilled labors in quite same proportion.

Table 4.21: Percentage change of sectoral employment of migrant labor from BAU for Thailand (Scenario B)

Change in sectoral employment of migrant labor from BAU (percentage)									
Type of labor	Sector	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Unskilled	Grains&Crops	0.04	0.30	0.56	0.80	1.03	1.27	1.51	1.76
	LiveStk&Meat	0.35	0.45	0.58	0.69	0.81	0.94	1.08	1.22
	Mining&Extractn	0.00	0.30	0.66	1.02	1.40	1.79	2.21	2.64
	Procfood	0.53	0.58	0.65	0.69	0.74	0.80	0.88	0.96
	Textiles&Clothing	0.12	0.32	0.54	0.74	0.94	1.13	1.33	1.53
	LightMnfc	0.74	0.81	0.90	0.98	1.06	1.13	1.22	1.31
	HeavyMnfc	0.71	0.80	0.92	1.03	1.14	1.26	1.38	1.52
	Util&Constuct	7.15	7.14	6.40	5.93	5.67	5.49	5.38	5.31
	OthServices	1.48	1.88	2.31	2.71	3.12	3.54	3.98	4.43
Skilled	Grains&Crops	0.05	0.31	0.58	0.82	1.06	1.30	1.55	1.80
	LiveStk&Meat	0.37	0.48	0.61	0.74	0.87	1.01	1.16	1.31
	Mining&Extractn	0.01	0.31	0.67	1.04	1.42	1.82	2.24	2.68
	Procfood	0.57	0.65	0.73	0.79	0.86	0.94	1.04	1.15
	Textiles&Clothing	0.16	0.39	0.63	0.86	1.08	1.29	1.52	1.74
	LightMnfc	0.78	0.88	1.00	1.10	1.20	1.30	1.40	1.52
	HeavyMnfc	0.75	0.87	1.01	1.14	1.28	1.42	1.57	1.72
	Util&Constuct	7.20	7.22	6.50	6.06	5.82	5.67	5.58	5.54
	OthServices	1.52	1.96	2.41	2.84	3.28	3.72	4.18	4.66

Source: Result from the study's model

Table 4.21 shows the percentage change from BAU case of sectoral employment of migrant labor for scenario B for Thailand. Most sectors employ more migrant labor especially utilities & construction sector because larger markets may make it possible to attract more foreign capital and to increase employment (Robson, 1968).

4.3.1.3 Scenario C: Reduce trade cost

Reduce trade costs are modeled by assuming a reduction in trade costs of 5% of trade values.

4.3.1.3.1 Effects on ASEAN

Table 4.22: Percentage change of GDP from BAU (Scenario C)

	Change in GDP from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	2.25	2.41	2.56	2.70	2.84	2.99	3.14	3.29
Indonesia	0.37	0.42	0.47	0.51	0.56	0.60	0.64	0.67
Lao PDR	1.70	1.90	2.10	2.29	2.48	2.67	2.86	3.06
Malaysia	1.62	1.73	1.87	2.00	2.12	2.20	2.27	2.36
Philippines	0.62	0.66	0.69	0.73	0.78	0.83	0.89	0.94
Singapore	1.80	1.81	1.93	2.02	2.05	2.08	2.11	2.14
Thailand	***0.82***	***0.88***	***0.96***	***1.03***	***1.10***	***1.19***	***1.28***	***1.37***
Vietnam	1.80	1.92	2.03	2.14	2.26	2.38	2.50	2.63
ROASEAN	1.03	1.19	1.34	1.48	1.61	1.72	1.80	1.84
ROW	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01

Source: Result from the study's model

Table 4.22 shows the percentage change from BAU case of real GDP for scenario C. Every country gains a positive effect from reduce trade cost because higher consumption which is from higher household income (Table AC.13, Appendix C3).

Table 4.23: Percentage change of consumption from BAU (Scenario C)

	Change in consumption from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	1.91	2.03	2.14	2.25	2.36	2.47	2.57	2.68
Indonesia	0.39	0.44	0.48	0.53	0.57	0.61	0.65	0.69
Lao PDR	1.60	1.79	1.97	2.14	2.31	2.48	2.65	2.83
Malaysia	1.87	1.99	2.13	2.28	2.40	2.49	2.56	2.65
Philippines	0.67	0.71	0.74	0.78	0.83	0.87	0.92	0.97
Singapore	2.17	2.18	2.31	2.41	2.45	2.50	2.53	2.57
Thailand	***0.89***	***0.95***	***1.03***	***1.10***	***1.18***	***1.27***	***1.35***	***1.45***
Vietnam	1.51	1.60	1.67	1.74	1.81	1.89	1.97	2.05
ROASEAN	1.03	1.19	1.33	1.48	1.63	1.76	1.88	1.97
ROW	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01

Source: Result from the study's model

Table 4.23 shows the percentage change from BAU case of consumption for scenario C. Reduce trade cost has the highest impact to consumption in Cambodia, Lao

PDR, and Malaysia, and it tends to increase over time due to the higher labor income (Table AC.13, Appendix C3).

Table 4.24: Percentage change of export from BAU (Scenario C)

	Change in export from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	-0.09	-0.03	0.03	0.10	0.17	0.24	0.32	0.39
Indonesia	0.65	0.69	0.76	0.83	0.91	0.99	1.07	1.16
Lao PDR	-0.10	0.06	0.22	0.39	0.56	0.73	0.90	1.07
Malaysia	0.47	0.64	0.83	1.04	1.22	1.35	1.44	1.56
Philippines	0.26	0.32	0.37	0.44	0.50	0.56	0.63	0.69
Singapore	0.53	0.67	0.94	1.14	1.28	1.42	1.54	1.67
Thailand	***0.29***	***0.42***	***0.58***	***0.72***	***0.86***	***1.00***	***1.14***	***1.29***
Vietnam	0.08	0.15	0.22	0.30	0.37	0.44	0.50	0.57
ROASEAN	0.03	0.23	0.48	0.76	1.04	1.33	1.60	1.83
ROW	-0.56	-0.52	-0.47	-0.42	-0.39	-0.36	-0.35	-0.33

Source: Result from the study's model

Table 4.24 shows the percentage change from BAU case of export for scenario C. Reduce trade cost has the highest impact to Malaysia, Singapore, and ROASEAN exports, and it tends to increase over time due to higher output level.

4.3.1.3.2 Effects on Thailand

Table 4.25: Percentage change of sectoral export from BAU for Thailand (Scenario C)

	Change in sectoral export from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	-0.13	0.19	0.47	0.72	0.94	1.16	1.39	1.63
LiveStk&Meat	-0.93	-0.70	-0.48	-0.30	-0.14	0.01	0.16	0.32
Mining&Extractn	2.40	2.20	2.10	1.99	1.94	1.94	1.98	2.06
Procfood	0.04	0.22	0.41	0.59	0.75	0.92	1.09	1.27
Textiles&Clothing	-0.61	-0.51	-0.38	-0.28	-0.18	-0.07	0.05	0.18
LightMnfc	-0.33	-0.24	-0.12	-0.03	0.06	0.15	0.25	0.35
HeavyMnfc	0.69	0.86	1.07	1.26	1.45	1.65	1.85	2.06
Util&Constuct	-0.20	-0.02	0.09	0.24	0.40	0.55	0.70	0.84
OthServices	-0.89	-0.96	-1.06	-1.16	-1.27	-1.37	-1.49	-1.62

Source: Result from the study's model

Table 4.25 shows the percentage change from BAU case of sectoral export for scenario C for Thailand. Most sectors have a positive effect from reduce trade cost especially mining & extraction and heavy manufacturing sectors. However, other services sector shows minus sign because the domestic demand of labor in this sector increase.

Table 4.26: Percentage change of sectoral import from BAU for Thailand (Scenario C)

	Change in sectoral import from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	2.15	2.09	2.05	2.03	2.03	2.04	2.05	2.06
LiveStk&Meat	2.51	2.47	2.43	2.42	2.44	2.47	2.50	2.53
Mining&Extractn	0.65	0.94	1.20	1.46	1.71	1.97	2.22	2.48
Procfood	2.56	2.62	2.67	2.73	2.81	2.90	2.99	3.09
Textiles&Clothing	2.64	2.73	2.80	2.88	2.97	3.07	3.18	3.29
LightMnfc	2.80	2.91	2.99	3.09	3.21	3.35	3.50	3.65
HeavyMnfc	2.15	2.28	2.39	2.50	2.64	2.78	2.94	3.09
Util&Constuct	2.55	2.71	2.75	2.83	2.96	3.13	3.29	3.47
OthServices	1.63	1.78	1.91	2.06	2.23	2.40	2.59	2.78

Source: Result from the study's model

Table 4.26 shows the percentage change from BAU case of sectoral import for scenario C for Thailand. Reduce trade cost increases every sector import because consumption increases.

Table 4.27: Percentage change of sectoral output from BAU for Thailand (Scenario C)

	Change in sectoral output from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	-0.04	0.19	0.41	0.61	0.80	0.99	1.18	1.39
LiveStk&Meat	-0.07	0.10	0.28	0.43	0.58	0.72	0.88	1.03
Mining&Extractn	-0.21	-0.28	-0.28	-0.29	-0.28	-0.25	-0.20	-0.13
Procfood	-0.03	0.14	0.32	0.48	0.64	0.81	0.98	1.16
Textiles&Clothing	-0.43	-0.32	-0.19	-0.07	0.05	0.18	0.31	0.46
LightMnfc	-0.32	-0.22	-0.10	0.00	0.11	0.22	0.33	0.45
HeavyMnfc	0.04	0.23	0.42	0.61	0.79	0.99	1.19	1.40
Util&Constuct	0.81	1.05	1.15	1.31	1.50	1.70	1.91	2.12
OthServices	-0.06	-0.03	-0.01	0.01	0.02	0.05	0.07	0.08

Source: Result from the study's model

Table 4.27 shows the percentage change from BAU case of sectoral output for scenario C for Thailand. Reduce trade cost increases every sector output except mining & extraction sector because Thailand imports more and produce less for this product.

Table 4.28: Percentage change of sectoral employment from BAU for Thailand (Scenario C)

	Change in sectoral employment from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	-0.08	0.06	0.20	0.32	0.43	0.54	0.66	0.78
LiveStk&Meat	-0.16	-0.17	-0.15	-0.16	-0.16	-0.16	-0.17	-0.17
Mining&Extractn	-0.84	-0.86	-0.86	-0.89	-0.91	-0.91	-0.91	-0.89
Procfood	-0.08	-0.20	-0.30	-0.42	-0.57	-0.70	-0.85	-1.00
Textiles&Clothing	-1.19	-1.25	-1.29	-1.37	-1.48	-1.59	-1.72	-1.85
LightMnfc	-0.90	-1.00	-1.11	-1.25	-1.41	-1.57	-1.75	-1.94
HeavyMnfc	0.19	0.06	-0.05	-0.17	-0.30	-0.42	-0.55	-0.69
Util&Constuct	2.51	2.45	1.97	1.66	1.44	1.28	1.11	0.95
OthServices	-0.11	-0.03	0.03	0.09	0.14	0.21	0.27	0.32

Source: Result from the study's model

Table 4.28 shows the percentage change from BAU case of sectoral employment for scenario C for Thailand. Employment tends to overall neutral to reduce trade cost, however there is a reallocation in each sector. Grains & crops, utilities & construction, and other services sectors employ more labor while livestock & meat products, mining & extraction, and processed food, textiles & clothing, light manufacturing, and heavy manufacturing sectors employ less labor.

Table 4.29: Percentage change of sectoral employment of domestic labor from BAU for Thailand (Scenario C)

Change in sectoral employment of domestic labor from BAU (percentage)									
Type of labor	Sector	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Unskilled	Grains&Crops	-0.15	0.00	0.14	0.25	0.36	0.47	0.58	0.69
	LiveStk&Meat	-0.30	-0.28	-0.27	-0.29	-0.30	-0.31	-0.32	-0.33
	Mining&Extractn	-0.89	-0.90	-0.91	-0.94	-0.96	-0.96	-0.96	-0.94
	Procfood	-0.40	-0.45	-0.55	-0.71	-0.87	-1.02	-1.19	-1.36
	Textiles&Clothing	-1.55	-1.53	-1.58	-1.69	-1.83	-1.95	-2.11	-2.27
	LightMnfc	-1.26	-1.28	-1.40	-1.57	-1.76	-1.93	-2.14	-2.36
	HeavyMnfc	-0.18	-0.22	-0.34	-0.49	-0.64	-0.78	-0.93	-1.11
	Util&Constuct	2.11	2.13	1.66	1.31	1.07	0.88	0.70	0.51
	OthServices	-0.51	-0.33	-0.26	-0.23	-0.20	-0.14	-0.10	-0.07
Skilled	Grains&Crops	-0.15	-0.01	0.12	0.23	0.32	0.42	0.52	0.63
	LiveStk&Meat	-0.30	-0.30	-0.31	-0.33	-0.37	-0.39	-0.42	-0.45
	Mining&Extractn	-0.89	-0.91	-0.92	-0.96	-0.98	-1.00	-1.00	-0.99
	Procfood	-0.40	-0.49	-0.62	-0.81	-1.02	-1.20	-1.41	-1.62
	Textiles&Clothing	-1.55	-1.58	-1.65	-1.81	-1.99	-2.16	-2.35	-2.57
	LightMnfc	-1.26	-1.33	-1.47	-1.69	-1.92	-2.13	-2.38	-2.65
	HeavyMnfc	-0.17	-0.27	-0.42	-0.61	-0.81	-0.98	-1.19	-1.40
	Util&Constuct	2.11	2.08	1.57	1.18	0.89	0.66	0.42	0.18
	OthServices	-0.51	-0.38	-0.35	-0.36	-0.38	-0.37	-0.38	-0.39

Source: Result from the study's model

Table 4.29 shows the percentage change from BAU case of sectoral employment of domestic labor for scenario C for Thailand. Most sectors employ less Thai labors, except grains & crops and utilities & construction, for both skilled and unskilled while employs more migrant labors for both skilled and unskilled (Table 4.30).

Table 4.30: Percentage change of sectoral employment of migrant labor from BAU for Thailand (Scenario C)

Change in sectoral employment of migrant labor from BAU (percentage)									
Type of labor	Sector	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Unskilled	Grains&Crops	0.72	0.81	1.00	1.18	1.35	1.53	1.71	1.90
	LiveStk&Meat	1.47	1.25	1.35	1.47	1.57	1.69	1.80	1.94
	Mining&Extractn	-0.28	-0.32	-0.29	-0.27	-0.25	-0.21	-0.15	-0.08
	Procfood	4.20	2.94	3.01	3.23	3.30	3.43	3.48	3.64
	Textiles&Clothing	3.75	2.25	2.41	2.73	2.85	3.04	3.12	3.34
	LightMnfc	4.06	2.51	2.60	2.86	2.93	3.06	3.09	3.25
	HeavyMnfc	5.20	3.61	3.69	3.99	4.10	4.28	4.35	4.57
	Util&Constuct	8.21	6.40	6.13	6.28	6.32	6.48	6.54	6.79
	OthServices	5.41	3.82	4.11	4.64	4.97	5.38	5.68	6.16
Skilled	Grains&Crops	0.72	0.82	1.01	1.19	1.37	1.55	1.73	1.93
	LiveStk&Meat	1.47	1.26	1.36	1.50	1.60	1.73	1.85	2.00
	Mining&Extractn	-0.28	-0.31	-0.28	-0.27	-0.24	-0.19	-0.14	-0.06
	Procfood	4.20	2.96	3.05	3.28	3.37	3.51	3.58	3.77
	Textiles&Clothing	3.75	2.27	2.45	2.79	2.93	3.13	3.23	3.48
	LightMnfc	4.06	2.53	2.63	2.91	3.00	3.16	3.20	3.38
	HeavyMnfc	5.19	3.63	3.73	4.04	4.18	4.37	4.47	4.71
	Util&Constuct	8.21	6.42	6.17	6.34	6.40	6.58	6.67	6.94
	OthServices	5.41	3.84	4.15	4.70	5.05	5.48	5.80	6.31

Source: Result from the study's model

Table 4.30 shows the percentage change from BAU case of sectoral employment of migrant labor for scenario C for Thailand. Most sectors employ more migrant labor because output level increases.

4.3.1.4 Scenario D: Combining A, B and C to represent AEC

In scenario D, the study combines scenario A, B, and C in order to represent the effect from AEC.

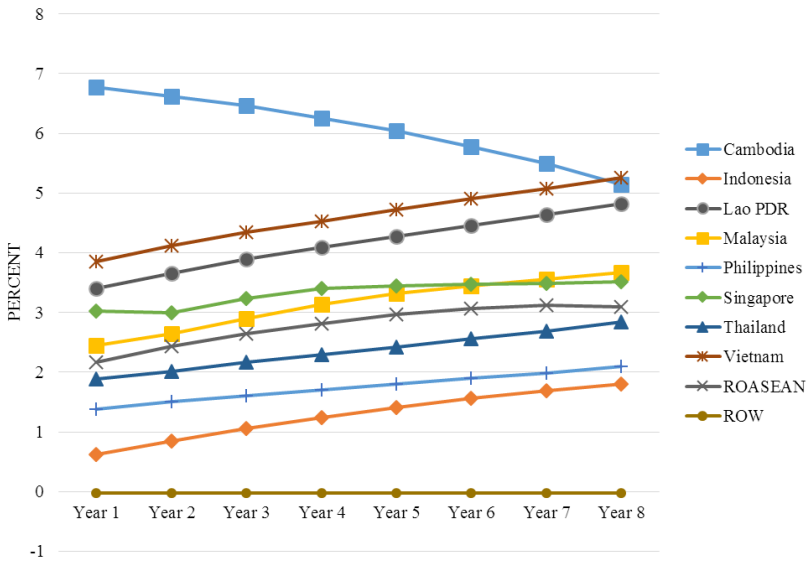
4.3.1.4.1 Effects on ASEAN

Table 4.31: Percentage change of GDP from BAU (Scenario D)

	Change in GDP from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	6.78	6.62	6.46	6.26	6.04	5.78	5.49	5.14
Indonesia	0.62	0.85	1.06	1.24	1.41	1.56	1.69	1.80
Lao PDR	3.40	3.66	3.89	4.09	4.28	4.46	4.64	4.82
Malaysia	2.45	2.65	2.90	3.14	3.32	3.45	3.56	3.67
Philippines	1.38	1.50	1.61	1.71	1.80	1.90	1.99	2.09
Singapore	3.03	3.00	3.23	3.40	3.44	3.48	3.49	3.51
Thailand	***1.88***	***2.01***	***2.16***	***2.29***	***2.42***	***2.56***	***2.69***	***2.84***
Vietnam	3.85	4.12	4.34	4.53	4.72	4.90	5.08	5.26
ROASEAN	2.16	2.43	2.64	2.82	2.97	3.07	3.12	3.10
ROW	-0.02	-0.02	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03

Source: Result from the study's model

Figure 4.5: Percentage change of GDP from BAU (Scenario D)



Source: Result from the study's model

Table 4.31 and Figure 4.5 show the percentage change from BAU case of real GDP for scenario D. AEC has a high impact to Cambodia, Lao PDR, Singapore, and Vietnam. The GDP gain is from the higher consumption (Table 4.32) which partly caused by higher consumption on import goods after reduce tariff to zero, improve investment climate, and reduce trade costs. However, Cambodia tends to lose its gain

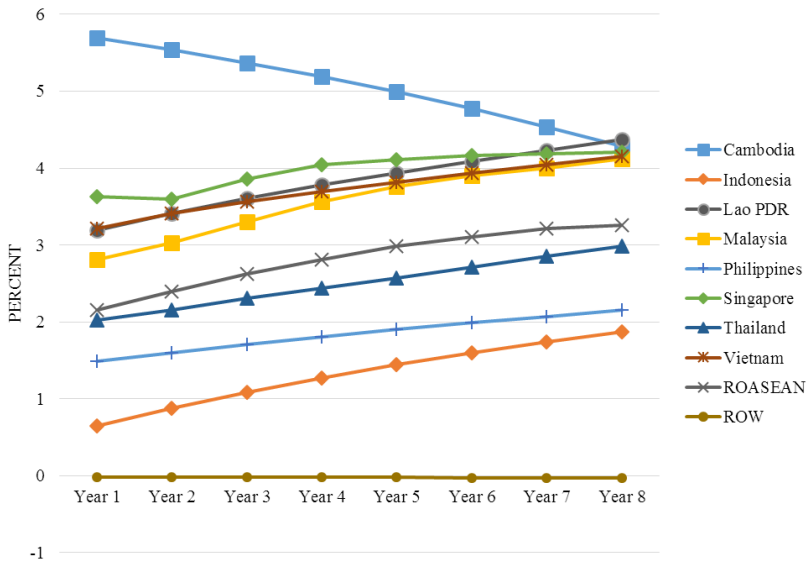
over time because consumption continuously declined due to the decline of labor income (Table AC.19, Appendix C4). In addition, AEC increases competition among producers in the region but it benefits to producer due to a larger market. This benefit would pass to the consumer in the region. Therefore, real GDP of ASEAN would increase due to better production and higher consumption (European Bank, 2012).

Table 4.32: Percentage change of consumption from BAU (Scenario D)

	Change in consumption from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	5.69	5.54	5.37	5.19	4.99	4.78	4.54	4.28
Indonesia	0.65	0.88	1.09	1.27	1.45	1.60	1.74	1.87
Lao PDR	3.19	3.41	3.61	3.78	3.94	4.09	4.23	4.37
Malaysia	2.81	3.03	3.30	3.56	3.76	3.90	4.00	4.12
Philippines	1.49	1.60	1.71	1.81	1.90	1.99	2.07	2.16
Singapore	3.63	3.60	3.86	4.05	4.11	4.16	4.19	4.21
Thailand	***2.02***	***2.15***	***2.31***	***2.44***	***2.57***	***2.71***	***2.85***	***2.99***
Vietnam	3.22	3.41	3.56	3.69	3.81	3.93	4.04	4.15
ROASEAN	2.15	2.40	2.62	2.81	2.98	3.11	3.21	3.26
ROW	-0.02	-0.02	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03

Source: Result from the study's model

Figure 4.6: Percentage change of consumption from BAU (Scenario D)



Source: Result from the study's model

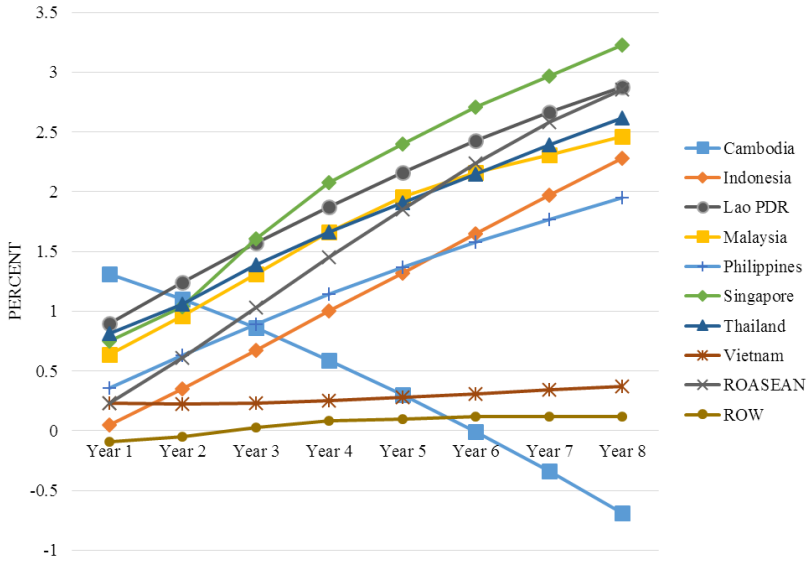
Table 4.32 and Figure 4.6 show the percentage change from BAU case of consumption for scenario D. AEC has a highest impact to consumption in Cambodia at the early years, but it tends to decrease over time due to the decline of labor income (Table AC.19, Appendix C4). Thailand and Malaysia are quite similar in consumption gain over time because the effect of improve investment climate that has a positive effect to consumption over time.

Table 4.33: Percentage change of export from BAU (Scenario D)

	Change in export from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	1.31	1.10	0.86	0.59	0.30	-0.01	-0.34	-0.69
Indonesia	0.05	0.35	0.67	1.00	1.32	1.65	1.97	2.28
Lao PDR	0.90	1.24	1.57	1.87	2.16	2.43	2.67	2.88
Malaysia	0.64	0.96	1.31	1.66	1.96	2.16	2.31	2.46
Philippines	0.36	0.63	0.89	1.14	1.37	1.58	1.77	1.95
Singapore	0.75	1.04	1.61	2.08	2.40	2.71	2.97	3.23
Thailand	***0.81***	***1.06***	***1.39***	***1.66***	***1.91***	***2.15***	***2.39***	***2.62***
Vietnam	0.23	0.22	0.23	0.25	0.28	0.31	0.34	0.37
ROASEAN	0.23	0.61	1.03	1.45	1.85	2.24	2.58	2.86
ROW	-0.09	-0.05	0.03	0.08	0.10	0.12	0.12	0.12

Source: Result from the study's model

Figure 4.7: Percentage change of export from BAU (Scenario D)



Source: Result from the study's model

Table 4.33 and Figure 4.7 show the percentage change from BAU case of export for scenario D. AEC increases the export to all ASEAN countries and the gain keep increasing over time because the positive effect from improve investment climate. However, Cambodia's export would decline over time and change to negative because its export products lost share to other ASEAN countries.

Moreover, according to Figure 4.5, 4.6, and 4.7, GDP, consumption and export gains of Cambodia decline overtime. This is a result of zero tariff (scenario A) leads to the decline of government spending due to less income from import and export taxes. Lower government spending has a negative effect on output and this leads to lower labor income overtime (Table AC.19) and lower export (Figure 4.7), thus lower consumption overtime (Figure 4.6). These all effects leads to the decline overtime of Cambodia's GDP (Figure 4.5).

In addition, due to economic integration, member countries can build their export capacity within the region where it enjoys zero tariffs, before using this developed capability to exploit a competitive advantage in exporting to other markets worldwide (European Bank, 2012). The advent of AEC should therefore be expected to boost trades both within the integrated ASEAN economies and also between ASEAN and the rest of the world.

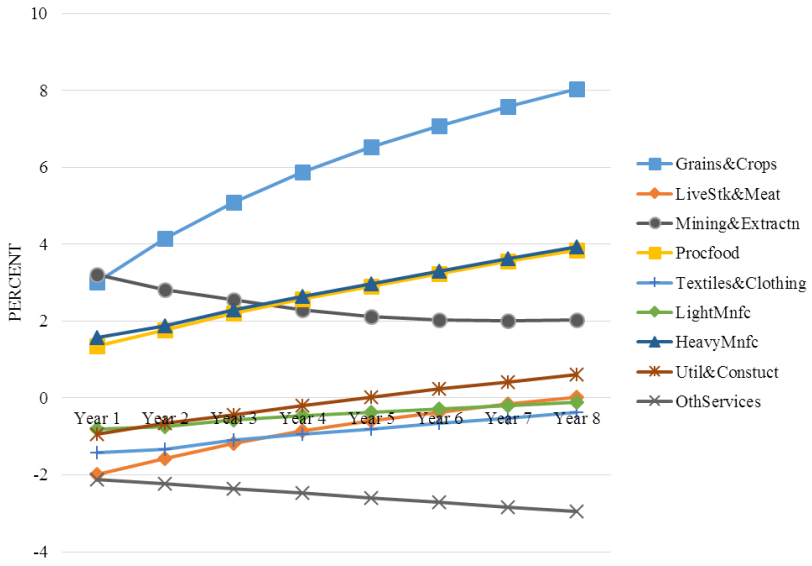
4.3.1.4.2 Effects on Thailand

Table 4.34: Percentage change of sectoral export from BAU for Thailand (Scenario D)

	Change in sectoral export from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	3.02	4.15	5.09	5.88	6.54	7.08	7.57	8.03
LiveStk&Meat	-2.00	-1.58	-1.17	-0.85	-0.60	-0.37	-0.16	0.03
Mining&Extractn	3.22	2.81	2.55	2.29	2.12	2.03	2.00	2.02
Procfood	1.36	1.76	2.20	2.57	2.91	3.24	3.55	3.85
Textiles&Clothing	-1.43	-1.33	-1.10	-0.94	-0.81	-0.66	-0.52	-0.38
LightMnfc	-0.80	-0.74	-0.56	-0.46	-0.38	-0.29	-0.20	-0.12
HeavyMnfc	1.57	1.88	2.29	2.64	2.97	3.30	3.62	3.94
Util&Constuct	-0.95	-0.65	-0.44	-0.20	0.02	0.23	0.42	0.60
OthServices	-2.12	-2.24	-2.35	-2.48	-2.60	-2.71	-2.84	-2.96

Source: Result from the study's model

Figure 4.8: Percentage change of sectoral export from BAU for Thailand (Scenario D)



Source: Result from the study's model

AEC would cause a significant adjustment in various sectors' values (Akapaiboon, 2010). The simulation results provide insight into the sector winners and losers. Table 4.34 and Figure 4.8 show the percentage change from BAU case of sectoral export for scenario D for Thailand. Overall Thailand has more export in scenario D, especially in grains & crops sector which has increased by 3.02% in year 1 and by 8.03% in year 8 comparing to BAU because, generally, agricultural sector has more tariff protection than other sectors before AEC (Plummer & Yue, 2009). In addition, Thailand has more export in mining & extraction, processed food, and heavy manufacturing sectors. This is because Thailand has more comparative advantage in these sectors comparing to other ASEAN countries.

According to Table AC.25, mining & extraction, processed food, and heavy manufacturing sectors are capital intensive sectors and these sectors have more export after AEC, this indicates that capital incomes of these sectors are relatively cheaper than the same sectors in other ASEAN countries. However, for grains & crops sector which is relatively labor intensive sector comparing to other sectors also have more export after AEC because wage of labor in grains & crops sector in Thailand is lower than grains & crops sector in other ASEAN countries.

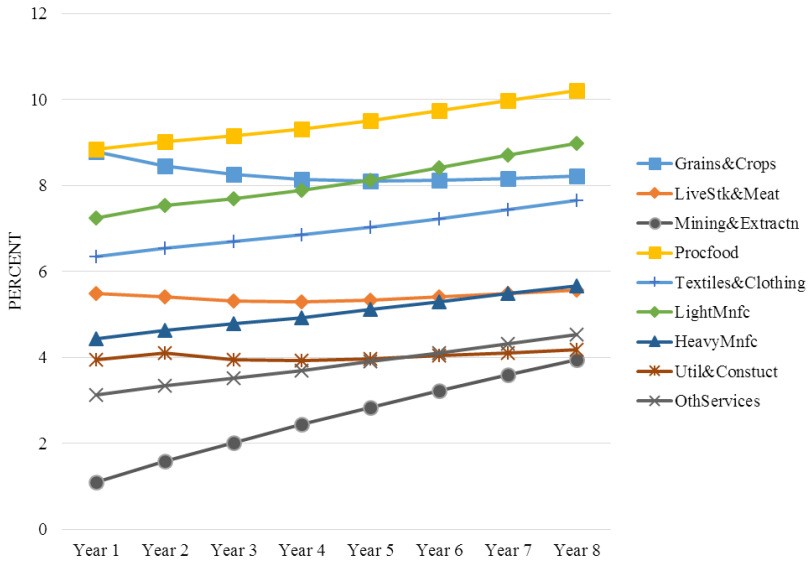
According to Hanson (2003), he claimed that when a member country eliminates trade barrier within the region, the country would become more specialize in its export product. This specialization would support the country to gain from international trade, however this gain is not likely to equally share by all sectors in the country. According to Figure 4.8, Grains & crops, processed food, and heavy manufacturing sectors gain more export overtime, thus this indicates that Thailand would become more specialize in these sectors. On the other hand, livestock & meat products, textiles & clothing, light manufacturing, utilities & construction, and other services sectors have less export after AEC but they would recover overtime because of higher output (Table 4.36) as a result of higher domestic demand due to higher labor income (Table AC.19).

Table 4.35: Percentage change of sectoral import from BAU for Thailand (Scenario D)

	Change in sectoral import from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	8.79	8.46	8.26	8.15	8.11	8.12	8.16	8.22
LiveStk&Meat	5.48	5.42	5.32	5.30	5.34	5.41	5.48	5.56
Mining&Extractn	1.09	1.58	2.02	2.44	2.84	3.23	3.60	3.95
Procfood	8.85	9.03	9.16	9.32	9.51	9.75	9.98	10.22
Textiles&Clothing	6.34	6.54	6.69	6.85	7.03	7.23	7.44	7.65
LightMnfc	7.24	7.53	7.69	7.89	8.13	8.41	8.70	8.99
HeavyMnfc	4.44	4.64	4.78	4.93	5.11	5.30	5.48	5.67
Util&Constuct	3.94	4.10	3.95	3.92	3.97	4.04	4.10	4.18
OthServices	3.12	3.35	3.51	3.70	3.90	4.11	4.32	4.53

Source: Result from the study's model

Figure 4.9: Percentage change of sectoral import from BAU for Thailand (Scenario D)



Source: Result from the study's model

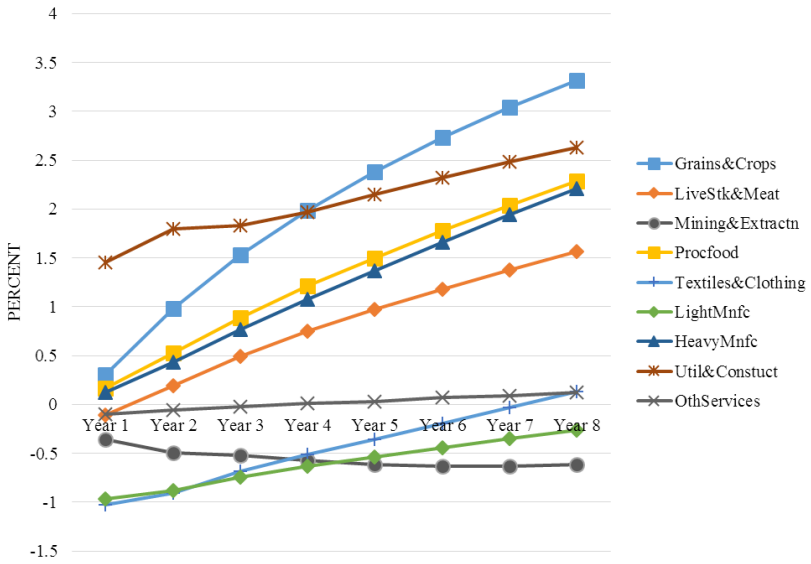
Table 4.35 and Figure 4.9 show the percentage change from BAU case of sectoral import for scenario D for Thailand. Thailand has more import in every sector in scenario D, especially in grains & crops and processed food sectors which have increased by 8.79% and 8.85% in year 1 and by 8.22% and 10.22% in year 8 comparing to BAU because higher domestic demand due to higher labor income (Table AC.19). Note that although the percentage change of sectoral imports are more than sectoral exports, Thailand is still net exporter in every sector except mining & extraction sector.

Table 4.36: Percentage change of sectoral output from BAU for Thailand (Scenario D)

	Change in sectoral output from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	0.30	0.98	1.53	1.99	2.38	2.73	3.04	3.32
LiveStk&Meat	-0.11	0.19	0.49	0.75	0.97	1.18	1.38	1.57
Mining&Extractn	-0.36	-0.49	-0.52	-0.57	-0.61	-0.63	-0.63	-0.61
Procfood	0.17	0.53	0.89	1.21	1.50	1.78	2.04	2.29
Textiles&Clothing	-1.03	-0.91	-0.68	-0.51	-0.36	-0.19	-0.03	0.13
LightMnfc	-0.97	-0.88	-0.74	-0.63	-0.54	-0.44	-0.35	-0.26
HeavyMnfc	0.12	0.43	0.77	1.08	1.37	1.66	1.94	2.21
Util&Constuct	1.45	1.80	1.83	1.97	2.15	2.32	2.48	2.63
OthServices	-0.10	-0.06	-0.02	0.01	0.03	0.07	0.09	0.12

Source: Result from the study's model

Figure 4.10: Percentage change of sectoral output from BAU for Thailand (Scenario D)



Source: Result from the study's model

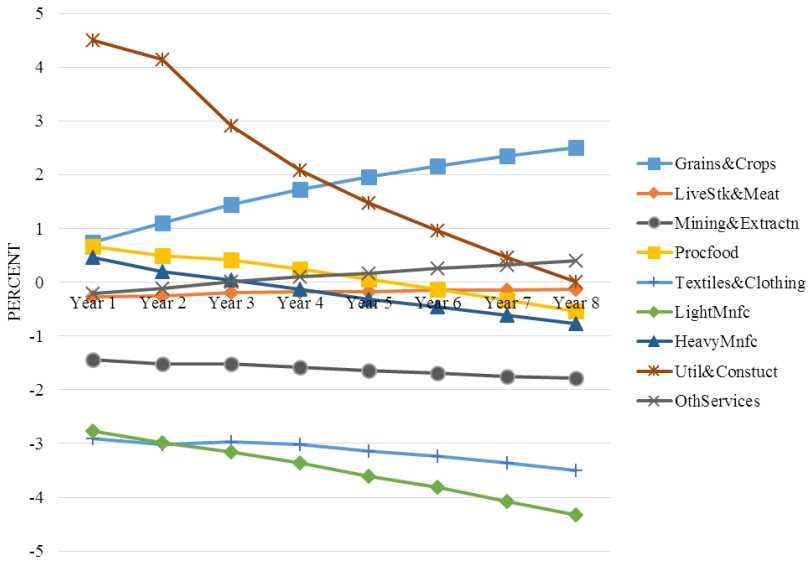
Table 4.36 and Figure 4.10 show the percentage change from BAU case of sectoral output for scenario D for Thailand. Overall AEC increases Thai output level over time. Thailand produces less mining & extraction, textiles & clothing, light manufacturing, and utilities & construction sectors because it imports more these products rather than increases domestic production.

Table 4.37: Percentage change of sectoral employment from BAU for Thailand (Scenario D)

	Change in sectoral employment from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Grains&Crops	0.74	1.11	1.45	1.73	1.96	2.17	2.35	2.51
LiveStk&Meat	-0.27	-0.26	-0.20	-0.18	-0.18	-0.15	-0.14	-0.13
Mining&Extractn	-1.44	-1.52	-1.52	-1.58	-1.65	-1.69	-1.75	-1.79
Procfood	0.66	0.50	0.41	0.25	0.05	-0.13	-0.33	-0.53
Textiles&Clothing	-2.90	-3.01	-2.97	-3.02	-3.14	-3.23	-3.36	-3.50
LightMnfc	-2.76	-2.99	-3.16	-3.36	-3.61	-3.82	-4.08	-4.33
HeavyMnfc	0.46	0.20	0.04	-0.13	-0.31	-0.45	-0.61	-0.77
Util&Constuct	4.51	4.15	2.91	2.08	1.47	0.96	0.46	0.01
OthServices	-0.21	-0.11	0.01	0.10	0.17	0.26	0.33	0.40

Source: Result from the study's model

Figure 4.11: Percentage change of sectoral employment from BAU for Thailand (Scenario D)



Source: Result from the study's model

Table 4.37 and Figure 4.11 show the percentage change from BAU case of sectoral employment for scenario D for Thailand. AEC has slightly negative impacted on employment in Thailand and it also affects reallocation of labor in every sector. Grains & crops, processed food, utilities & construction, and other services sectors employ more labor because these sectors produce more output (Table 4.36). On the other hand, livestock & meat products, mining & extraction, textiles & clothing, light

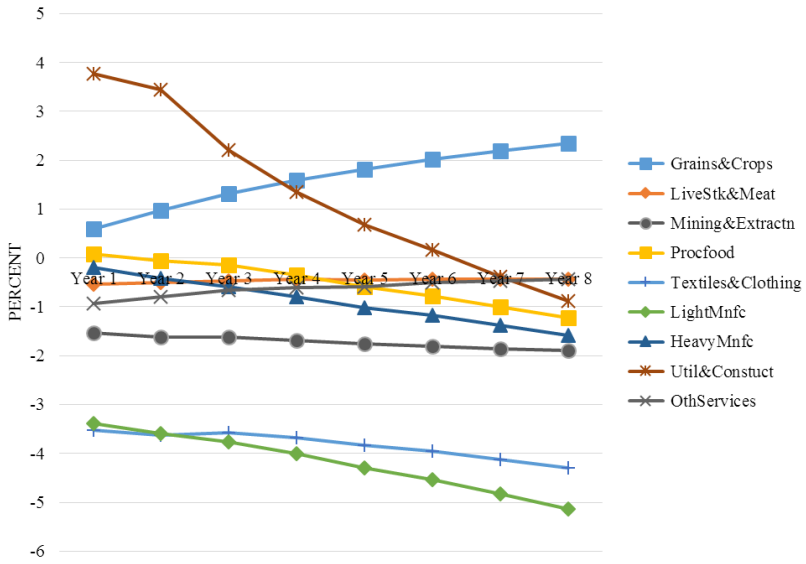
manufacturing, and heavy manufacturing sectors employ less labor because these sectors produce less output. Nevertheless, livestock & meat products, and heavy manufacturing sectors employ less labor but produce more output which indicates that these sectors substitute labor by using more capital and become more capital intensive sectors (Table AC.25, Appendix C4). In addition, other services sector employs more labor but has less output because this sector lose some capitals to other sectors and has to employ more labors instead (Table AC.25, Appendix C4).

Table 4.38: Percentage change of sectoral employment of domestic labor from BAU for Thailand (Scenario D)

Change in sectoral employment of domestic labor from BAU (percentage)									
Type of labor	Sector	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Unskilled	Grains&Crops	0.60	0.98	1.32	1.59	1.82	2.02	2.19	2.35
	LiveStk&Meat	-0.53	-0.50	-0.46	-0.44	-0.45	-0.43	-0.44	-0.44
	Mining&Extractn	-1.54	-1.61	-1.62	-1.68	-1.75	-1.80	-1.85	-1.89
	Procfood	0.08	-0.05	-0.15	-0.34	-0.58	-0.77	-1.00	-1.23
	Textiles&Clothing	-3.53	-3.62	-3.58	-3.67	-3.84	-3.95	-4.13	-4.30
	LightMnfc	-3.39	-3.60	-3.76	-4.01	-4.30	-4.54	-4.83	-5.13
	HeavyMnfc	-0.20	-0.42	-0.59	-0.79	-1.02	-1.18	-1.38	-1.58
	Util&Constuct	3.77	3.44	2.21	1.35	0.69	0.16	-0.38	-0.88
	OthServices	-0.93	-0.79	-0.66	-0.61	-0.58	-0.50	-0.46	-0.43
Skilled	Grains&Crops	0.61	0.98	1.30	1.57	1.78	1.97	2.13	2.28
	LiveStk&Meat	-0.51	-0.50	-0.48	-0.49	-0.51	-0.52	-0.55	-0.57
	Mining&Extractn	-1.53	-1.61	-1.62	-1.70	-1.77	-1.83	-1.89	-1.95
	Procfood	0.13	-0.05	-0.20	-0.43	-0.72	-0.96	-1.25	-1.53
	Textiles&Clothing	-3.47	-3.62	-3.63	-3.78	-4.00	-4.16	-4.39	-4.63
	LightMnfc	-3.33	-3.60	-3.81	-4.11	-4.46	-4.75	-5.10	-5.45
	HeavyMnfc	-0.14	-0.43	-0.64	-0.90	-1.18	-1.40	-1.66	-1.91
	Util&Constuct	3.84	3.44	2.16	1.23	0.51	-0.08	-0.68	-1.24
	OthServices	-0.86	-0.79	-0.72	-0.72	-0.76	-0.73	-0.76	-0.79

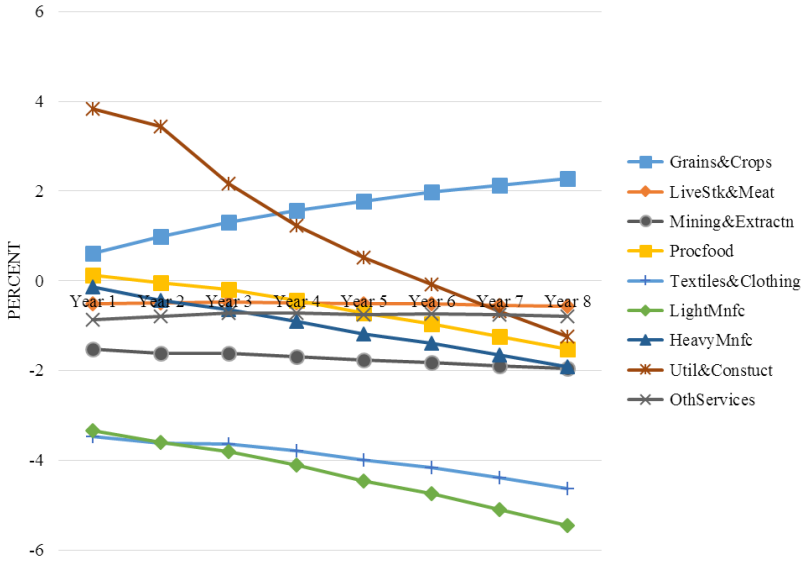
Source: Result from the study's model

Figure 4.12: Percentage change of sectoral employment of domestic unskilled labor from BAU for Thailand (Scenario D)



Source: Result from the study's model

Figure 4.13: Percentage change of sectoral employment of domestic skilled labor from BAU for Thailand (Scenario D)



Source: Result from the study's model

Table 4.38, Figure 4.12, and Figure 4.13 show the percentage change from BAU case of sectoral employment of domestic labor for scenario D for Thailand. Every sector

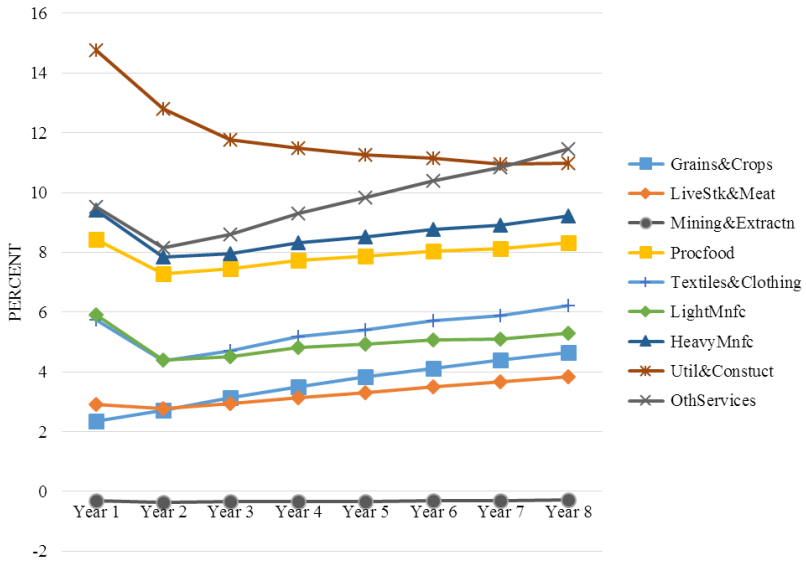
employs less Thai labors for both skilled and unskilled while employs more migrant labors for both skilled and unskilled (Table 4.39).

Table 4.39: Percentage change of sectoral employment of migrant labor from BAU for Thailand (Scenario D)

Change in sectoral employment of migrant labor from BAU (percentage)									
Type of labor	Sectors	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Unskilled	Grains&Crops	2.35	2.73	3.14	3.51	3.84	4.13	4.40	4.66
	LiveStk&Meat	2.90	2.77	2.95	3.14	3.31	3.49	3.66	3.85
	Mining&Extractn	-0.31	-0.37	-0.33	-0.33	-0.33	-0.32	-0.31	-0.29
	Procfood	8.44	7.28	7.44	7.74	7.86	8.03	8.12	8.32
	Textiles&Clothing	5.75	4.38	4.71	5.18	5.42	5.72	5.89	6.21
	LightMnfc	5.90	4.40	4.51	4.81	4.92	5.07	5.11	5.29
	HeavyMnfc	9.40	7.84	7.96	8.32	8.52	8.77	8.92	9.23
	Util&Constuct	14.76	12.79	11.77	11.49	11.26	11.15	10.96	10.99
	OthServices	9.53	8.15	8.60	9.31	9.83	10.39	10.84	11.46
Skilled	Grains&Crops	2.35	2.73	3.15	3.53	3.85	4.15	4.43	4.70
	LiveStk&Meat	2.89	2.77	2.96	3.16	3.34	3.53	3.71	3.91
	Mining&Extractn	-0.31	-0.37	-0.33	-0.32	-0.32	-0.31	-0.29	-0.27
	Procfood	8.41	7.28	7.46	7.78	7.93	8.13	8.24	8.47
	Textiles&Clothing	5.72	4.39	4.73	5.23	5.50	5.82	6.02	6.37
	LightMnfc	5.87	4.40	4.53	4.86	4.99	5.17	5.24	5.45
	HeavyMnfc	9.37	7.84	7.98	8.37	8.59	8.87	9.06	9.39
	Util&Constuct	14.73	12.79	11.80	11.55	11.35	11.26	11.11	11.17
	OthServices	9.50	8.15	8.63	9.37	9.91	10.51	10.99	11.64

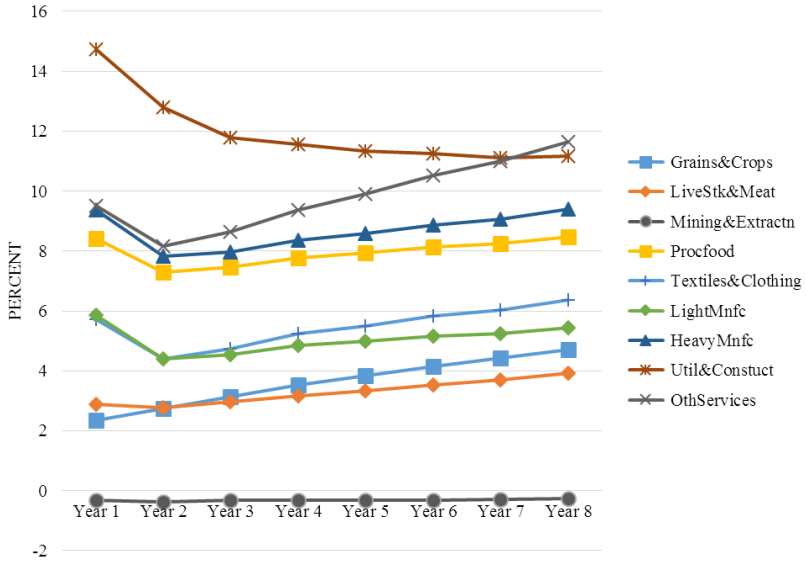
Source: Result from the study's model

Figure 4.14: Percentage change of sectoral employment of unskilled migrant labor from BAU for Thailand (Scenario D)



Source: Result from the study's model

Figure 4.15: Percentage change of sectoral employment of skilled migrant labor from BAU for Thailand (Scenario D)



Source: Result from the study's model

Table 4.39, Figure 4.14, and Figure 4.15 show the percentage change from BAU case of sectoral employment of migrant labor for scenario D for Thailand. Every sector

employs more migrant labors especially utilities & construction sectors sector due to higher output.

4.3.2 Results analysis

This chapter estimates the effects of the AEC on each ASEAN countries, especially Thailand by combining scenario zero tariff, improve investment climate, and reduce trade cost. Based on all findings generated in this chapter, there are two main suggestions that can be developed. Firstly, chapter 6 will show that there exists the season migration supporting the production capability of both agricultural and non-agricultural sectors. Although this evidence indicates the flexibility of the labor market correcting the problem of underemployment in rural areas, it also impedes the progress of applying new machines and production technology to both farm and non-farm activities in Thailand. With the region economic integration or AEC in the near future, this domestic migration may decline in the future due to freer flows of capital and labor. Therefore, Thai government should focus on sectors that have the greatest potential for Thai economy rather than wasting limited resources to all sectors as will be shown in section 4.3.3.1.

Secondly, the results from simulation show that the supply side policies namely reduction of switching cost and the increasing labor productivity are effective on Thai economy. As projected by the CGE model, both policy options would lead to the increment of aggregate supply which results in the increasing aggregate output, rising aggregate income, and lowered price index. However, this study suggests the increased labor productivity policy with two main reasons.

Firstly, since Thailand is currently challenged by both outside and inside country such as challenged by countries with certain comparative advantages and by the issue of aging society, the long-term policy in line with these challenges should be strongly supported such as encouraging R&D outlay, fortifying intellectual property rights, growing labor efficiency, and improving the value added in the production of goods and services (Pholphirul, 2012).

However, only increase labor productivity can be reasonable quantify and implement to the CGE model. According to NESDB (2012), the average period

schooling is 8.2 years which is lower than the 10-year target. Workers who attend primary school education were 45.6% of the overall, below the 60% government target. Therefore, there is an intensive that increase labor productivity is one main objective of Thai government.

Secondly, the tendencies of aging society in various nations and unrestricted labor migration will strengthen labor employment competition internationally. Also, Thailand's ineffectiveness in migrant labor management will be a limitation on economic progress (NESDB, 2012). Therefore, Thailand may not have enough migrant labor to meet the demand for labor in the future. Thailand also has entered to an aging society trend due to the decline in the fertility rate and the proportion of working age, thus the supply of Thai working labor will be less (NESDB, 2012). Therefore, development of human capital is needed to replace the shortage in the labor supply as will be shown in section 4.3.3.2.

4.3.2 Effect of AEC on Thai economy

Table 4.40: Effects of scenario shock to GDP

Effects of scenario on GDP										
Country	Billion US Dollar[22]	Average percent change from BAU[23]				Average percent growth per year[24]				
	BAU	Scenario				BAU	Scenario			
		A	B	C	D		A	B	C	D
Cambodia	8.62	2.59	0.52	2.77	6.07	3.77	3.83	3.91	4.20	4.46
Indonesia	501.91	0.20	0.54	0.53	1.28	4.99	5.01	5.12	5.08	5.23
Lao PDR	5.30	1.21	0.59	2.38	4.15	6.64	6.73	6.78	7.04	7.27
Malaysia	201.51	0.85	0.22	2.02	3.14	4.06	4.16	4.13	4.36	4.53
Philippines	157.48	0.42	0.53	0.77	1.75	4.33	4.34	4.46	4.45	4.60
Singapore	163.10	1.11	0.16	1.99	3.32	3.63	3.77	3.66	3.91	4.08
Thailand	***248.93***	***0.88***	***0.32***	***1.08***	***2.35***	***2.81***	***2.91***	***2.90***	***2.99***	***3.18***
Vietnam	64.57	2.05	0.18	2.21	4.60	3.57	3.85	3.60	3.91	4.24
ROASEAN	37.21	0.60	0.61	1.50	2.79	8.48	8.48	8.63	8.72	8.89
ROW	54,728.16	-0.01	-0.01	-0.01	-0.02	1.88	1.88	1.88	1.88	1.88

Source: Result from the study's model

Table 4.40 reports the average real GDP value for BAU case as well as the effect in term of average percent change from BAU and average percent growth of real GDP for scenario A (zero tariff), B (improve investment climate), C (reduce trade cost), and D (AEC effect). As noted earlier, scenario D represents the implement of AEC by combining scenario A, B, and C. According to average percent change in scenario D, Cambodia and Vietnam have the highest gain of GDP from AEC by 6.07% and 4.60% respectively while Thailand gains by 2.35%. The result from Table 4.40 is consistence

[22] The average real GDP of the first 8 years under AEC which is estimated by the study's model. BAU is averaged from Table 3.7.

[23] The average percent change of real GDP of the first 8 years under AEC which is estimated by the study's model. Scenario A, B, C, D are averaged from Table 4.4, 4.13, 4.22, and 4.31 respectively.

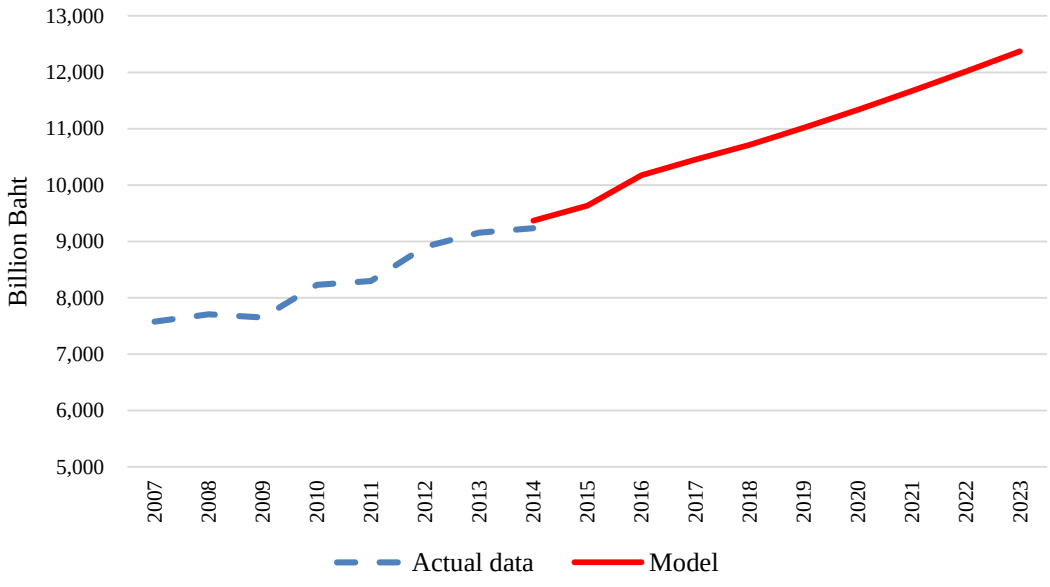
[24] The average percent growth of real GDP of the first 8 years under AEC which is estimated by the study's model. Scenario BAU, A, B, C, D are averaged from Table 3.7, AC.2, AC.8, AC.14, and AC.20 respectively.

with previous literatures as economic integration or AEC has positive effect on country members (Plummer & Yue, 2009; Akapaiboon, 2010; Petri, Plummer, & Zhai, 2012).

ROW represents economies that are not part of ASEAN experienced losses because of AEC trade improvement. However, these losses are smaller (10.95 billion US Dollar) compared to ASEAN's gains. Overall, AEC will generate net benefits 20.58 billion US Dollar (calculated from Table 4.40). Although the gain value of AEC is different, the result has the same direction with result of Petri *et al.* (2012)'s study.

Moreover, by comparing the average percent growth of scenario D to BAU, if percent growth of scenario D is more than BAU, it means AEC leads to the better growth part for country in the long run. However, if percent growth of scenario D is less than BAU, it means the positive effect from AEC would converse to BAU in the long run. According to Table 4.40, every ASEAN country has a better growth part than BAU, thus AEC clearly has a positive effect for every country in South East Asia region.

Figure 4.16: Real GDP of Thailand between 2007 and 2023



Source: Bank of Thailand (2007-2014) and result from the study's model

Figure 4.16 shows real GDP of Thailand between 2007 and 2023. The real GDP value from 2007 to 2014 are actual data (Appendix F1) while from 2015 to 2023 are forecasted from the study's model. Real GDP year 2015 and 2023 are 9,638 and 12,207

Billion Baht. According to Table 4.40, Thailand would have 3% average real GDP growth after AEC which shows in Figure 4.16 as a red solid line.

In summary, the dynamic multi-countries CGE model of the study estimates that every member country gains higher real GDP from AEC in average 3.27% and has average growth rate by 5.16% comparing to 4.70% in BAU case (calculated from Table 4.40). In addition, the real GDP gain from AEC is more than the real GDP loss from ROW. Although the gain from AEC in this study seems less than other studies estimation such as Petri *et al.* (2012) who estimated 5% increase. The study has the goal to generate the lower bound estimation. In addition, the study may under-estimate extra FDI inflows and exclude the effects of intra-FDI flows and non-tariff barriers.

4.3.3 Policy suggestions

4.3.3.1 Facilitate potential sectors

AEC would cause a significant adjustment in sectors' value and labor allocation (Akapaiboon, 2010). The simulation results provide insight into the sector winners and losers, thus policy makers could sort out the prior sectors to gain the competitive advantage for Thai economy in the long run.

Table 4.41: Effects of scenario shock to sectoral output of Thailand

Effects of scenario on sectoral output										
Sector	**Billion US Dollar**[25]	Average percent change from BAU[26]				Average percent growth per year[27]				
	BAU	Scenario				BAU	Scenario			
		A	B	C	D		A	B	C	D
All	**548.73**	-0.41	0.73	0.44	0.72	2.87	2.76	3.05	2.99	3.04
Grains&Crops	**24.29**	0.25	0.99	0.69	2.03	2.53	2.50	2.78	2.70	2.94
LiveStk&Meat	**9.98**	-0.54	0.89	0.49	0.80	2.91	2.76	3.13	3.04	3.11
Mining&Extractn	**14.62**	-1.29	1.19	-0.24	-0.55	1.44	1.10	1.76	1.42	1.36
Procfood	**27.50**	-0.02	0.74	0.56	1.30	2.70	2.64	2.91	2.85	2.99
Textiles&Clothing	**22.06**	-0.85	0.49	0.00	-0.45	2.92	2.72	3.10	2.98	2.94
LightMnfc	***26.74***	***-1.13***	***0.60***	***0.06***	***-0.60***	***2.65***	***2.41***	***2.83***	***2.71***	***2.62***
HeavyMnfc	***214.31***	***-0.32***	***0.83***	***0.71***	***1.20***	***2.85***	***2.73***	***3.08***	***3.03***	***3.13***
Util&Constuct	**40.20**	-1.88	2.77	1.44	2.08	1.51	1.16	1.97	1.78	1.84
OthServices	**169.03**	-0.11	0.13	0.02	0.02	3.42	3.40	3.46	3.43	3.44

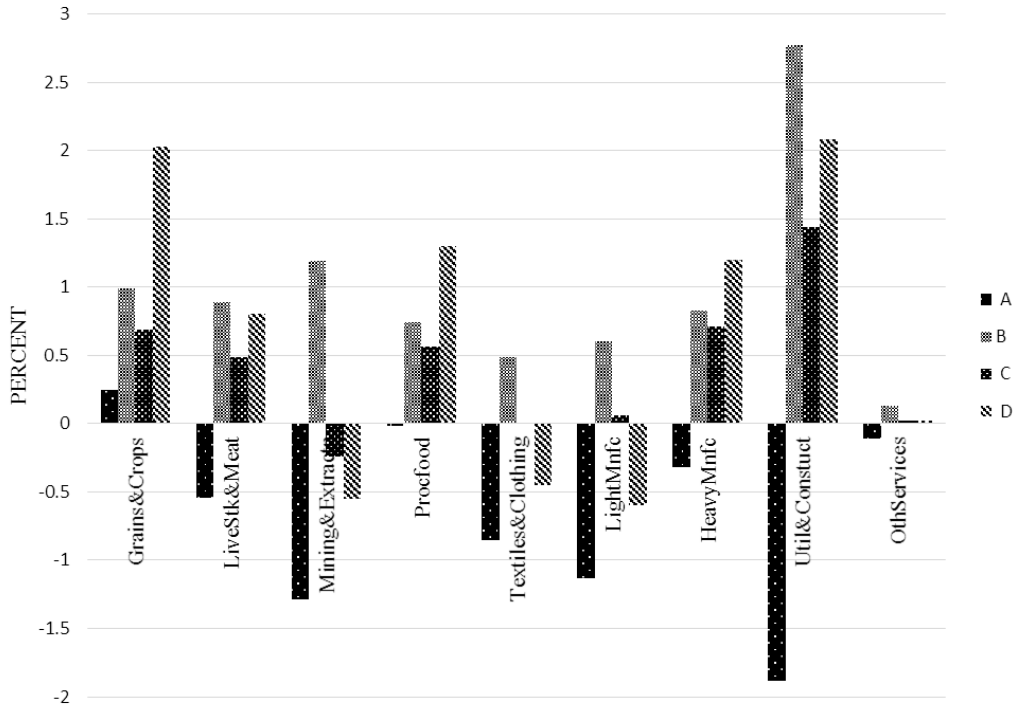
Source: Result from the study's model

[25] The average output of the first 8 years under AEC which is estimated by the study's model. BAU is averaged from Table 3.12.

[26] The average percent change of output of the first 8 years under AEC which is estimated by the study's model. Scenario A, B, C, D are averaged from Table 4.9, 4.18, 4.27, and 4.36 respectively.

[27] The average percent growth of output of the first 8 years under AEC which is estimated by the study's model. Scenario BAU, A, B, C, D are averaged from Table 3.12, AC.6, AC.12, AC.18, and AC.24 respectively.

Figure 4.17: Effects of scenario shock to sectoral output of Thailand



Source: Result from the study's model

Table 4.41 reports the value and average growth rate of sectoral output for BAU case as well as the effect in term of average percent change from BAU (Figure 4.17) and average percent growth of real GDP for scenario A, B, C, and D. As noted earlier, scenario D represents the implement of AEC by combining scenario A, B, and C. Thailand produces more total output in average 0.72% after AEC. According to average percent change in scenario D, grains & crops, livestock & meat products, processed food, heavy manufacturing, and utilities & construction sectors, and other services sectors produce more output in average by 2.03%, 0.80%, 1.30%, 1.20%, 2.08%, and 0.02%, respectively. On the other hand, mining & extraction, textiles & clothing, light manufacturing produce less output by average 0.55, 0.45%, and 0.60%, respectively. In addition, other service sector is unchanged relative to BAU, this result is similar to Petri *et al*. (2012) who claimed that other services sector inclines to be locally produced and these demand effects will compensate decreasing comparative advantage in a number of service industries. As a result, it is expected to be basically unaffected relative to BAU.

Those sectors which have a higher output also have a higher growth rate (scenario D in average percent growth per year column) comparing to BAU case. On the other hand, those sectors which have a lower output have a lower growth rate comparing to BAU case. This indicates Thailand would become more specialize in higher-output sectors after AEC.

Table 4.42: Effects of scenario shock to sectoral employment of Thailand

Effects of scenario on sectoral employment										
Sector	**Billion US Dollar**[28]	Average percent change from BAU[29]				Average percent growth per year[30]				
	BAU	Scenario				BAU	Scenario			
		A	B	C	D		A	B	C	D
All	**82.54**	0.00	-0.01	-0.03	-0.05	1.05	1.05	1.04	1.04	1.03
Grains&Crops	**5.12**	0.85	0.40	0.36	1.75	1.53	1.53	1.66	1.63	1.85
LiveStk&Meat	**1.22**	0.13	-0.17	-0.16	-0.19	1.93	1.93	1.91	1.90	1.91
Mining&Extractn	**1.91**	-1.41	0.88	-0.88	-1.62	0.08	0.08	0.34	-0.03	-0.15
Procfood	**2.15**	1.80	-1.33	-0.52	0.11	1.05	1.05	0.79	0.92	0.98
Textiles&Clothing	**2.65**	-0.24	-1.47	-1.47	-3.14	1.60	1.60	1.37	1.37	1.15
LightMnfc	***3.25***	***-0.83***	***-1.29***	***-1.36***	***-3.51***	***1.09***	***1.09***	***0.83***	***0.84***	***0.54***
HeavyMnfc	***16.47***	***1.18***	***-1.23***	***-0.24***	***-0.20***	***1.28***	***1.28***	***1.05***	***1.20***	***1.19***
Util&Constuct	**3.65**	-2.76	3.42	1.67	2.07	-0.93	-0.93	-0.81	-0.85	-0.99
OthServices	**46.13**	-0.27	0.32	0.12	0.12	1.08	1.08	1.16	1.12	1.13

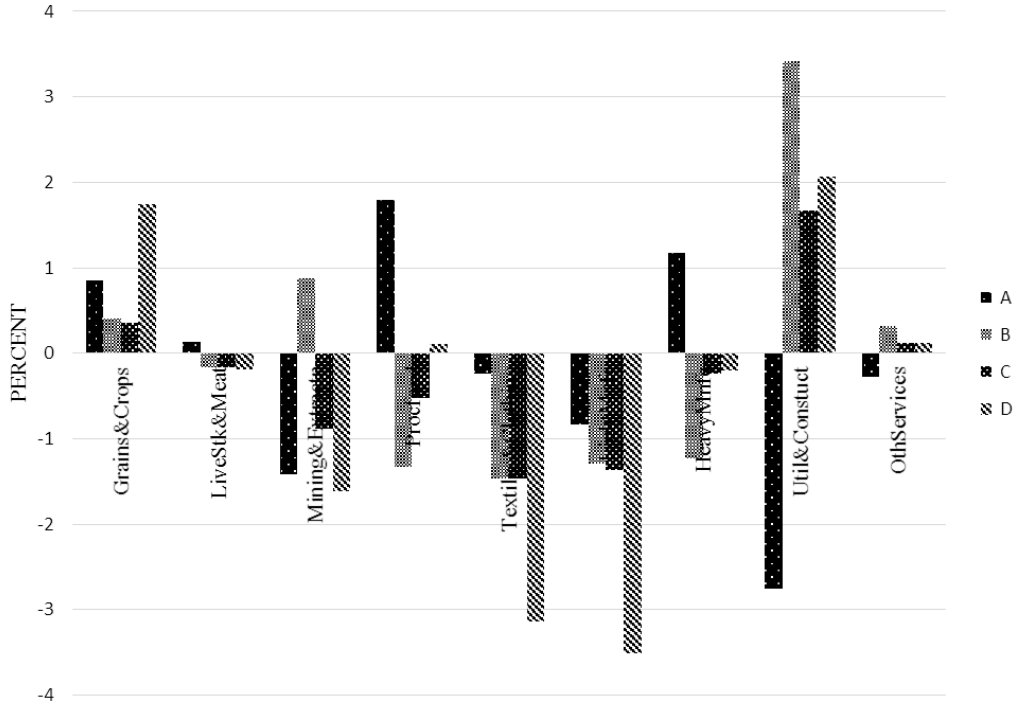
Source: Result from the study's model

[28] The average sectoral employment of the first 8 years under AEC which is estimated by the study's model. BAU is averaged from Table 3.13.

[29] The average percent change of sectoral employment of the first 8 years under AEC which is estimated by the study's model. Scenario A, B, C, D are averaged from Table 4.10, 4.19, 4.28, and 4.37 respectively.

[30] The average percent growth of sectoral employment of the first 8 years under AEC which is estimated by the study's model. Scenario BAU, A, B, C, D are averaged from Table 4.10, AC.5, AC.11, AC.17, and AC.23 respectively.

Figure 4.18: Effects of scenario shock to sectoral employment of Thailand



Source: Result from the study's model

Table 4.42 reports the value and average growth rate of sectoral employment for BAU case as well as the effect in term of average percent change from BAU (Figure 4.18) and average percent growth of real GDP for scenario A, B, C, and D. Thailand has slightly less total employment by average 0.05% after AEC (scenario D). Grains & crops, processed food, utilities & construction, and other services sectors employ more labor by average 1.75%, 0.11%, 2.07%, and 0.12%, respectively because these sectors produce more output. On the other hand, livestock & meat products, mining & extraction, textiles & clothing, light manufacturing, and heavy manufacturing sectors employ less labor by average 0.19%, 1.62%, 3.14%, 3.51%, and 0.20% respectively because these sectors produce less output. Nevertheless, livestock & meat products, and heavy manufacturing sectors employ less labor but produce more output which indicates that these sectors substitute labor by using more capital and become more capital intensive sectors (Table AC.25, Appendix C4). In addition, other services sector

employs more labor but has less output because this sector lose some capitals to other sectors and has to employ more labors instead (Table AC.25, Appendix C4).

Moreover, according to Table 2.6, employment shares of agricultural and non-agricultural sectors were approximately 40% and 60%, respectively. However, according to Table 4.42, the share of agricultural sector would increase after AEC, since the average growth rate of grains & crops sector (1.85%) is higher than total average (1.03%).

The objective of AEC is to be a production base, thus it is possible to gain the most substantial effects on manufacturing sectors. However, lessened barriers to trade and investments ought to create more interdependence, robust production networks, higher degree of economies of scale, and broader access to product varieties. According to Table 4.41, light manufacturing and heavy manufacturing sectors of Thailand are the majority output production account for 44% before and after AEC.

Thailand should focus in both light and heavy manufacturing sectors because, firstly, they produce the highest output which equals to 241.05 Billion US dollar (Table 4.41, scenario D) or 43.93% of total output. Secondly, there is a potential to absorb more productive labors since light manufacturing and heavy manufacturing sectors employ labor less labors by 3.51% and 0.20% (Table 4.42, scenario D) after AEC. If Thai government strongly promotes the R&D investment, increasing labor productivity, improve infrastructure network, light manufacturing and heavy manufacturing sector have potential to produce more output and employ more labor which lead to more export and more consumption, thus generating more GDP. Furthermore, with the benefits that cannot measure from AEC such as stronger production networks, higher degree of economies of scale, and broader access to product varieties, Thailand would enjoy production advantages and gain much more benefits in manufacturing sector from AEC.

Table 4.43: Effects of scenario shock to sectoral employment growth of Thailand (unit in percent growth per year)

Effects of scenario on sectoral employment growth										
Sector	Average percent growth per year of Thai labor[31]					Average percent growth per year of migrant labor[32]				
	BAU	Scenario				BAU	Scenario			
		A	B	C	D		A	B	C	D
All	0.65	0.65	0.61	0.63	0.61	6.72	6.54	7.00	6.72	6.81
Grains&Crops	1.18	1.13	1.34	1.29	1.41	6.91	6.73	7.19	2.66	2.80
LiveStk&Meat	1.57	1.59	1.57	1.57	1.60	4.57	4.39	4.84	4.15	4.21
Mining&Extractn	-0.16	-0.44	0.12	-0.18	-0.22	4.81	4.62	5.08	0.80	0.78
Procfood	-0.13	0.02	-0.32	-0.24	-0.27	6.91	6.73	7.19	5.33	5.39
Textiles&Clothing	0.01	0.13	-0.08	-0.06	-0.04	3.40	3.22	3.67	6.25	6.37
LightMnfc	***0.08***	***0.20***	***-0.12***	***-0.05***	***-0.13***	***4.41***	***4.22***	***4.68***	***6.23***	***6.24***
HeavyMnfc	***0.04***	***0.15***	***-0.14***	***-0.09***	***-0.14***	***6.98***	***6.80***	***7.27***	***6.20***	***6.24***
Util&Constuct	6.56	6.76	5.57	6.11	5.37	8.72	8.54	9.00	12.92	12.24
OthServices	0.65	0.61	0.69	0.69	0.69	4.31	4.13	4.58	7.55	7.67

Source: Result from the study's model

Table 4.43 reports the average employment growth of domestic and migrant labors of BAU case as well as scenario A, B, C, and D. Overall, AEC has a negative effect on employment of domestic labor since the average employment growth of domestic labor (0.61%) is lower than of BAU case (0.65%). The effects are positive in some sectors including grains & crops, livestock & meat products, utilities & construction, and other services sectors but the rest has shown the negative effect from AEC. In contrast, AEC has a positive effect on employment of migrant labor in every sector and the employment growth of migrant labor is higher than of domestic labor in every sector. This indicates that, in the long run, the share of migrant labor in every sector would keep on increasing and every sector in Thailand would rely on migrant labors.

Utilities & construction sector has the highest employment growth for both domestic and migrant labors. According to Table 3.4, utilities & construction sector

[31] The average percent growth of sectoral Thai labor employment of the first 8 years under AEC which is estimated by the study's model.

[32] The average percent growth of sectoral migrant labor employment of the first 8 years under AEC which is estimated by the study's model.

includes electricity, gas manufacture, distribution, water, construction which employ significant number of labors account for approximately 22% of nation total employment (Table 2.6, 2.3-2.6). In addition, heavy manufacturing sector which includes petroleum, electronic equipment, and machinery is the second highest employment growth of migrant labor.

Moreover, according to Table 2.6, primary materials sectors includes grains & crops, livestock & meat products, and mining & extraction (Table 3.4) has employment share approximately 40% of nation total employment. According to Table 4.43, these sectors still have positive employment growth rate for domestic labor although migrant labor is concentrated in these sectors (Manning & Bhatnagar, 2004).

Table 4.44: Effects of scenario shock to number of migrant labor in Thailand (unit in person)

Effects of scenario on migrant labor					
Country	Persons	Persons			
	BAU	Scenario A	Scenario B	Scenario C	Scenario D
All	4,507,731	4,576,897	4,613,767	4,655,689	4,841,885
Cambodia	***765,331***	***777,050***	***783,287***	***765,498***	***796,101***
Indonesia	740	752	758	719	748
Lao PDR	***981,491***	***996,547***	***1,004,552***	***1,061,975***	***1,104,208***
Malaysia	1,522	1,545	1,558	1,522	1,583
Philippines	1,396	1,418	1,429	1,562	1,624
Singapore	789	801	808	976	1,015
Vietnam	7,673	7,791	7,853	6,271	6,519
ROASEAN	***2,598,348***	***2,638,258***	***2,659,571***	***2,651,767***	***2,758,087***
ROW	150,441	152,736	153,951	165,399	172,001

Source: Result from the study's model

Table 4.44 reports the number of migrant labors of BAU case as well as scenario A, B, C, and D. Thailand would have 334,154 more migrant labors after AEC or account for 7.41% increase from BAU case. ROASEAN was the majority of migrant labors in Thailand following by Lao PDR and Cambodia. These countries accounted for 96.39% of total migrant labor after AEC. These countries, except Brunei, share the same border with Thailand. In addition, according to Figure 2.4, migrant labors in Thailand are dominated by labors from Cambodia, Lao PDR, and Myanmar, accounting for 89.9%.

The main factors which influence the trend for migrant labors to move to Thailand are the income gap between Thailand and its neighbors, the downturn in the growth of the Thai workforce and the enhanced infrastructure allowing easier movement between the nations of the Greater Mekong Sub-region. Moreover, a large demand for low-skilled labors in labor-intensive production also attracts migrant laborers to come across the borders and work in Thailand (Pholphirul, 2012).

In summary, the result shows the potential of manufacturing sectors Thailand should focus and it would match with the main objective of AEC to become a single market and production base. Scale effects correlated with superior regional manufacture and trade could provide benefits to the products of this sector, which possess a high trade value. In addition, relatively low protection in manufacturing sectors would provide room for improving productivity, and increasing specialization (Petri *et al.*, 2012). Productivity increases in the manufacturing sectors could reinforce Thailand's competitive advantage in several manufacturing subsectors which could result in more exports to both ASEAN partners and world markets.

Moreover, according to Table 4.43, the average growth of domestic labor is lower than the average growth of migrant labor, this indicates that Thailand would depend on migrant labors after AEC. However, Cambodia, Lao PDR, and Myanmar countries are liberalizing their trade and developing their countries which in turn contribute to economic growth. Therefore, these countries are trying to attract their labors back home because these labors are considered as experience labors. If Thailand wants to sustain its economy and prevent the shock of large outflow of migrant labors, increase productivity of labor is the solution to sustain Thai economy in the long run.

4.3.3.2 Mitigate the aging society effect

The tendencies of aging society in numerous nations and unrestricted labor migration will strengthen labor employment competition globally and Thailand's ineffectiveness in migrant labor management will be a limitation on economic growth (NESDB, 2012). Therefore, Thailand may not have enough migrant labor to meet the demand for labor in the future because the decline in the fertility rate and the proportion of working age, thus the supply of Thai working labor will be less in the future

(NESDB, 2012). Therefore, development of human capital is needed to replace the shortage in the labor supply.

Moreover, Thailand is becoming an aging society. The percentage of young and working age people has constantly weakened and this will disturb the supply of labor in the future (NESDB, 2012). The scarcity of both unskilled and skilled labors is a serious apprehension. NESDB forecasts that from 2010 to 2040, labor supply in Thailand would have average growth by -0.613%.

In development strategy of the Eleventh National Economic and Social Development Plan of Thailand for 2012 – 2016 suggests that Thailand should increase labor productivity to support sustainable agriculture. It generates a variety of benefits which are the foundation of employment creation, food security, reserves the customary way of life, lightens deficiency and lessens the effects of global warming (NESDB, 2012).

Table 4.45: Effects of labor supply decline and labor productivity increase for Thailand

Lower labor supply & Higher labor productivity				
	LS	Labor productivity of grains & crops sector		
Average percent per year	-0.613% [33]	+10%	+7.5%	+5%
Real GDP (Billion US Dollar)	248.77[34]	252.62	252.51	252.40
Real GDP change from BAU (percentage)	***-0.060***	0.161	0.123	***0.083***

Source: Result from the study's model

Table 4.45 reports the effect of lower labor supply on real GDP in term of value and average percentage change from BAU case comparing to labor productivity adjustment. One objective of the Eleventh National Economic and Social Development Plan is to enhance labor productivity in order to sustain agriculture sector subject to the reduction in future labor supply. The study uses the CGE model to find the required level of labor productivity in grains & crops sector to sustain the real GDP subject to

[33] Average labor supply growth from 2010-2040 according to NESDB forecasted.

[34] Average real GDP of Thailand in BAU scenario (without AEC).

average labor supply growth minus 0.613% (NESDB's forecast). According to Table 4.45, 0.613% reduction in labor supply growth reduces real GDP by 0.06% comparing to BAU. On the other hand, if labor productivity of grains & crops sector increases by 10%, 7.5%, and 5%, real GDP will increase by 0.161%, 0.123%, and 0.083% respectively. Therefore, Thailand should enhance productivity of labor in this sector at least 5% in order to compensate the real GDP loss from lower labor supply growth.

Moreover, productivity in grains & crops sector is low comparing to other sectors. The ratio of employment/total employment (6.2% as shown in Table 4.42) is more than the ratio of output/total output (4.43% as shown in Table 4.41). In addition, grains & crops sector is labor intensive sector comparing to other sector, Capital/Labor ratio equals to 8.36 (Table AC.25, Appendix C4). Therefore, productivity increases in grains & crops sector as a whole will reinforce Thailand's comparative advantage in grains & crops sector and its subsectors (Table 3.4), resulting in more exports which will contribute to larger GDP.

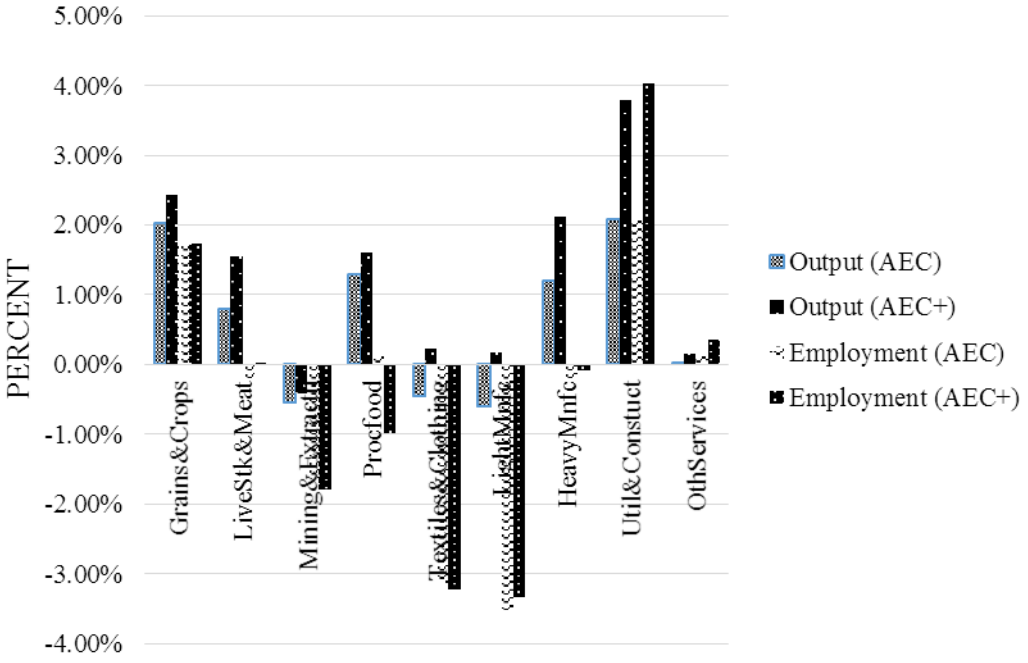
Table 4.46 shows the value and percentage change of output and employment under AEC, and percentage change of output and employment under AEC plus 5% increase in labor productivity in grains & crops sector. Figure 4.19 graphically illustrates the percentage change of output and employment under AEC (AEC) and plus 5% increase in labor productivity in grains & crops sector (AEC+). When labor productivity in grains & crops sector increase 5%, it employ less labor but has more output. This affects positively to output of every sector, especially heavy manufacturing and utilities & construction sectors. Moreover, every sector employment has changed due to labor reallocation between sectors. Heavy manufacturing and utilities & construction sectors gain both output and employment. This may because more productivity labors from grains & crops sector move to seek higher wage from heavy manufacturing and utilities & construction sectors.

Table 4.46: Effects of AEC and labor productivity shocks to sectoral output of Thailand

Sector	BAU (Billion US Dollar)		AEC (percentage change)		AEC +5% LP in Grains&Crops (percentage change)	
	Output	Employment	Output	Employment	Output	Employment
Grains&Crops	***24.29***	***5.12***	***2.03***	***1.75***	***2.43***	***1.73***
LiveStk&Meat	9.98	1.22	0.80	-0.19	1.55	0.01
Mining&Extractn	14.62	1.91	-0.55	-1.62	-0.42	-1.80
Procfood	27.50	2.15	1.30	0.11	1.61	-0.98
Textiles&Clothing	22.06	2.65	-0.45	-3.14	0.22	-3.22
LightMnfc	26.74	3.25	-0.60	-3.51	0.17	-3.34
HeavyMnfc	214.31	16.47	1.20	-0.20	2.12	-0.08
Util&Constuct	40.20	3.65	2.08	2.07	3.80	4.04
OthServices	169.03	46.13	0.02	0.12	0.16	0.36

Source: Result from the study's model

Figure 4.19: Effects of AEC and labor productivity shocks to sectoral output of Thailand



Source: Result from the study's model

4.4 Conclusion

The main objective of AEC is to be a production base, thus it tends to have the greatest important effects on manufacturing sector. However, weakened barriers to trade and investments would produce better interdependence, robust production networks, superior economies of scale, and broader access to product diversities (Petri *et al.*, 2012). Profounder integration would empower ASEAN to syndicate and achieve additional completely the production advantages presented by its diverse affiliation. This would create substantial productivity advances. Therefore, Thailand should plan its position to yield the advantage of manufacturing network. In the near future, Thailand also face some challenged both outside and inside country such as challenged by countries with certain comparative advantages and by the issue of aging society.

The chapter suggests 2 main sectors that Thai government should focus in different issues. For the issue of boosting Thai economy, manufacturing sectors are chosen to focus because manufacturing sectors produce the highest output, these sectors have potential to absorb more productive labors, and it corresponds with the main objective of AEC to become a single market and production base.

For the issue of shortage of labor supply, the study suggests the increase labor productivity policy for agricultural sector as follow from the Eleventh National Economic and Social Development Plan of Thailand for 2012 – 2016 which suggests focusing on agricultural sector. The study's model estimates that in order to sustain real GDP of Thailand subject to the decline in labor supply in Thailand, productivity of labor in agricultural sector should increase by at least 5%. Therefore, Thai government should implement policies that enhance the human capital or improve the knowledge of labor in this sector in order to prevent from the shortage of Thai and migrant labors supply in the future.

Chapter 5

The Effect of Minimum Wage Policies on Economy and Employment: The Case of Thailand as a Part of AEC

Thailand implemented a minimum wage policy in 1972 and it was set at 12 Baht per day (Chandoevwit, 2004; Paitoonpong, Akkarakul, & Sukaruji, 2005). Since then, the minimum wage has adjusted the amount several times. The last adjustment was in 2013 which set the minimum wage at 300 Baht per day 2013 (Kida & Fujikura, 2015). The minimum wage in Thailand is an important topic for debate, with labor unions seeking an increase in the minimum wage[35]. One key question concerns the potential effects for the economy and employment levels if the Thai government responded positively to such demands and raised the level while wages in other ASEAN members were not increased at the same time, this would affect Thai economy directly and affect other ASEAN members as well since every ASEAN economy will be closer linkage under AEC. Therefore, it is important to consider the policy options available to Thailand's policy makers.

This chapter investigates the ways in which wage policies in Thailand affect the economy as a whole and the labor market in particular. The potential influence on real GDP, employment, output, and investment in both Thailand and other ASEAN members will be assessed in the light of implemented AEC. This evaluation considers the effects of 3 policy mechanisms which are a minimum wage increase, a rise in minimum wages with government subsidization, and a minimum wage cut. The outcomes of these policy changes will be compared in order to determine which approach might most effectively serve Thai employment objectives and improve the economy.

[35] http://www.bangkokpost.com/news/general/513659/workers-ask-for-b360-minimum-wage and http://englishnews.thaipbs.or.th/pm-rejects-minimum-wage-increase

The structure of the chapter is divided into 4 parts. The first part is the background including literature reviews of the minimum wage policy and the relationship between economic integration, minimum wage, and labor productivity. The second part is the methodology including the conceptual framework and the setup scenarios of minimum wage adjustment and labor productivity shock. The third part shows the results of wage policy and labor productivity shocks on economy and employment for ASEAN and Thailand in particular. The last part describes the concluding remarks.

5.1 Background

Under rapid industrialization and globalization, labor market is adjusted as well as final product and service markets to response to the globalization (Bhula-or & Kripornsak, 2008). Some national economies benefit from high levels of external demand to increase employment levels, while other countries are concerned that their labor is being attracted to external sources of supply and employment (Maechler & Holst, 1995). This is because the use of human resources to drive economic expansion through increased trade is a strategy of interest in the developing countries (Maechler & Holst, 1995). Comparative advantage derived from the quality or quantity of labor is one important component of any strategy given the mobility of capital and diffusion of technology, thus any wage policy which has an influence upon the labor market will be highly significant.

According to trade theory, a convergence in goods prices due to free trade would lead to convergence in factor prices (Hanson, 2003). Therefore, wage level for both unskilled and skilled labor in trading partners would be affected. Moreover, Hanson (2003) reported that economic integration increased FDI as well as wages for skilled labor which leads to higher relative demand for skilled labor, given that capital is complement with skilled labor. Thus, increased minimum wage for low paid or unskilled labor is reasonable policy in order to not widen income gap and income inequality.

Increased minimum wage will enhance the well-being of labor and strengthen domestic demand because labors have more income, thus more purchasing power.

Moreover, it induces the adjustment more in the knowledge and skilled-based and businesses focus on hiring labors with knowledge and more experience to make it worth the cost of labor. On the other hand, prices of products and services may be higher because the higher cost of producing goods and services[36].

In the developing countries, the adoption of minimum wage policies has become a widespread approach for many countries, although the exact mechanism of minimum wage determination is often not fully indicated (Bertrand & Squire, 1980), while countries which already have a minimum wage may consider reforms to improve the effectiveness of their policies (Carpio, Nguyen, & Wang, 2012). Understanding the effects of minimum wage policies and policy changes upon employment must therefore be a priority, especially for developing economies where the conditions are typically not the same as those found in the developed world. The labor market is often more segmented, has lower education levels in developing countries, and has a relatively high proportion of male labor to female labor. Furthermore, many sectors rely upon small or informal businesses for much of their economic activity (Carpio, Nguyen, & Wang, 2012). For this reason, when the minimum wage is changed in a developing country including Thailand, it would also affect other ASEAN members as well since every ASEAN economy will be closer linkage under AEC.

The objective of this chapter is to investigate the ways in which wage policies in Thailand affect the economy as a whole and the labor market in particular. The potential influence on real GDP, employment, output, and investment in both Thailand and other ASEAN members will be assessed in the light of implemented AEC. The following will explore literatures of the effect of minimum wage policy and relationship between economic integration and minimum wage.

[36] The industry average labor costs of 22.6% in the goods and services sector 15.6 % (data from the SME I/O Table). *Source: http://www.sme.go.th/Lists/EditorInput/DispF.aspx?List=15dca7fb-bf2e-464e-97e5-440321040570&ID=1525*

5.1.1 Increase and decrease minimum wage

The minimum wage is a controversial policy. The objective of increased minimum wage is for unskilled labor to be able to achieve sufficient living standard (Jayanthakumaran, Sangkaew, & O'Brien, Trade liberalisation and manufacturing wage premiums: Evidence from Thailand, 2013; Dolado, et al., 1996). However, its opponents argue that it may price low-skill labors out of jobs (Dolado, et al., 1996). One important consideration for developing economies is that the effect upon employment of minimum wage changes is negatively significant to small businesses and labors who have low levels of education (Carpio, Nguyen, & Wang, 2012; Carpio, Messina, & Galdeano, 2014). For large companies and labors educated to high school level and beyond, the impact is typically less dramatic. Furthermore, when the impact is negative, the effect is more severe in non-production labor categories than it is for labor working in production (Carpio *et al*., 2012). Moreover, Carpio *et al.* (2014) studied the minimum wage in Thailand and also found that minimum wage has a negative effects on employment, especially among female and less-educated labors.

There are studies which revealed that setting minimum wages at higher levels can result in lower levels of employment (Holland, Bhattacharjee, & Stodick, 2006; Carpio, Nguyen, & Wang, 2012; Akpansung, 2014). The work of Holland *et al.* (2006) employed a CGE model to investigate the outcomes of the economy from a minimum wage rate increase in Washington. The short-run model outcome revealed a 2.5% fall in employment when the minimum wage was raised by 5%. These results were supported by Akpansung (2014), who discovered that the minimum wage was highly correlated with unemployment, the correlation coefficient was 0.8328. Empirical result showed unemployment levels rising as a result of minimum wage increases. Indeed, it has been shown that increasing the federal minimum wage by 1% served to cut employment by 6.4% in the same year, rising to 9.9% in the following year (Akpansung, 2014). In addition, the research of Dixon, Madden & Rimmer (2009) revealed that increasing wage rates by 4.2% would lead to a fall in employment of 0.77% when compared with a scenario which involved constant wage rates. This can be seen as a trade-off where wages which are 4.2% higher will cost 0.77% of jobs. This employment reduction would be spread broadly across all industries and regions and

not just focused upon those industries which are highly labor intensive (Dixon, Madden, & Rimmer, 2009).

Countries around the world have some types of minimum wage. Policymakers have often claimed that an increase in the minimum wage results in an increase in the income of the low-wage labor force, thereby serving as a means to reduce both inequality and poverty. In some circumstances, it is possible to raise the minimum wage without causing job losses. It has also been suggested that that raising wages can also help to increase productivity as labors are encouraged to work harder, turnover falls, and companies are more likely to provide training to labors (Raff & Summers, 1987; Levine, 1992).

It has been shown that increasing the minimum wage does not in every case result in an increase in the unemployment rate (Reich, Jacobs, & Bernhardt, 2014). Although the cost of labor increases, these costs can sometimes be offset by improvements in efficiency, lower labor turnover, higher prices, or the acceptance of lower profits. Reich *et al.* (2014) observed in the restaurant sector that when the minimum wage rose, the income of the low-wage labors is also increased, while the cost to the businesses can actually fall as labor turnover is lowered. Small price increases in these restaurants are often also seen. However, the research of these authors does not provide any indication of the consequences of more significant minimum wage increases.

Moreover, Agénor and Aynaoui (2003) investigated unemployment in Morocco and its relationship with labor market policies. It was shown that cutting the minimum wage could cause unemployment rates to fall for unskilled labor in the short term, and the process of achieving balance in the labor market would involve various types of dynamic effects, these include migration from rural to urban areas, adjustment of formal-informal labor supplies, and changes in the domestic and international flows of labor. However, one drawback is that investment and output would also fall lead to lower consumption and lower tax revenues. The drop in tax revenues could then lead to increasing fiscal deficits which are not sustainable over the longer term. It was thus determined that such a policy in Morocco would not bring about long term benefits

unless suitable fiscal adjustments were applied simultaneously (Agénor & Aynaoui, 2003).

In theory, a single economy that raises its minimum wage will raise its wages relative to competitors with adverse effects on economy. This argument makes sense if the labor market is competitive. Then, the more elastic (flatter) is the labor demand curve, a given rise in the minimum wage will have a larger negative effect on employment (Dolado, et al., 1996). Note that the employment loss from a given minimum wage will be larger the more elastic is the demand for labor. Moreover, the effect of a minimum wage change on employment level also depends on what the current wage level is set relative to labor's marginal product of labor (MPL). In cases where the existing wage is set below the MPL, as may be the case with monopsonistic[37] firm, a higher minimum wage will be beneficial to the labors without causing a fall in employment. This is because the employer continues to benefit from employing the labor, even though the profits may no longer be quite so large at the higher wage rate (Rebitzer & Taylor, 1995). In contrast, if the labor market is already competitive, and current wages are equal to the MPL, job losses will be the result of any increase in wages.

5.1.2 Minimum wage subsidy

It has been stated by Terra, Bucheli, Laens and Estrades (2006) that subsidy policies have a positive influence upon GDP. Terra et al. (2006) conducted a study in which wages of unskilled labors were subsidized and revealed that while wages increased, GDP benefitted from efficiency gains derived from the fall in informal employment or unemployment. The subsidy was shown to stimulate the demand for unskilled labors, thereby offsetting the fall in demand which would result from the inefficiencies caused by the wage premium. This policy could therefore lead to higher employment levels and better income distribution. However, the long term effects of such a policy may not be beneficial due to the potential for negative consequences. The

[37] Monopsony: The name given to the situation where there is only one buyer in a market, who thus has the ability to drive down the price paid for labor. It is the counterpart to a monopoly but on the buying side of the market.

shortcoming is a likely fall in investment and a potential reduction in the disincentive to human capital accumulation (Terra et al., 2006). This could adversely affect future growth rates. While that would not entirely rule out the use of such a policy, it would be advisable to apply it only in specific labor sectors (Terra, Bucheli, Laens, & Estrades, 2006).

A study in the Democratic Republic of Congo by Erero, Pambudi and Bonga (2013) examined the effects of subsidizing wages in the formal employment sector for unskilled labors. The research employed multi-sectoral empirically-calibrated general equilibrium model to assess all the transactions taking place within the economy between the informal and formal sectors. The simulation was carried out over the short and long term, showing that when unskilled labors' wages are subsidized, household incomes in both formal and informal sectors are increased, thus narrowing the income gap between rich and poor households, and also between informal and formal sectors. It was also found that targeting unskilled formal labors with a wage subsidy would cause an increase in GDP by 1.19% in the short run and by 3.19% in the long run as measured from the baseline (Erero, Pambudi, & Bonga, 2013).

Erero *et al.* (2013) also suggest that the use of a subsidy to target unskilled formal labors has a positive effect in boosting real incomes and in particular supports low income households. This occurs because informal producers face competition from the formal sector which is now subsidized. As a result, the informal sector is encouraged to operate more formally. In simulations, it was shown that providing a wage subsidy of 10% to formal sector unskilled labor would cause employment to rise on aggregate by 2.48% and 4.8% in the short and in the long runs, respectively (Erero, Pambudi, & Bonga, 2013). This rise in the employment figures reflect a rise in the quantity of labor involved in the process of production. This can lead to productivity increases across the whole economy, boosting employment levels.

There is also an effect upon the consumer price index (CPI) of imposing a 10% wage subsidy, in this case the CPI falls by 2.19% in short run and by 1.25% over the long run. Furthermore, the resulting increase in productivity allows higher levels of competitiveness among producers in the economy, thus export growth tends to become higher and export volumes also rise. In this case, export volumes were shown to rise by

6.96% in the short run and 7.09% in the long run. When exports rise, this typically benefits the formal sector more than the informal sector since exporters are more likely to be found in the formal sector. This motivates informal business to formalize their operations to benefit from this trend (Erero *et al.*, 2013).

5.1.3 Effect of economic integration on minimum wage and labor productivity

An increase in real wages is a common indicator of improved industrial performance and economic development. Under the assumption of perfect competition and labor are immobility wages in an industry are dependent upon the prices of goods and services produced and the marginal product of labor (Jayanthakumaran, Sangkaew, & O'Brien, Trade liberalisation and manufacturing wage premiums: Evidence from Thailand, 2013). Any decline in import tariffs as part of trade liberalization would presumably lower the profit margins of domestic firms and cause a proportional declines in wages. In the long run, when factors of production are mobile across industries, standard Heckscher-Ohlin's theory predicts that a convergence in goods prices due to free trade would lead to convergence in factor prices which will be equalized across industries and any differences in wages for similar types of work will eventually disappear (Jayanthakumaran, Sangkaew, & O'Brien, Trade liberalisation and manufacturing wage premiums: Evidence from Thailand, 2013; Hanson, 2003). In other word, increased trade openness should narrow the wage gap between skilled and unskilled labors in developing countries due to an increase in the demand for the abundant of unskilled labor.

Hanson (2003) reported the positive correlation between wage changes in Mexico and U.S. He found that when U.S. wage increased by 10%, wage in Mexican interior cities increased by 1.8% and wages in Mexican border cities increased by 2.5%. Moreover, Revenga and Montenegro (1998) found the positive correlation between Mexico-U.S. relative wages and Mexican tariffs. They found that when tariff reduced by 50%, the relative wages between Mexico-U.S. reduced by 3.7% for unskilled labor and 4.3% for skilled labor. This was as Heckscher–Ohlin's predictions and suggested that there was at least a partial integration of labor markets between the two countries.

However, imperfectly competitive product and labor markets should react in a different way. Trade liberalization would lower the profit margins of domestic firms which therefore lowers industrial wages. The decline in import tariffs could be associated with subsequent improvements in productivity, with the expectation that this would reflect in higher wages across industries reliant upon these inputs. This will eventually lead to some industries operating with sustained higher wage premiums than others (Jayanthakumaran, Sangkaew, & O'Brien, Trade liberalisation and manufacturing wage premiums: Evidence from Thailand, 2013). In addition, some empirical studies examining the link between trade liberalization and industry sector wage premiums in developing countries have shown results which contradicting Heckscher–Ohlin's prediction (Bhula-or & Kripornsak, 2008; Jayanthakumaran, Sangkaew, & O'Brien, Trade liberalisation and manufacturing wage premiums: Evidence from Thailand, 2013). Bhula-or & Kripornsak (2008) studied how trade liberalization policy consisting of reduced tariffs and non-tariff barriers influenced wage inequality. They emphasized that both developed and developing countries are found increasing in skilled and unskilled wage gaps due to increasing demand of skilled labor which leads to the larger income inequality.

Similar to Jayanthakumaran *et al.* (2013) who revealed a divergence in the trends of output and employment within the manufacturing sector and argued that certain firms and industries are growing faster than others. This leads to more demand for skilled labors which encouraged industrial wage premiums as a result from trade liberalization. In addition, Hanson (2003) claimed that when a member country eliminates trade barrier within the region, the country would become more specialize in its export product. This specialization would support the country to gain from international trade, however this gain is not likely to equally share by all sectors in the country.

On the other hand, although eliminating trade barriers would presumably lower the profit margins of domestic firms and cause a proportional declines in wages, it induces higher productivity. Casacuberta, Fachola, and Gandelma (2004) found that in response to reductions in trade barriers, the Uruguayan manufacturing sectors upgraded

their production technologies and became more capital intensive. The use of such technologies would also increase labor productivity.

5.2 Methodology

CGE model can capture the interaction of economic factors due to wage policies (Maechler & Holst, 1995). Thus, it is appropriate model for this chapter. Model structure in this chapter contains 8 sets of equation, which are production, income and saving, producer supplies of products and international trade, prices, equilibrium, gross domestic product, dynamics, Warlas' law (Appendix G1), closure rule (Appendix G3). The dynamic multi-countries CGE model used in this chapter is based on a global general equilibrium model developed by Robichaud *et al.* (2013). The complete list of equations, sets, variables and parameters are in Appendix B.

The full specification and equations of the model are described in Appendix B. It is calibrated from the GTAP Version 8 database[38] and the 2007 base year of that dataset is projected for eight years in the baseline using the data from several sources for growth projections as shown in Table 3.1.

There are basic assumptions for the CGE model. Prices will be set at market-clearing levels, businesses will seek to maximize their profits, and customers will aim to maximize their utility. Such an economy is expected to reach equilibrium when supply and demand are adjusted in response to relative costs of production to the point where they are equal in each market. The production structure of businesses is assumed to encompass zero pure profits.

Closure rules (Appendix G3) and exogenous growth variables are typical assumptions for this study. Difference in these assumptions can affect empirical simulation results. Closure rules are as following.

- Government spending growth equals to GDP growth
- Investment growth equals to GDP growth
- Household saving growth equals to GDP growths

[38] Robichaud *et al.* (2013)

- Exchange rate is fixed
- GDP deflator of ROW is a numeraire (Appendix G2)
- Minimum consumption growth equals labor supply growth
- Wage of migrant labor growth equals to inflation growth

This chapter assumes wage is exogenous, wage increases will cause lower employment because the demand of labor will decline as the factor price increases. The chapter uses the dynamic multi-countries CGE model to investigate the potential effects of wage policy decision on economy and employment in Thailand. The purpose of this chapter is to estimate the effects of wage policy and labor productivity on Thai economy. The study simulates the cause of wage policy into 4 main scenarios as following.

Business as usual (BAU): AEC integration is occurred but nothing change in wage policy.

Minimum wage increase: Thailand establish the new minimum wage law causing the increase in minimum wage of unskilled labor in Thailand.

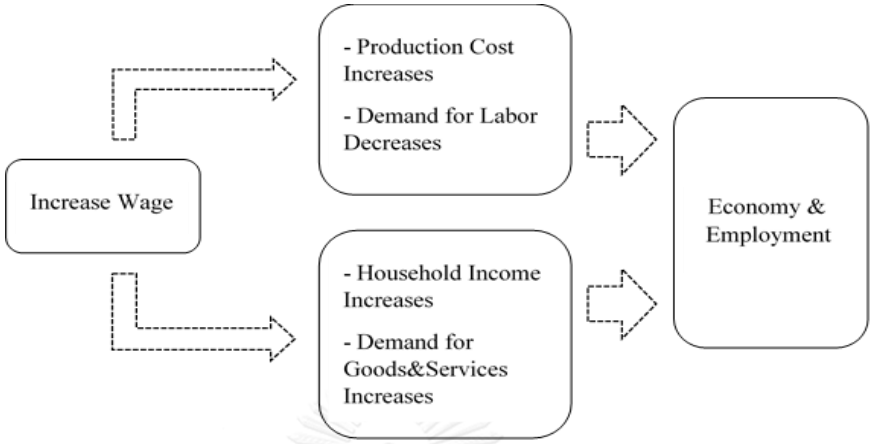
Minimum wage subsidy: Alternative policy in which government chooses to subsidy the entire wage gap for minimum wage law by using government budget to prevent the rising cost in production side.

Minimum wage decrease: The most extreme policy scenarios. The study assumes that minimum wage law in Thailand has been cancel out and this causes the decline in minimum wage of unskilled labor in Thailand.

Labor productivity increase: In the response of increased minimum wage, productivity of labor who earn minimum wage should increase in order to compensate the negative impact of increased minimum wage policy.

5.2.1 Increase minimum wage

Figure 5.1: Effect of increase minimum wage policy

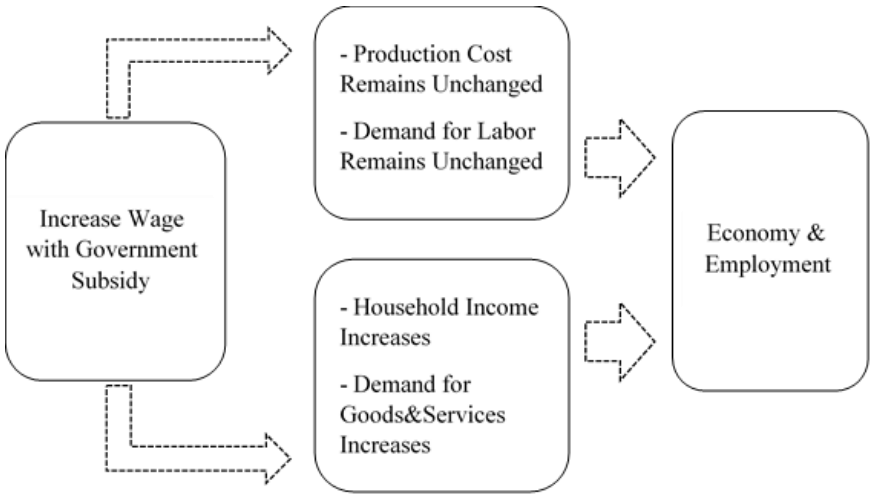


Source: The study's diagram

Figure 5.1 illustrates the transmission of wage policy through economy and employment. The effect of increased minimum wage will raise the production cost and decrease demand for labor while household income will increase as well as demand for goods and services.

5.2.2 Minimum wage subsidy

Figure 5.2: Effect of minimum wage subsidy policy

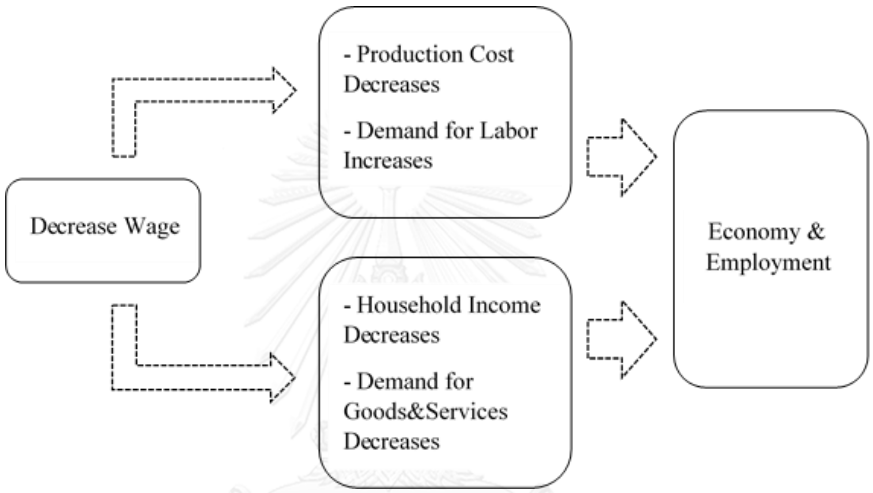


Source: The study's diagram

Figure 5.2 illustrates the effect of minimum wage subsidy which will not affect the production cost and labor demand because government pay for the amount of increased wage while household income will increase as well as demand for goods and services because more wage from government subsidy policy.

5.2.3 Decrease minimum wage

Figure 5.3: Effect of decrease minimum wage policy



Source: The study's diagram

Figure 5.3 illustrates the effect of decreased minimum wage which will lower the production cost, thus demand for labor increases while household income will decrease as well as demand for goods and services.

This chapter uses dynamic multi-countries CGE model to analyze the effects of wage policy and labor productivity on the Thai economy. It is based on the model by Robichaud *et al.* (2013). For the wage policies, the study simulates minimum wage rise into 3 simulations as follow:

Minimum wage of unskilled labor in Thailand increases by 6.67%: Since the model does not have the minimum wage variable, the study computes the average change of wage by arise of minimum wage from 300 to 320 Baht per day (6.67%

change). In addition, the study assumed that only 25%[39] of labor in Thailand paid at minimum wage (300 baht per day).

Minimum wage of unskilled labor in Thailand increases by 20%: The study uses the same method as above computed from minimum wage rising from 300 to 360 Baht per day, if the unskilled wage in Thailand increases while other countries in AEC remain the same.

Minimum wage of unskilled labor in Thailand increases by 61%: The extreme case that the minimum wage rising from 300 to 481 Baht per day[40], if the unskilled wage in Thailand increases while other countries in AEC remain the same.

Therefore, all the wage scenarios in this chapter as follow. Thailand's unskilled minimum wage increases by 6.67%, 20%, and 61%. Thailand's unskilled minimum wage rise by 6.67%, 20%, and 61% by government subsidy. Thailand's unskilled minimum wage decrease by 6.67%, 20%, and 61%.

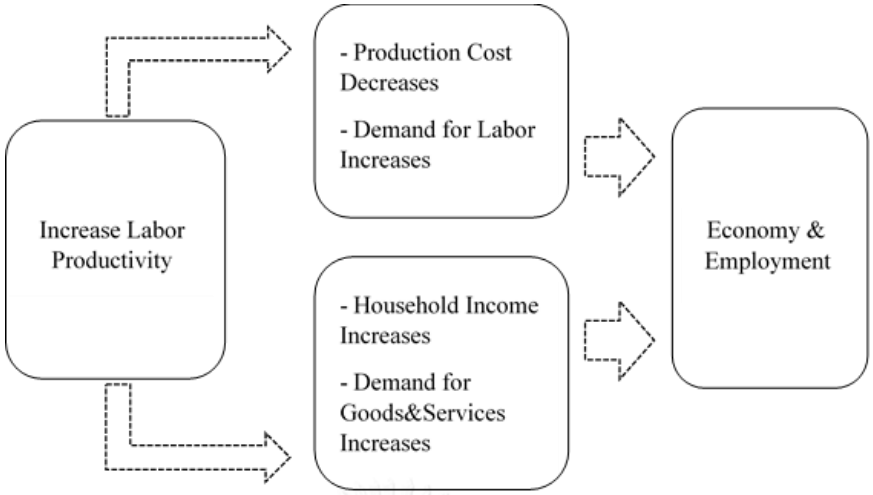
5.2.4 Increase labor productivity

Labor productivity describes the levels of output per unit of labor input. An increase in labor productivity means that the same quantity of a labor can produce more goods and services. For example, new training may enable a labor to produce twice as many output as previously (Burfisher, 2011).

[39] The report shows that about 11.5 million persons was paid at the minimum wage rate compared with labor force in Thailand is about 37 million persons. Consequently, the study arbitrary assumes at 25% for convenient *(source: http://www.thailandfuturefoundation.org/th/reports/detail.php?ID=44&SECTION_ID=12)*.

[40] The report found that with the minimum wage at 483 Baht per day, the head of household can be able to take care his/her spouse and one child living with one's self -esteem. *(Source: http://research.mol.go.th/2013/rsdat/Data/doc/NKSJUQ4.pdf)*

Figure 5.4 Effect of decrease minimum wage policy



Source: The study's diagram

Figure 5.4 illustrates the transmission of increased labor productivity through economy and employment. The effect of increase labor productivity will relatively reduce the production cost because of more output can be produce for a unit of labor. Thus, labor demand will increase and leads to increase in household income as well as demand for goods and services.

Table 5.1: *Growth of labor productivity per person employed for Thailand*

Growth of labor productivity per person employed (percent growth)										
Year	2000	2001	2002	2003	2004	2005	2006	2007	Average	Standard deviation
LP growth	2.35	0.83	3.08	4.72	3.57	2.61	3.65	3.81		
Year	2008	2009	2010	2011	2012	2013	2014	2015	2.62	2.36
LP growth	-0.46	-2.67	6.48	-0.5	5.75	2.98	2.91	2.84		

Source: The Conference Board 2015[41]

Table 5.1 shows labor productivity per person employed for Thailand which is defined as real output (gross value added) divided by total employed persons[42]. Table

[41] The Conference Board Total Economy Database™, May 2015, http://www.conference-board.org/data/economydatabase/

[42] Definitions: http://stats.oecd.org/mei/default.asp?lang=e&subject=19

5.1 illustrates labor productivity growth per year between 2000 and 2015. The average growth during this period equals to 2.62% and standard deviation is 2.36%. This indicates that 2.5% labor productivity growth for Thailand is not incapable. Thus, the first scenario for increased labor productivity case is 2.5%. The second and third scenarios are 10% and 20%, respectively, to represent the simulation of 2.5% growth for 4 and 8 years. All labor productivity scenarios in this chapter as follow, labor productivity of unskilled labors who earn minimum wage in Thailand increases by 2.5%, 10%, and 20%, respectively. Table 5.2 concludes all scenario's shocks in this chapter.

Table 5.2: Scenarios of the chapter

Scenario	Shock magnitude
Thai minimum wage adjustment	Minimum wage increases by 6.67%
	Minimum wage increases by 20%
	Minimum wage increases by 61%
	Minimum wage increases by 6.67% but government subsidy
	Minimum wage increases by 20% but government subsidy
	Minimum wage increases by 61% but government subsidy
	Minimum wage decreases by 6.67%
	Minimum wage decreases by 20%
	Minimum wage decreases by 61%
Thai labor productivity adjustment	Labor productivity increases by 2.5%
	Labor productivity increases by 10%
	Labor productivity increases by 20%

Source: The study's scenarios

5.3 Results

This section consists of 3 mains parts. First part shows the results of minimum wage adjustment scenario which will simulate the effect of each scenario on ASEAN and Thai economies. Second part shows the results of labor productivity adjustment

scenario which will simulate the effect of each scenario on ASEAN and Thai economies. The last part shows the results of the combination of minimum wage and labor productivity adjustments.

5.3.1 Effects of Thai minimum wage adjustment

5.3.1.1 Effects on ASEAN

Table 5.3: Real GDP change of ASEAN countries from BAU by varying minimum wage (unit in Billion US Dollar)

	Minimum Wage Increases			Government Subsidy			Minimum Wage Decreases		
Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Cambodia	-0.005	-0.017	-0.052	-0.003	-0.009	-0.028	0.007	0.022	0.075
Indonesia	0.070	0.217	0.656	0.030	0.094	0.309	-0.098	-0.315	-1.088
Lao PDR	-0.007	-0.022	-0.068	-0.003	-0.011	-0.035	0.011	0.035	0.122
Malaysia	-0.005	-0.016	-0.045	-0.008	-0.025	-0.079	0.007	0.022	0.080
Philippines	0.019	0.058	0.173	0.007	0.023	0.073	-0.025	-0.080	-0.277
Singapore	0.026	0.082	0.243	0.000	-0.001	-0.002	-0.034	-0.109	-0.370
Thailand	-1.195	-3.696	-10.818	-0.288	-0.896	-2.888	1.482	4.691	15.990
Vietnam	0.000	0.002	0.006	0.000	0.002	0.007	-0.001	-0.002	-0.004
ROASEAN	-0.035	-0.109	-0.338	-0.013	-0.043	-0.143	0.060	0.200	0.726
ROW	-0.332	-0.996	-2.942	-0.116	-0.357	-1.131	0.378	1.177	3.892

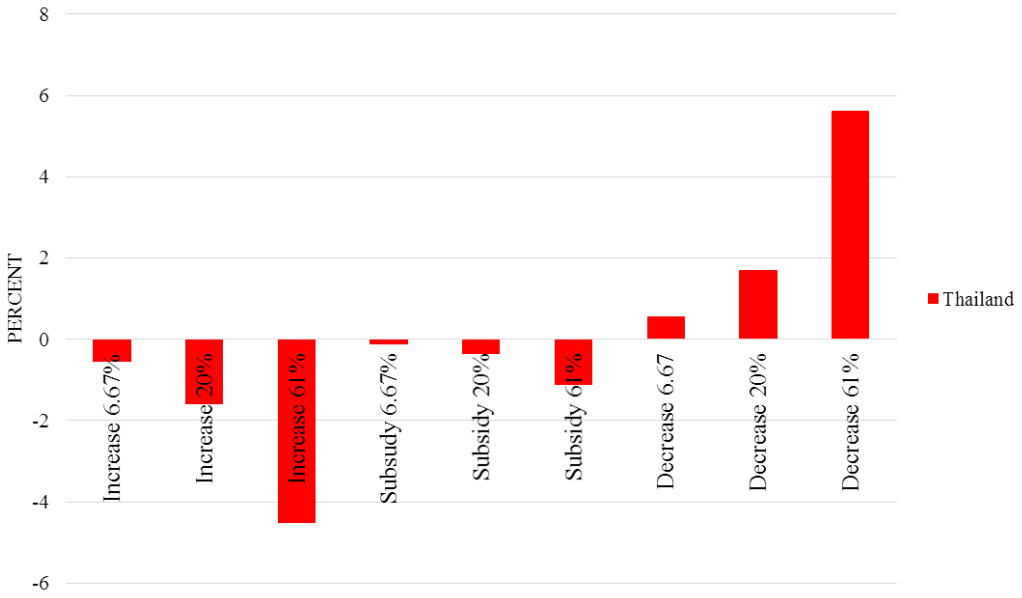
Source: Result from the study's model

Table 5.4: Percentage change of ASEAN countries' GDP from BAU by varying minimum wage (unit in percent change)

	Minimum Wage Increases			Government Subsidy			Minimum Wage Decreases		
Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Cambodia	-0.07	-0.21	-0.60	-0.03	-0.09	-0.29	0.07	0.22	0.72
Indonesia	0.02	0.05	0.14	0.01	0.02	0.06	-0.02	-0.05	-0.18
Lao PDR	-0.17	-0.49	-1.42	-0.07	-0.20	-0.61	0.17	0.53	1.73
Malaysia	0.00	-0.01	-0.02	0.00	-0.01	-0.04	0.00	0.01	0.03
Philippines	0.01	0.04	0.12	0.00	0.01	0.04	-0.01	-0.04	-0.15
Singapore	0.02	0.05	0.16	0.00	0.00	0.00	-0.02	-0.06	-0.19
Thailand	-0.54	-1.58	-4.50	-0.12	-0.35	-1.11	0.55	1.70	5.61
Vietnam	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	-0.01
ROASEAN	-0.13	-0.38	-1.08	-0.04	-0.11	-0.35	0.13	0.41	1.39
ROW	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.01

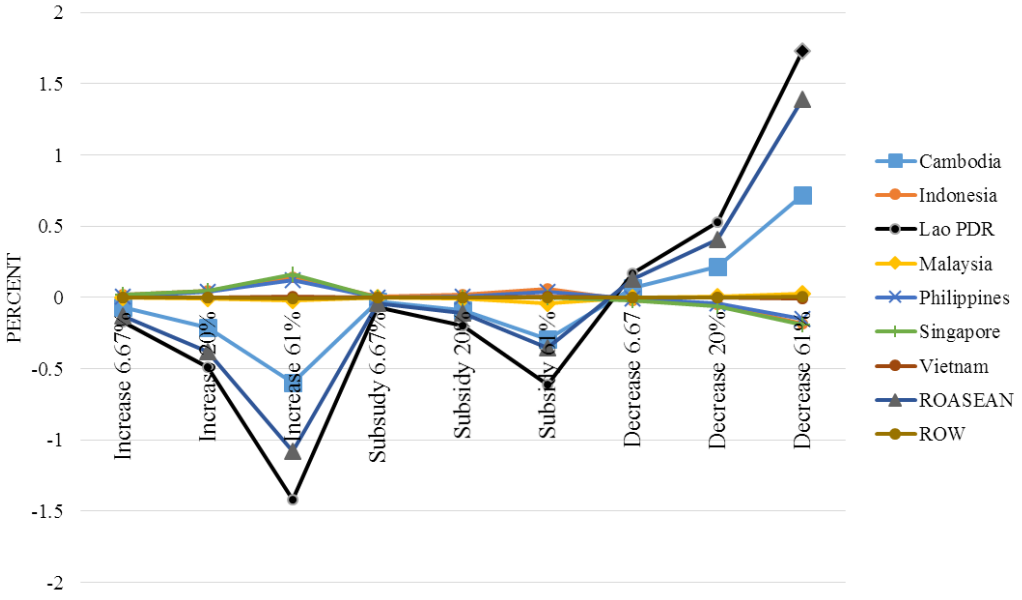
Source: Result from the study's model

Figure 5.5: Percentage change of Thailand's GDP from BAU by varying minimum wage



Source: Result from the study's model

Figure 5.6: Percentage change of ASEAN countries' GDP excluding Thailand from BAU by varying minimum wage



Source: Result from the study's model

Table 5.3 and 5.4 show the simulation result of the effect of minimum wage policy on GDP. Figure 5.5 shows the effect of varying minimum wage on Thai GDP. It shows negative relationship between real GDP and increased minimum wage and between real GDP and minimum wage subsidy but positive relationship between real GDP and decreased minimum wage. Figure 5.6 shows the effects of varying minimum wage on other ASEAN members. It shows that ROASEAN (Myanmar + Brunei), Lao PDR, and Cambodia are affected significantly by minimum wage policies from Thailand. This is because Thailand is the major trading partner for these countries as shown in Table 5.5. It shows that Cambodia, Lao PDR, and ROASEAN have the highest trade value with Thailand account for 19.52%, 51.79%, and 21.21% of total trade, respectively.

Table 5.5: Share of ASEAN intra-trade from 2015-2023 (unit in percentage)

	Cambodia	Lao PDR	ROASEAN	Thailand	Malaysia	Philippines	Singapore	Indonesia	Vietnam
Cambodia		0.00	0.01	19.52	1.77	0.15	3.81	1.45	7.45
Lao PDR	0.01		0.02	51.79	1.90	0.06	0.55	0.32	9.98
ROASEAN	0.01	0.00		21.21	4.14	0.12	5.06	8.89	0.55
Thailand	0.71	0.59	1.70		6.65	1.83	4.77	3.61	2.09
Malaysia	0.06	0.02	0.30	6.03		1.95	13.16	3.63	1.40
Philippines	0.01	0.00	0.02	4.23	4.98		5.13	2.56	1.55
Singapore	0.11	0.00	0.32	3.78	11.50	1.76		6.61	1.96
Indonesia	0.07	0.00	0.94	4.76	5.28	1.46	10.99		1.42
Vietnam	0.74	0.31	0.12	5.69	4.20	1.82	6.75	2.93	

Source: Result from the study's model

According to Table 5.3 and 5.4, for increased minimum wage scenario, the effect of minimum wage rise from 300 to 320 baht per day (6.67%) causes GDP of Thailand to fall by 1.195 billion US dollar (-0.54%). This is because the rising wage causes the increase in production cost, then producers decide to decrease their own production level causing GDP to fall. Cambodia, Lao PDR, and ROASEAN which have the relation with Thailand as an important trading partner have a decline in GDP as well because producers in Thailand produce less output (Table 5.6) which causes less volume of trade between Thailand and these countries. While other countries seem to have a very small effect from increased minimum wage from Thailand. Further effect

of increased minimum wage by 20% and 61% would cause the reduction in GDP equals to 3.696 billion US dollar (-1.58%) and 10.818 billion US dollar (-4.50%) respectively.

According to Table 5.4, real GDP of Thailand are positively correlated with real GDP of Cambodia, Lao PDR, and Myanmar (CLM countries) under minimum wage adjustment from Thailand. This indicates that there is at least partial economic integration between these countries. This result is in line with the study of Hanson (2003) who found that when U.S. wage increased by 10%, wage in Mexican interior cities increased by 1.8% and wages in Mexican border cities increased by 2.5%.

For minimum wage subsidy scenario, minimum wage subsidy could reduce the negative effect of increased minimum wage, since the study assumes that government will pay for the amount of increased minimum wage to support the production side. According to Table 5.3 and 5.4, GDP decreases less than the increased minimum wage scenario, the amount of decrease equals to 0.288 (-0.12%), 0.896 (-0.35%), and 2.888 (-1.11%) billion US dollars, respectively, from 6.67%, 20%, and 61% of rising unskilled labor's minimum wage. Note that the very first year, GDP of Thailand will be increased due to the minimum wage subsidy, however, the later year, GDP of Thailand will be declined since government budget balance is less than BAU scenario in which model assumes that all the government saving go to investment. Therefore, total investment will reduce overtime and will less than BAU scenario. This result is in line with the results of Terra *et al.* (2006) and Agénor and Aynaoui (2003) who also found that in the long run, minimum wage subsidy policy will lead to a disincentive to human capital accumulation and unsustainable increase in fiscal deficits overtime. However, according to Dolado *et al.* (1996) supported the minimum wage subsidy policy. They claimed that this policy provides subsidies for employers to cut wages which causes the living standards of the low paid actually fall when their labor is subsidized.

For decreased minimum wage scenario, this scenario is an alternative policy of government by cancelled the minimum wage policy. The study arbitrary assumes that if the law is cancelled, the minimum wage of unskilled labor in Thailand will decrease without the political context and labor can accept the minimum wage decrease. GDP will rise by 1.482 (0.55%), 4.691 (1.70%), and 15.990 (5.61%) billion US dollars, respectively, from 6.67%, 20%, and 61% of unskilled labor's decreased minimum

wage. This happens because production side will produce more products and hires more labors because of the cheaper labor cost relative to other countries in AEC. Note that in this study, labor market assumption is labor demand always equal to labor supply, thus the study assumes that labor will accept less wage than before in this scenario.

Table 5.6: Percentage change of ASEAN countries' total output from BAU by varying minimum wage (unit in percent change)

	Minimum Wage Increases			Government Subsidy			Minimum Wage Decreases		
Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Cambodia	-0.02	-0.07	-0.21	-0.01	-0.03	-0.08	0.02	0.07	0.24
Indonesia	0.02	0.07	0.19	0.01	0.03	0.08	-0.02	-0.07	-0.24
Lao PDR	-0.12	-0.35	-1.00	-0.04	-0.13	-0.40	0.12	0.37	1.22
Malaysia	0.01	0.02	0.05	0.00	0.00	0.00	-0.01	-0.02	-0.06
Philippines	0.01	0.04	0.12	0.01	0.02	0.05	-0.02	-0.05	-0.15
Singapore	0.02	0.06	0.18	0.00	0.00	0.02	-0.02	-0.07	-0.22
Thailand	***-0.74***	***-2.15***	***-6.10***	***-0.22***	***-0.65***	***-2.02***	***0.76***	***2.33***	***7.78***
Vietnam	0.01	0.04	0.11	0.01	0.02	0.05	-0.01	-0.04	-0.14
ROASEAN	-0.11	-0.31	-0.87	-0.02	-0.07	-0.23	0.11	0.34	1.13
ROW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01

Source: Result from the study's model

According to Table 5.6, total output has the same direction with the GDP. The more minimum wage increases, the more output declines due to the higher labor cost. Minimum wage subsidy will cause less effect than without subsidy. Lastly, decreased minimum wage will be good for the production side, thus more output.

For increased minimum wage scenario, the effect of increased minimum wage from 300 to 320 baht per day (6.67%) causes total output of Thailand to fall by 0.74%. This is because the rising wage causes the increase in production cost, then producers decides to decrease their own output level. Cambodia, Lao PDR, and Myanmar (CLM countries), which have the relationship with Thailand as an important trading partner, have a decline in output as well because producers in Thailand produce less output which causes less volume of trade between Thailand and these countries. While other countries seem to have a very small effect from minimum wage increase in Thailand. Further effect of increase in minimum wage by 20%, and 61% would negatively affect total output equals to -2.15%, and -6.10%, respectively.

For minimum wage subsidy scenario, minimum wage subsidy could reduce the negative effect of increased minimum wage since the study assumes that government will pay for the amount of increased minimum wage to support the production side. According to Table 5.6, total output will decrease less than the previous scenario, the amount of decrease equals to 0.22%, 0.65%, and 2.02%, respectively, from 6.67%, 20% and 61% of rising unskilled labor's minimum wage.

For decreased minimum wage scenario, this scenario is an alternative policy of government by cancelled the minimum wage policy. The study arbitrary assumes that if the law is cancelled, the minimum wage of unskilled labor in Thailand will decrease without the political context and labor can accept the minimum wage decrease. Total output will rise by 0.76%, 2.33%, and 7.78%, respectively, from 6.67%, 20%, and 61% of decreased unskilled labor's minimum wage. This happens because production side will produce more products and hires more labors because of the cheaper labor cost relatively with other countries in AEC.

Table 5.7: Percentage change of ASEAN countries' investment from BAU by varying minimum wage (unit in percent change)

	Minimum Wage Increases			Government Subsidy			Minimum Wage Decreases		
Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Cambodia	-0.04	-0.12	-0.35	-0.02	-0.06	-0.18	0.04	0.12	0.38
Indonesia	0.05	0.14	0.41	0.02	0.06	0.18	-0.05	-0.15	-0.50
Lao PDR	-0.25	-0.73	-2.09	-0.10	-0.29	-0.89	0.25	0.78	2.57
Malaysia	0.02	0.05	0.15	0.00	0.01	0.02	-0.02	-0.06	-0.18
Philippines	0.04	0.12	0.35	0.02	0.05	0.15	-0.04	-0.13	-0.43
Singapore	0.05	0.14	0.41	0.00	0.01	0.04	-0.05	-0.15	-0.50
Thailand	***-0.93***	***-2.72***	***-7.80***	***-1.28***	***-3.84***	***-11.70***	***0.95***	***2.91***	***9.55***
Vietnam	0.03	0.08	0.23	0.01	0.04	0.11	-0.03	-0.09	-0.28
ROASEAN	-0.42	-1.22	-3.42	-0.11	-0.34	-1.06	0.43	1.33	4.46
ROW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: Result from the study's model

According to Table 5.7, the effect on investment is the same as from other literatures. After minimum wage increases, total investment will decrease because of higher cost of production which will lead to lower return on investment. The minimum wage subsidy scenarios will cause less investment since the government budget balance

will go more deficits. The decreased minimum wage scenario will be opposite to the increased minimum wage scenario.

For increased minimum wage scenario, the effect of increased minimum wage from 300 to 320 baht per day (6.67%) causes investment in Thailand to fall by 0.93%. Cambodia, Lao PDR, and Myanmar (CLM countries) that has the relationship with Thailand as an important trading partner have a decline in investment as well because their economies are closely related. While other countries seem to have a very small effect from increased minimum wage from Thailand. Further effect of increase in minimum wage by 20% and 61% would negatively affect investment equals to -1.22% and -3.42%, respectively.

For minimum wage subsidy scenario, minimum wage subsidy could worsen the situation since the study assume that government will pay for the amount of increasing minimum wage to support the production side. Therefore, total investment is reduced because lower government revenue causes government saving and investment to fall. According to Table 5.7, investment will decrease less than the previous scenario, the amount of decrease equals to 1.28%, 3.84%, and 11.70%, respectively, from 6.67%, 20%, and 61% of rising unskilled labor's minimum wage.

For decreased minimum wage scenario, this group of scenarios is an alternative policy of government by cancelled the minimum wage policy. The study arbitrary assumes that if the law is cancelled, the minimum wage of unskilled labor in Thailand will decrease without the political context and labor can accept the minimum wage decrease. Investment will rise by 0.95%, 2.91%, and 9.55%, respectively, from 6.67%, 20%, and 61% of decreased unskilled labor's minimum wage. This happens because production side will produce more products and invest more factors of production.

Table 5.8: Percentage change of ASEAN countries' inflation from BAU by varying minimum wage (unit in percent change)

	Minimum Wage Increases			Government Subsidy			Minimum Wage Decreases		
Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Cambodia	0.05	0.14	0.41	0.02	0.06	0.20	-0.05	-0.15	-0.50
Indonesia	0.02	0.05	0.13	0.01	0.02	0.06	-0.02	-0.05	-0.16
Lao PDR	-0.04	-0.13	-0.36	-0.02	-0.05	-0.15	0.04	0.13	0.44
Malaysia	0.01	0.03	0.08	0.00	0.01	0.04	-0.01	-0.03	-0.10
Philippines	0.01	0.04	0.12	0.01	0.02	0.06	-0.01	-0.05	-0.15
Singapore	0.01	0.03	0.08	0.00	0.01	0.02	-0.01	-0.03	-0.11
Thailand	***0.13***	***0.38***	***1.08***	***0.05***	***0.16***	***0.48***	***-0.13***	***-0.41***	***-1.34***
Vietnam	0.02	0.05	0.14	0.01	0.03	0.08	-0.02	-0.05	-0.17
ROASEAN	-0.06	-0.17	-0.47	-0.02	-0.05	-0.15	0.06	0.18	0.61
ROW	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	-0.01

Source: Result from the study's model

According to Table 5.8, inflation is in line with the economic theory. The more minimum wage increases, the more inflation occurs because the production cost increases, which supply will shift left due to higher product price or called cost push inflation, as well as labors have more income, thus more spending or called demand pull inflation. The result is similar to Erero *et al.* (2013) who found that increased wage or wage subsidies cases, inflation will increase. On the other hand, the more wage declines, the less inflation occurs.

For increased minimum wage scenario, the effect of increased minimum wage from 300 to 320 baht per day (6.67%) causes inflation of Thailand to rise by 0.13%. This is because production cost increases, thus price of products increases created cost push inflation. Moreover, labors earn more income, thus consumption increases created demand pull inflation. Further effect of increase in minimum wage by 20% and 61% would positively affect inflation equals to 0.38% and 1.08%, respectively.

For minimum wage subsidy scenario, inflation increases but less than the previous scenario because there is no more cost push inflation since there is subsidy from government. According to Table 5.8, inflation will increase less than the previous scenario, the amount of increase equals to 0.05%, 0.16%, and 0.48%, respectively, from 6.67%, 20%, and 61% of unskilled labor's minimum wage subsidy.

For decreased minimum wage scenario, this scenario is an alternative policy of government by cancelled the minimum wage policy. The study arbitrary assumes that

if the law is cancelled, the minimum wage of unskilled labor in Thailand will decrease without the political context and labor can accept the minimum wage decrease. Inflation will fall by 0.13%, 0.41%, and 1.34%, respectively, from 6.67%, 20%, and 61% of decreased unskilled labor's minimum wage. This happens because production side will produce more products, thus price of product will fall and supply curve shift right although there is demand pull inflation but the effect of decline in product price is larger, thus inflation falls.

Table 5.9: Percentage change of ASEAN countries' employment from BAU by varying minimum wage (unit in percent change)

		Minimum Wage Increases			Government Subsidy			Minimum Wage Decreases		
	Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Unskilled Labor	Cambodia	-0.03	-0.09	-0.26	-0.01	-0.04	-0.12	0.03	0.09	0.29
	Indonesia	0.04	0.11	0.32	0.02	0.05	0.14	-0.04	-0.12	-0.39
	Lao PDR	-0.18	-0.53	-1.51	-0.07	-0.20	-0.61	0.18	0.56	1.85
	Malaysia	0.01	0.03	0.09	0.00	0.00	0.01	-0.01	-0.03	-0.11
	Philippines	0.03	0.09	0.27	0.01	0.04	0.12	-0.03	-0.10	-0.33
	Singapore	0.03	0.09	0.26	0.00	0.01	0.02	-0.03	-0.10	-0.33
	Thailand	***-2.26***	***-6.52***	***-17.78***	***-0.06***	***-0.19***	***-0.62***	***2.35***	***7.36***	***25.82***
	Vietnam	0.02	0.06	0.19	0.01	0.03	0.11	-0.02	-0.07	-0.22
	ROASEAN	-0.16	-0.47	-1.32	-0.04	-0.13	-0.39	0.17	0.51	1.73
	ROW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
Skilled Labor	Cambodia	-0.04	-0.13	-0.38	-0.02	-0.07	-0.23	0.04	0.13	0.42
	Indonesia	0.04	0.11	0.32	0.01	0.04	0.14	-0.04	-0.12	-0.40
	Lao PDR	-0.25	-0.73	-2.10	-0.11	-0.32	-0.98	0.26	0.78	2.58
	Malaysia	0.01	0.03	0.09	0.00	0.00	-0.01	-0.01	-0.03	-0.10
	Philippines	0.03	0.09	0.27	0.01	0.03	0.10	-0.03	-0.10	-0.33
	Singapore	0.03	0.09	0.27	0.00	0.00	0.01	-0.03	-0.10	-0.33
	Thailand	***-0.27***	***-0.81***	***-2.35***	***-0.03***	***-0.09***	***-0.30***	***0.28***	***0.85***	***2.72***
	Vietnam	0.02	0.05	0.15	0.01	0.02	0.05	-0.02	-0.05	-0.18
	ROASEAN	-0.19	-0.55	-1.55	-0.05	-0.15	-0.48	0.19	0.60	2.02
	ROW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: Result from the study's model

For increased minimum wage scenario, according to Table 5.9, result of employment is following economic theory (Brown, Gilroy, & Kohen, 1982). Increased minimum wage causes the labor demand to drop and results to the lower output and less employs both skilled and unskilled labors in Thailand and its 3 neighboring

countries (CLM countries). When minimum wage of unskilled labor increases by 6.67%, 20%, and 61%, employment of unskilled labor decreases by 2.26%, 6.52%, and 17.78%, respectively, while employment of skilled labor decreases by 0.27%, 0.81%, and 2.35%, respectively. The effect of increased minimum wage is larger for unskilled labor than for skilled labor because wage of skilled labor does not change, thus employer substitutes more skilled labor for unskilled labor. This result is in line with the study of Brown, Gilroy, and Kohen, 1982 who found that as a 10% increase in the minimum wage reduces employment by 1% to 3%.

For minimum wage subsidy scenario, minimum wage subsidy could reduce the negative effect of increasing minimum wage since the study assumes that government will pay for the amount of increasing minimum wage to support the production side. When minimum wage of unskilled labor increases by 6.67%, 20%, and 61%, employment of unskilled labor decreases by 0.06%, 0.19%, and 0.62%, respectively, while employment of skilled labor decreases by 0.03%, 0.09%, and 0.30%, respectively. The subsidy almost compensates all negative effect from increased minimum wage on employment because production cost does not increase.

For decreased minimum wage scenario, this scenario is an alternative policy of government by cancelled the minimum wage policy. The study arbitrary assumes that if the law is cancelled, the minimum wage of unskilled labor in Thailand will decrease without the political context and labor can accept the minimum wage decrease. When minimum wage of unskilled labor decreases by 6.67%, 20%, and 61%, employment of unskilled labor increases by 2.35%, 7.36%, and 25.82%, respectively, while employment of skilled labor increases by 0.28%, 0.85%, and 2.72%, respectively. The effect of increased minimum wage is larger for unskilled labor than for skilled labor because wage of skilled labor wage does not change, thus employer substitutes more unskilled labor for skilled labor. The result is in line with Dolado *et al.* (1996). A single economy that raises its minimum wage will raise its wages relative to competitors with adverse effects on its employment (Dolado, et al., 1996). According to Table 5.9, as employment in Thailand decreases, employment of other countries increase except Cambodia, Lao PDR, and ROASEAN which are trade dependence on Thailand.

5.3.1.2 Effects on Thailand

Table 5.10: Percentage change of sectoral output from BAU by varying minimum wage for Thailand (unit in percent change)

	Minimum Wage Increases			Government Subsidy			Minimum Wage Decreases		
Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Grains&Crops	-0.81	-2.36	-6.70	-0.18	-0.56	-1.88	0.83	2.56	8.50
LiveStk&Meat	-0.80	-2.34	-6.65	-0.11	-0.34	-1.17	0.82	2.52	8.35
Mining&Extractn	-0.58	-1.68	-4.69	-0.36	-1.09	-3.22	0.60	1.85	6.29
Procfood	-0.69	-2.01	-5.73	-0.17	-0.53	-1.72	0.70	2.16	7.13
Textiles&Clothing	-1.01	-2.94	-8.26	-0.18	-0.55	-1.73	1.04	3.22	10.87
LightMnfc	-0.95	-2.77	-7.81	-0.22	-0.67	-2.09	0.98	3.02	10.13
HeavyMnfc	-0.73	-2.14	-6.07	-0.33	-0.98	-3.01	0.75	2.31	7.67
Util&Constuct	-0.87	-2.56	-7.26	-0.67	-2.02	-6.12	0.90	2.76	9.17
OthServices	-0.66	-1.91	-5.41	0.01	0.03	0.07	0.67	2.08	6.95

Source: Result from the study's model

According to Table 5.10, when minimum wage increases without subsidy, the producer's cost will be higher resulting lower labor demand and producer would decide to produce less than BAU scenario, thus lower output. When government subsidies, the amount of increased minimum wage, output decreases less than in the increased minimum wage scenario because consumption would increase due to higher household income, thus output would not reduce as much as in the increased minimum wage scenario. However, output still declines although government does subsidy. This is because total investment decreases due to lower amount of government saving. For the decreased minimum wage scenario, Table 5.10 shows the positive effect of decreased minimum wage on total output in every sector. In addition, the study model shows the nonlinear characteristic of positive effect from decreased minimum wage scenario and negative effect from increased minimum wage scenario to sectoral output, the result shows positive effect is more than the negative one.

Textiles & clothing sector is mostly affected from increased minimum wage of unskilled labor because elasticity between labor and capital is high compared to other sectors, according to Table AE.2. In addition, according to Table AC.25, this sector is labor intensive sector compared to some sectors. Although grains & crops sector is more labor intensive sector than textiles & clothing sector, labor in grains & crops sector has lower elasticity between labor and capital than in textiles & clothing sector.

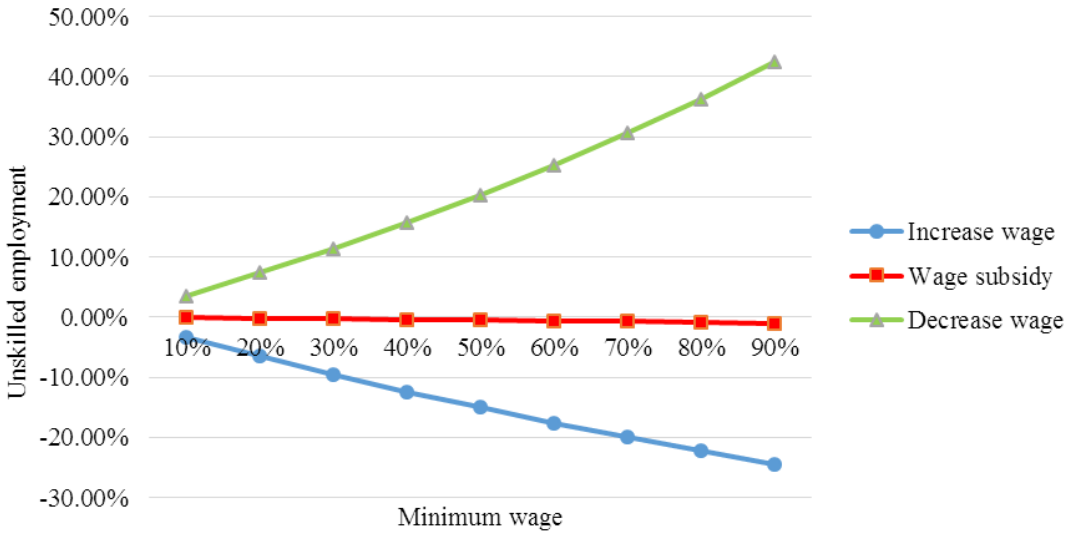
This make sense in practice because labor in grains & crops sector does not earn a minimum wage.

Table 5.11: Percentage change of sectoral employment from BAU by varying minimum wage for Thailand (unit in percent change)

		Increased minimum wage			Government Subsidy			Minimum Wage Decreases		
	Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Unskilled Labor	Grains&Crops	-1.14	-3.33	-9.37	-0.06	-0.20	-0.74	1.17	3.62	12.17
	LiveStk&Meat	-1.40	-4.06	-11.35	0.13	0.38	1.13	1.44	4.46	15.14
	Mining&Extractn	-1.00	-2.91	-8.13	-0.39	-1.16	-3.46	1.03	3.20	10.90
	Procfood	-2.12	-6.14	-16.82	0.22	0.66	1.97	2.21	6.89	23.98
	Textiles&Clothing	-2.60	-7.48	-20.22	0.13	0.38	1.14	2.71	8.51	30.17
	LightMnfc	-2.49	-7.18	-19.49	0.04	0.12	0.35	2.60	8.13	28.65
	HeavyMnfc	-2.33	-6.72	-18.33	-0.11	-0.33	-1.01	2.43	7.59	26.62
	Util&Constuct	-2.66	-7.66	-20.83	-0.95	-2.88	-9.02	2.77	8.68	30.51
	OthServices	-2.47	-7.11	-19.34	0.02	0.06	0.15	2.57	8.06	28.35
Skilled Labor	Grains&Crops	-0.69	-2.02	-5.76	-0.06	-0.20	-0.74	0.71	2.17	7.19
	LiveStk&Meat	-0.55	-1.61	-4.61	0.13	0.38	1.13	0.56	1.73	5.71
	Mining&Extractn	-0.67	-1.96	-5.49	-0.39	-1.16	-3.46	0.69	2.15	7.29
	Procfood	-0.29	-0.87	-2.49	0.22	0.66	1.97	0.30	0.92	3.01
	Textiles&Clothing	-0.55	-1.61	-4.60	0.13	0.38	1.14	0.56	1.72	5.67
	LightMnfc	-0.44	-1.29	-3.72	0.04	0.12	0.35	0.45	1.37	4.44
	HeavyMnfc	-0.27	-0.81	-2.34	-0.11	-0.33	-1.01	0.28	0.86	2.79
	Util&Constuct	-0.44	-1.30	-3.90	-0.95	-2.88	-9.02	0.44	1.33	4.13
	OthServices	-0.25	-0.74	-2.15	0.02	0.06	0.15	0.25	0.77	2.47

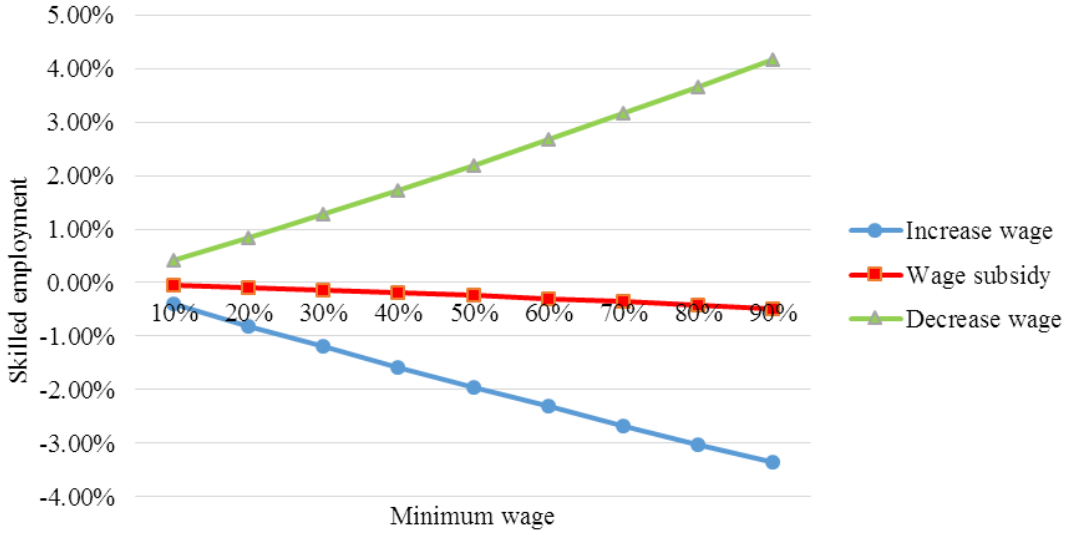
Source: Result from the study's model

Figure 5.7: Effect of minimum wage adjustment on employment of unskilled labor



Source: Result from the study's model

Figure 5.8: Effect of minimum wage adjustment on employment of skilled labor



Source: Result from the study's model

Table 5.11 shows percentage change of sectoral employment from BAU scenario by varying minimum wage for Thailand. Figure 5.7 and 5.8 show the effect of minimum wage adjustment on aggregate employment of unskilled and skilled labors by varying minimum wage from 1% to 9%. According to Figure 5.7 and 5.8, unskilled

labor responses to adjusting minimum wage more than skilled labor because wage of skilled labor does not increase.

When minimum wage increases without subsidy, the producer's cost will be higher resulting lower labor demand and producer would decide to produce less than BAU scenario. Unskilled labor will be employed less than BAU scenario in every sector and utility & construction sector is mostly affected. Skilled labor will be affected indirectly from lower level of production but with relatively low amount since producer can shift to use skilled labor instead of unskilled labor under CES production-function assumption, but not perfectly substitute. The percentage change of each sector varies depending on elasticity of labors, labor intensive, and number of employed labor.

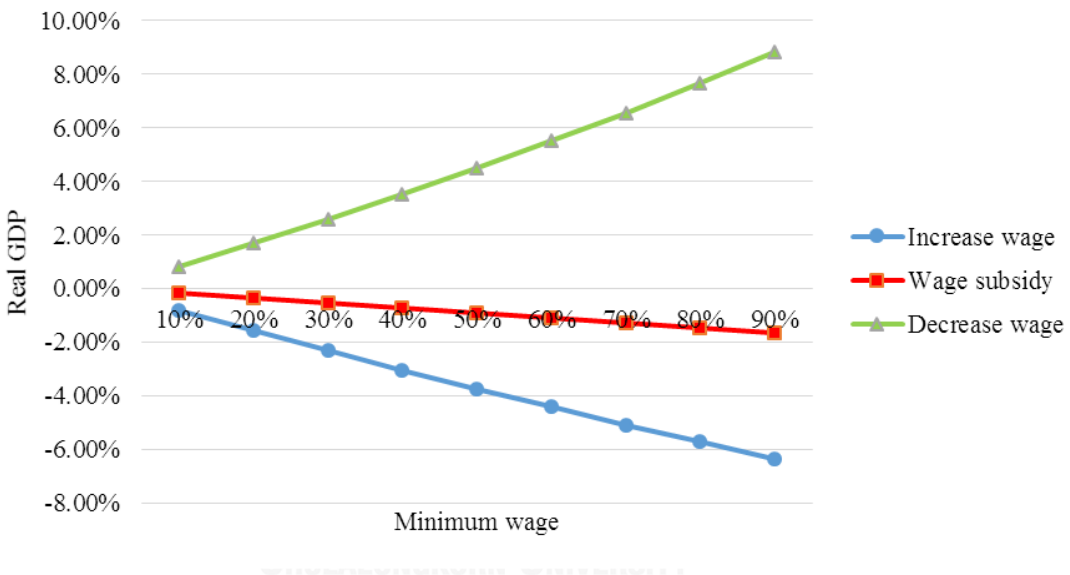
Utilities & construction sector is mostly affected from increased minimum wage of unskilled labor because elasticity between labors is high compared to other sectors, according to Table AE.2. Also according to Table AC.25, this sector is labor intensive sector compared to some sectors. Although grains & crops sector is more labor intensive sector than utilities & construction sector, labor in grains & crops sector has lower elasticity between labor and capital than in utilities & construction sector. This make sense in practice because labor in grains and crops sector is not likely earning a minimum wage.

The simulation result is in line with Carpio *et al.* (2012) and Carpi*o et al.* (2014) who claimed that the employment effects of minimum wage are significant and negative among producers and less educated labors or unskilled labor. However, our result shows there is negative effect on skilled labor as well while Carpio *et al.* (2012) found no effect of increased minimum wage on skilled labor.

For minimum wage subsidy scenario, some sectors employ more labors and other employ less labors, while more subsidies on minimum wage will cause higher labor demand. It can be explained by the increase in household consumption due to higher income. However, lower public investment causes some sectors employ less labors than BAU scenario includes utilities & construction and mining & extraction sectors. Moreover, according to Figure 5.7, employment of unskilled labor is affected by minimum wage subsidy scheme and the effect is more severe when higher wage increases. This is because the relative price between unskilled and skilled labors becomes closer, thus producers substitute some unskilled labor for skilled one.

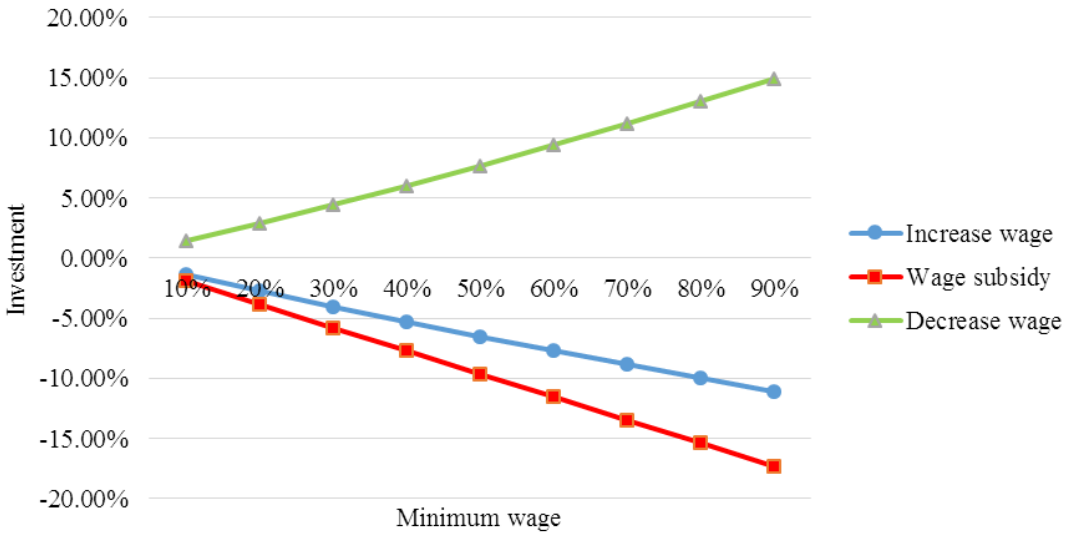
For decreased minimum wage scenario, employments in every sector increases in both unskilled and skilled labors. According to Figure 5.7 and 5.8, minimum wage adjustment affects employment both unskilled and skilled labors in the same direction but different in magnitude. Employment of unskilled labor will take direct effect while skilled labor will be affected indirectly from lower level of production but with relatively low amount since firm can shift to use skilled labor instead of unskilled labor under CES production-function assumption, but not perfectly substitute.

Figure 5.9: Effect of minimum wage adjustment on GDP



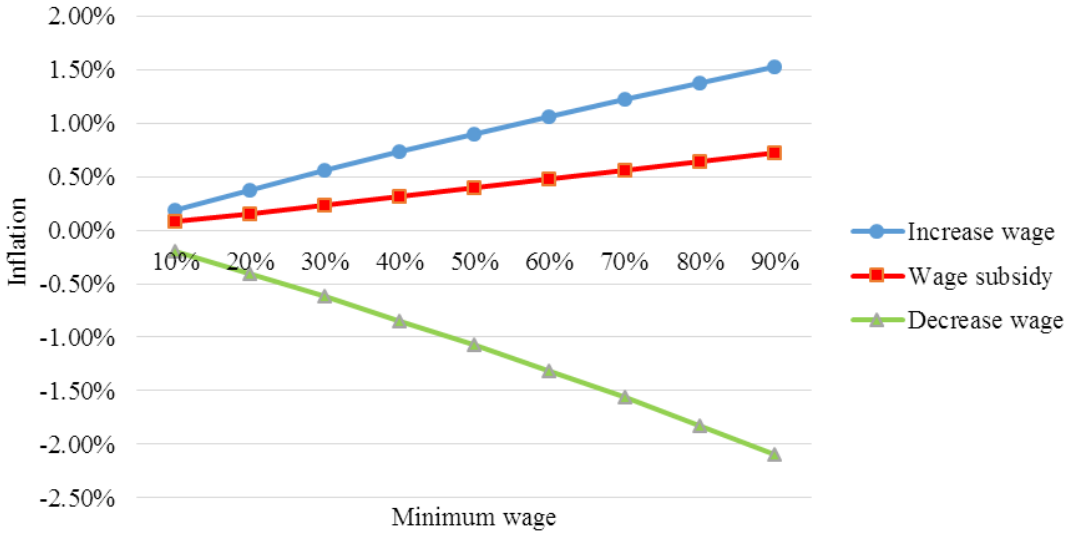
Source: Result from the study's model

Figure 5.10: Effect of minimum wage adjustment on investment



Source: Result from the study's model

Figure 5.11: Effect of minimum wage adjustment on inflation



Source: Result from the study's model

Figure 5.9, 5.10, and 5.11 graphically show the effect of minimum wage adjustment on GDP, investment, and inflation, respectively. The results show the negative correlation between minimum wage and real GDP and between minimum wage and investment. When minimum wage increases, GDP and investment will

decline due to higher cost of production which leads to lower output and less incentive for private investment, while decreased minimum wage leads to the increase in GDP and investment. This is in line with the results of Terra *et al.* (2006) and Agénor and Aynaoui (2003). Moreover, although increased minimum wage leads to the reduction in both GDP and investment, the result shows that investment has a negative response from minimum wage subsidy scenario more than increased minimum wage scenario. This is because total investment consists of government investment which would lower in the minimum wage subsidy scenario due to higher government spending. Moreover, government subsidy has little effect on GDP comparing to increased minimum wage scenario but it discourages investment which is the source of economic growth because investment may come with new knowledge and technology.

According to Figure 5.11, inflation has a positive relationship with the minimum wage. The more minimum wage increases, the more inflation occurs as the production cost increases as well as labor has more income, thus more spending. The result is similar to Erero *et al.* (2013) who found that increased wage or subsidy cases, inflation will increase.

5.3.2 Effect of Thai labor productivity adjustment

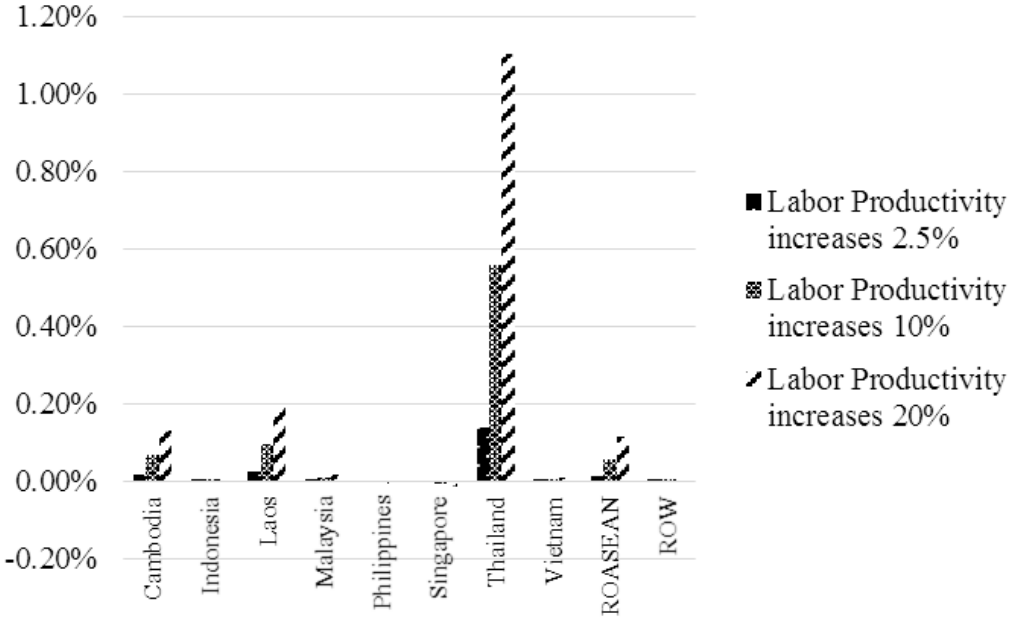
5.3.2.1 Effects on ASEAN

Table 5.12: Percentage change of GDP and total output from BAU by varying unskilled labor productivity in Thailand (unit in percent change)

	GDP			Total Output		
	Labor Productivity Increases			Labor Productivity Increases		
Percentage	2.5	10	20	2.5	10	20
Cambodia	0.02	0.07	0.13	0.00	0.01	0.02
Indonesia	0.00	0.00	0.00	0.00	0.00	0.00
Lao PDR	0.02	0.10	0.19	0.01	0.03	0.06
Malaysia	0.00	0.01	0.02	0.00	0.00	0.00
Philippines	0.00	0.00	-0.01	0.00	0.00	0.00
Singapore	0.00	-0.01	-0.01	0.00	0.00	0.00
Thailand	***0.14***	***0.56***	***1.10***	***0.19***	***0.77***	***1.53***
Vietnam	0.00	0.01	0.01	0.00	0.00	-0.01
ROASEAN	0.01	0.06	0.12	0.00	0.01	0.02
ROW	0.00	0.00	0.00	0.00	0.00	0.00

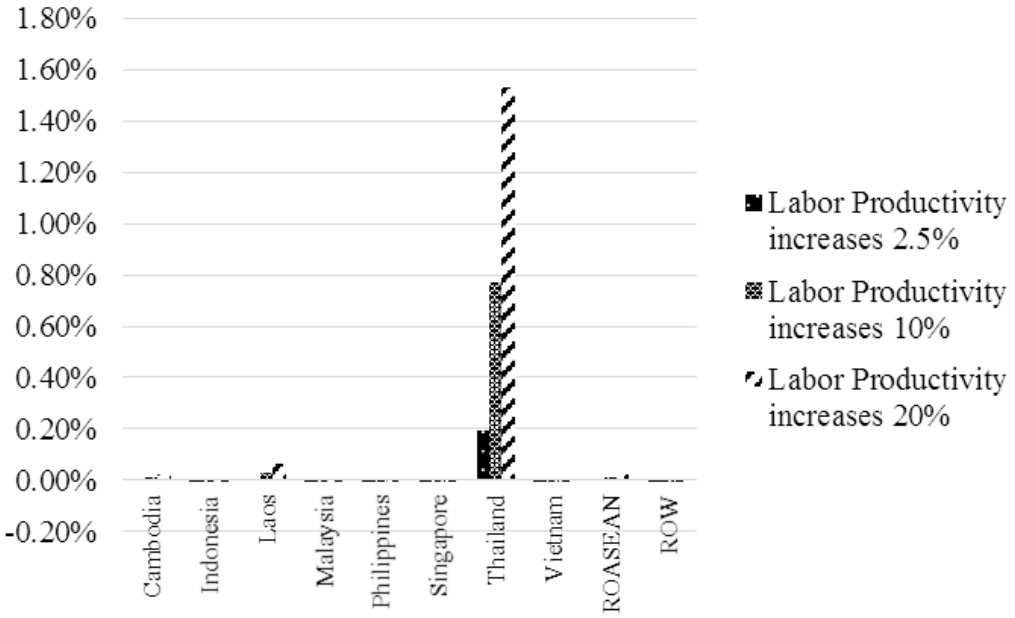
Source: Result from the study's model

Figure 5.12: Percentage change of GDP from BAU by varying unskilled labor productivity in Thailand (unit in percent change)



Source: Result from the study's model

Figure 5.13: Percentage change of total output from BAU by varying unskilled labor productivity in Thailand (unit in percent change)



Source: Result from the study's model

Table 5.12 shows percentage change from BAU of real GDP and total output of ASEAN countries by varying unskilled labor productivity in Thailand. Figure 5.12 and 5.13 show them in bar graph. The study adjusts unskilled labors productivity, who earn minimum wage, by increasing 2.5%, 10%, and 20%. The result illustrates GDP increases as labor productivity increases as well as total output. When unskilled labor productivity increases by 2.5%, 10%, and 20%, GDP increases by in average 0.14%, 0.56%, and 1.10%, respectively, and output increases by in average 0.19%, 0.77%, and 1.53%, respectively. This is because the higher labor productivity contributes more efficiency per labor head leading to more output level, this change leads to the positive GDP responses.

Cambodia, Lao PDR, and Myanmar have higher GDP as well as output because Thai firms produce more output which causes higher volume of trade between Thailand and these countries. This is because Thailand is the major trading partner for these countries as shown in Table 5.5. It shows that Cambodia, Lao PDR, and ROASEAN have the highest trade value with Thailand account for 19.52%, 51.79%, and 21.21% of total trade, respectively. While other countries seem to have a very small effect from unskilled labor productivity increases in Thailand.

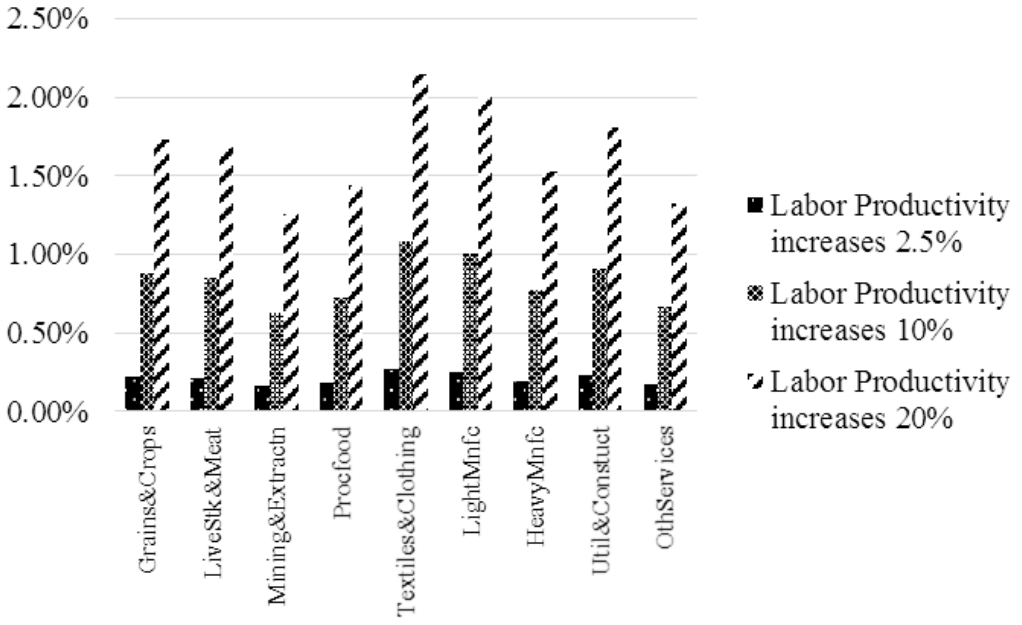
5.3.2.2 Effects on Thailand

Table 5.13: Percentage change of sectoral output from BAU by varying unskilled labor productivity in Thailand (unit in percent change)

	Sectoral Output		
	Labor Productivity Increases		
Percentage	2.5	10	20
Grains&Crops	0.22	0.87	1.73
LiveStk&Meat	0.21	0.85	1.69
Mining&Extractn	0.16	0.63	1.26
Procfood	0.18	0.73	1.44
Textiles&Clothing	0.27	1.08	2.14
LightMnfc	0.25	1.01	2.00
HeavyMnfc	0.19	0.77	1.53
Util&Constuct	0.23	0.91	1.81
OthServices	0.17	0.67	1.33

Source: Result from the study's model

Figure 5.14: Percentage change of sectoral output from BAU by varying unskilled labor productivity in Thailand (unit in percent change)



Source: Result from the study's model

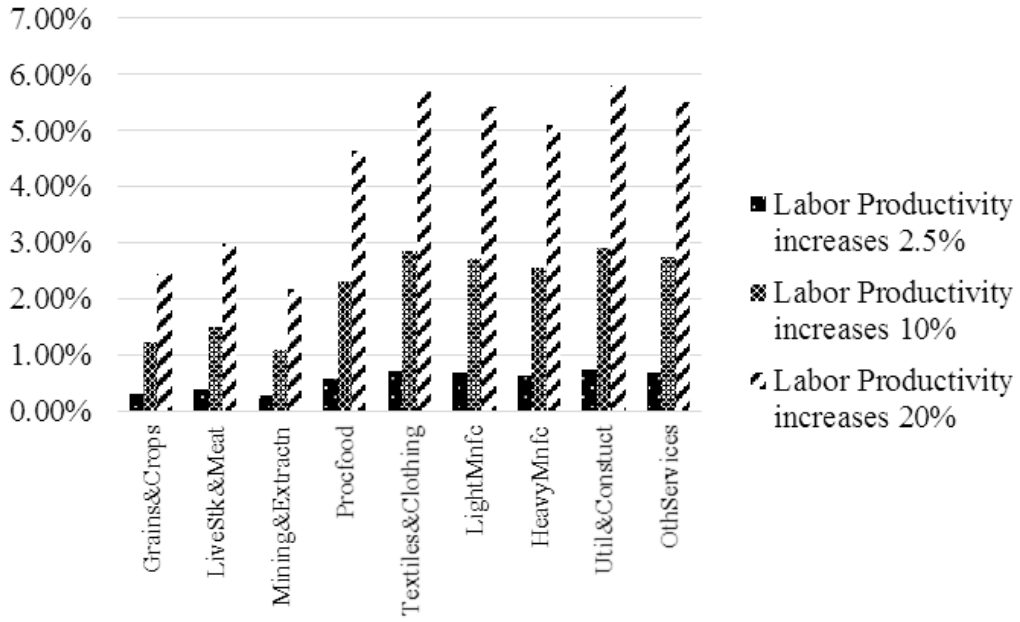
Table 5.13 shows percentage change from BAU of sectoral output of Thailand by varying unskilled labor productivity in Thailand. Figure 5.14 shows it in bar graph. The study adjusts unskilled labors productivity, who earn minimum wage, by increasing 2.5%, 10%, and 20%. The result illustrates sectoral output increases as labor productivity increases. When unskilled labor productivity increases by 2.5%, 10%, and 20%, sectoral output increases in every sector. This is because the higher labor productivity contributes more efficiency per labor head leading to more output level. Textiles & clothing sector has the most positive response from increased labor productivity of unskilled labor because elasticity between labor and capital is high compared to other sectors according to Table AE.2, thus producer can substitute labors for capitals.

Table 5.14: Percentage change of sectoral employments of unskilled and skilled labors from BAU by varying unskilled labor productivity in Thailand (unit in percent change)

	Sectoral Employment of Unskilled Labor			Sectoral Employment of Skilled Labor		
	Labor Productivity Increases			Labor Productivity Increases		
Percentage	2.5	10	20	2.5	10	20
Grains&Crops	0.31	1.23	2.45	0.17	0.67	1.33
LiveStk&Meat	0.38	1.49	2.97	0.11	0.45	0.89
Mining&Extractn	0.27	1.09	2.17	0.17	0.68	1.36
Procfood	0.58	2.32	4.63	0.01	0.04	0.08
Textiles&Clothing	0.71	2.84	5.69	0.07	0.27	0.54
LightMnfc	0.68	2.71	5.43	0.04	0.14	0.28
HeavyMnfc	0.64	2.54	5.09	-0.01	-0.02	-0.04
Util&Constuct	0.72	2.90	5.80	0.03	0.11	0.22
OthServices	0.69	2.75	5.49	-0.01	-0.03	-0.05

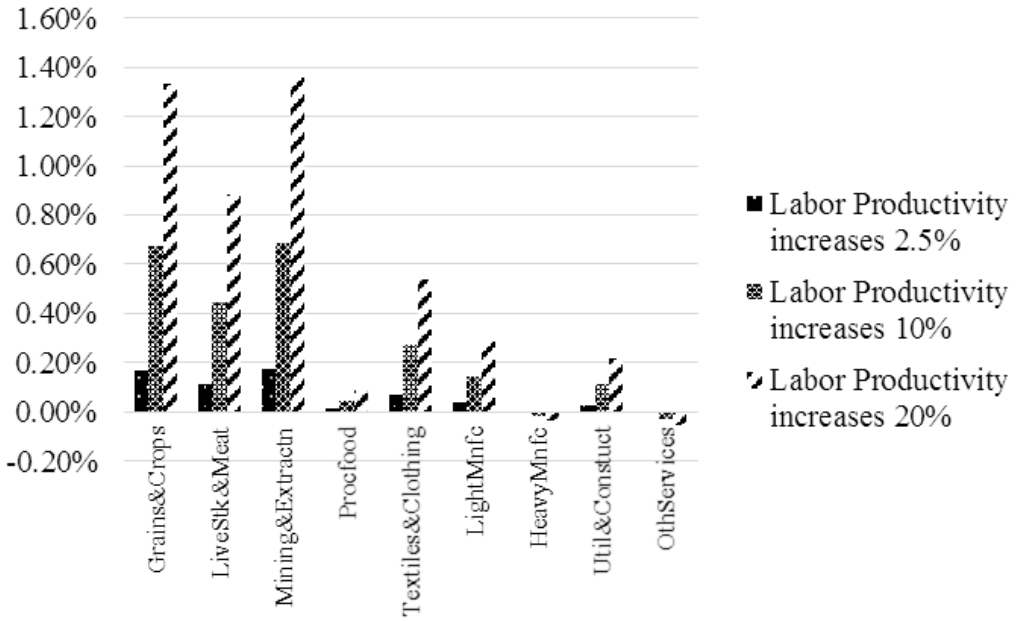
Source: Result from the study's model

Figure 5.15: Percentage change of sectoral employments of unskilled labor from BAU by varying unskilled labor productivity in Thailand (unit in percent change)



Source: Result from the study's model

Figure 5.16: Percentage change of sectoral employments of skilled labors from BAU by varying unskilled labor productivity in Thailand (unit in percent change)



Source: Result from the study's model

Table 5.14 shows percentage change from BAU of sectoral employment of unskilled and skilled labors by varying unskilled labor productivity in Thailand. Figure 5.12 and 5.13 show them in bar graph. Unskilled employment increases as labor productivity increases but skilled employment decreases because employer hires more unskilled labors as their productivity increases.

The study adjusts unskilled labors productivity, who earn minimum wage, by increasing 2.5%, 10%, and 20%. The result illustrates sectoral employment for both unskilled and skilled labors increases as unskilled labor productivity increases. When unskilled labor productivity increases by 2.5%, 10%, and 20%, employment increases in every sector except skilled labor employment in heavy manufacturing and other service sectors. This is because more output (Table 5.13) leads to more labors hiring.

As more efficiency per labor head, producers will substitute more unskilled labor for skilled labor in their production process at any given production level. The more producer can substitute toward unskilled labor, the lower their production costs will become. As production costs fall, then in perfectly competitive markets, so will

goods and services price. Lower goods and services prices will simulate consumer demand, thus outputs and prices will increase.

5.3.3 Effect of minimum wage adjustment and labor productivity of Thailand

When the effective endowment of one factor changes, it may affect the demand for and prices of other factors. A change in input price could lead to substitution and output effects on the demand for both factors. In the case of a change in the effective price, it comprises of 3 effects.

The first two are the substitution and output effects. For example, if labor productivity increases, a fall in the effective wage motivates producers to become more labor-intensive and use less capitals for any given output level, to the extent that their technology allows it. Producer will want to use more of the newly trained labor and less capital to produce its current output quantity because the cost of labor per product has fallen relative to the cost of capital. This is the substitution effect of productivity changes on the demand for actual labors and for capitals.

Second, given the competitive markets assumed in the CGE models, a fall in production costs due to increased productivity is passed on to consumers through lower product prices, which in turn leads to higher demand and production levels. The output effect describes an increase in demand for all factors by the same proportion as the change in output, holding relative factor prices constant.

The third effect is the impact of a factor's productivity change on demand for that factor, for a given output level. Producer will need fewer labors to produce the same number of product when labor productivity increases. The net effect of a factor's productivity change on demand for all factors in the economy is the sum of the substitution, output, and productivity effects.

5.3.3.1 Effects on ASEAN

Table 5.15: Percentage change of ASEAN countries' GDP from BAU by varying minimum wage and labor productivity (unit in percent change)

		Minimum Wage Increases			Government Subsidy			Minimum Wage Decreases		
	Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Thailand	2.5	***-0.40***	***-1.44***	***-4.37***	0.02	-0.21	-0.97	0.69	1.84	5.77
	10	***0.01***	***-1.03***	***-3.97***	0.44	0.20	-0.56	1.11	2.27	6.22
	20	***0.56***	***-0.50***	***-3.46***	0.99	0.75	-0.02	1.66	2.83	6.81
Cambodia	2.5	-0.05	-0.19	-0.59	-0.01	-0.08	-0.28	0.09	0.24	0.73
	10	0.00	-0.14	-0.54	0.04	-0.03	-0.23	0.14	0.29	0.78
	20	0.06	-0.08	-0.47	0.10	0.04	-0.16	0.20	0.35	0.85
Indonesia	2.5	0.02	0.05	0.14	0.01	0.02	0.06	-0.02	-0.05	-0.18
	10	0.02	0.05	0.15	0.01	0.02	0.06	-0.02	-0.05	-0.18
	20	0.02	0.05	0.15	0.01	0.02	0.06	-0.02	-0.05	-0.18
Lao PDR	2.5	-0.14	-0.47	-1.40	-0.04	-0.17	-0.58	0.20	0.55	1.76
	10	-0.07	-0.40	-1.33	0.03	-0.10	-0.51	0.27	0.62	1.83
	20	0.02	-0.31	-1.24	0.12	-0.01	-0.42	0.36	0.72	1.93
Malaysia	2.5	0.00	-0.01	-0.02	0.00	-0.01	-0.04	0.01	0.01	0.03
	10	0.01	0.00	-0.02	0.00	0.00	-0.03	0.01	0.02	0.04
	20	0.01	0.01	-0.01	0.01	0.00	-0.02	0.02	0.03	0.05
Philippines	2.5	0.01	0.04	0.12	0.00	0.01	0.04	-0.02	-0.05	-0.15
	10	0.01	0.04	0.12	0.00	0.01	0.04	-0.02	-0.05	-0.15
	20	0.01	0.04	0.11	0.00	0.01	0.04	-0.02	-0.05	-0.15
Singapore	2.5	0.02	0.05	0.15	0.00	0.00	0.00	-0.02	-0.06	-0.19
	10	0.01	0.05	0.15	-0.01	-0.01	-0.01	-0.03	-0.07	-0.20
	20	0.01	0.04	0.14	-0.01	-0.01	-0.02	-0.03	-0.07	-0.21
Vietnam	2.5	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00
	10	0.01	0.01	0.01	0.01	0.01	0.02	0.00	0.00	0.00
	20	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01
ROASEAN	2.5	-0.12	-0.37	-1.06	-0.02	-0.10	-0.34	0.15	0.43	1.41
	10	-0.07	-0.33	-1.03	0.02	-0.06	-0.29	0.19	0.48	1.46
	20	-0.02	-0.27	-0.98	0.08	0.00	-0.24	0.25	0.54	1.53
ROW	2.5	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.01
	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01

Source: Result from the study's model

Table 5.15 shows percentage change from BAU of real GDP of ASEAN countries by varying unskilled labor productivity and minimum wage in Thailand. ROASEAN (Myanmar + Brunei), Lao PDR, and Cambodia are affected significantly by these policies from Thailand. This is because Thailand is the major trading partner for these countries as shown in Table 5.5. It shows that Cambodia, Lao PDR, and ROASEAN have the highest trade value with Thailand account for 19.52%, 51.79%, and 21.21% of total trade, respectively. Moreover, GDP of Thailand are positively

correlated with GDP of Cambodia, Lao PDR, and ROASEAN (Myanmar + Brunei) under minimum wage adjustment from Thailand. This indicates that there is at least partial economic integration between these countries. This result is in line with the study of Hanson (2003) who found that when U.S. wage increased by 10%, wage in Mexican interior cities increased by 1.8% and wages in Mexican border cities increased by 2.5%.

The increased minimum wage causes the increase in production cost and producer decides to decrease their own production level causing GDP to fall. On the other hand, the higher labor productivity contributes more efficiency per labor head leading to more output level, this change leads to the positive GDP responses. The GDP will be positive or negative depending on which effect, between increased minimum wage and increase unskilled labor productivity, is larger on GDP.

According to Table 5.15, when minimum wage increases from 300 to 320 baht per day (6.67%) and unskilled labor productivity increases by 2.5%, these will affect GDP of Thailand to fall by 0.40% comparing 0.54% fall (Table 5.4) without increased unskilled labor productivity. Cambodia, Lao PDR, and ROASEAN that have the relation with Thailand as an important trading partner have a decline in GDP as well because producers in Thailand produce less output (Table 5.16) which causes less volume of trade between Thailand and these countries leads to lower GDP. While other countries seem to have a very small effect from increased minimum wage in Thailand.

In order to compensate the GDP loss from 6.67% increased minimum wage, unskilled labor productivity should increase at least 10%, and then GDP will increase by 0.01% as shown in Table 5.15. However, with government subsidy for 6.67% increased minimum wage, it only requires unskilled labor productivity increased by 2.5% in order to compensate the GDP loss from increased minimum wage, GDP will increase by 0.02% comparing to BAU. For the decreased minimum wage scenario and increased unskilled labor productivity, Thai GDP will extremely increases since both are positive effect to GDP. This happens because production side will produce more products and hires more labors because of the cheaper cost of labor relatively with other countries in AEC. Moreover, the higher labor productivity contributes more efficiency

per labor head leading to more output level, this change leads to the positive GDP responses.

Table 5.16: Percentage change of ASEAN countries' total output from BAU by varying minimum wage and labor productivity (unit in percent change)

		Minimum Wage Increases			Government Subsidy			Minimum Wage Decreases		
	Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Thailand	2.5	***-0.54***	***-1.96***	***-5.92***	-0.02	-0.46	-1.83	0.95	2.53	7.99
	10	***0.03***	***-1.40***	***-5.39***	0.55	0.11	-1.27	1.54	3.13	8.63
	20	***0.78***	***-0.67***	***-4.69***	1.31	0.87	-0.53	2.30	3.91	9.47
Cambodia	2.5	-0.02	-0.07	-0.21	-0.01	-0.02	-0.08	0.03	0.08	0.24
	10	-0.01	-0.06	-0.20	0.00	-0.02	-0.07	0.04	0.09	0.25
	20	0.00	-0.05	-0.19	0.01	0.00	-0.06	0.05	0.10	0.26
Indonesia	2.5	0.02	0.07	0.19	0.01	0.03	0.08	-0.02	-0.07	-0.24
	10	0.02	0.06	0.19	0.01	0.02	0.08	-0.03	-0.07	-0.24
	20	0.02	0.06	0.19	0.00	0.02	0.08	-0.03	-0.08	-0.24
Lao PDR	2.5	-0.11	-0.34	-0.99	-0.04	-0.12	-0.39	0.13	0.38	1.23
	10	-0.09	-0.32	-0.97	-0.01	-0.10	-0.37	0.15	0.40	1.26
	20	-0.06	-0.29	-0.94	0.02	-0.07	-0.34	0.18	0.44	1.29
Malaysia	2.5	0.01	0.02	0.05	0.00	0.00	0.00	-0.01	-0.02	-0.06
	10	0.01	0.02	0.05	0.00	0.00	0.00	-0.01	-0.02	-0.06
	20	0.00	0.02	0.05	0.00	0.00	0.00	-0.01	-0.02	-0.07
Philippines	2.5	0.01	0.04	0.12	0.01	0.02	0.05	-0.02	-0.05	-0.15
	10	0.01	0.04	0.12	0.00	0.02	0.05	-0.02	-0.05	-0.16
	20	0.01	0.04	0.12	0.00	0.01	0.05	-0.02	-0.05	-0.16
Singapore	2.5	0.02	0.06	0.18	0.00	0.00	0.01	-0.02	-0.07	-0.22
	10	0.02	0.06	0.18	0.00	0.00	0.01	-0.02	-0.07	-0.23
	20	0.02	0.06	0.18	0.00	0.00	0.01	-0.03	-0.07	-0.23
Vietnam	2.5	0.01	0.04	0.11	0.00	0.02	0.05	-0.01	-0.04	-0.14
	10	0.01	0.04	0.11	0.00	0.01	0.05	-0.02	-0.05	-0.14
	20	0.01	0.03	0.11	0.00	0.01	0.05	-0.02	-0.05	-0.15
ROASEAN	2.5	-0.10	-0.31	-0.87	-0.02	-0.07	-0.22	0.11	0.34	1.13
	10	-0.10	-0.30	-0.87	-0.01	-0.06	-0.21	0.12	0.35	1.15
	20	-0.09	-0.29	-0.87	0.00	-0.05	-0.20	0.13	0.37	1.18
ROW	2.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01

Source: Result from the study's model

Table 5.16 shows percentage change from BAU of total output of ASEAN countries by varying unskilled labor productivity and minimum wage in Thailand. The increased minimum wage causes the increase in production cost and producer decides to decrease their own production level causing output to fall. On the other hand, the higher labor productivity contributes more efficiency per labor head leading to more output level.

According to Table 5.16, when minimum wage increases from 300 to 320 baht per day (6.67%) and unskilled labor productivity increases by 2.5%, these will affect output of Thailand to fall by 0.54% comparing 0.74% fall (Table 5.6) without increased unskilled labor productivity. Cambodia, Lao PDR, and ROASEAN that have the relation with Thailand as an important trading partner have a decline in output as well because producers in Thailand produce less output which causes less volume of trade between Thailand and these countries leads to lower output. While other countries seem to have a very small effect from minimum wage increase in Thailand.

In order to compensate the output loss from 6.67% increased minimum wage, unskilled labor productivity should increase at least 10%, and then output will increase by 0.03% as shown in Table 5.16. However, with government subsidy for 6.67% increased minimum wage, it only requires unskilled labor productivity increased higher than 2.5% in order to compensate the output loss from increased minimum wage. For the decreased minimum wage and increased unskilled labor productivity scenarios, Thai output will extremely increases since both are positive effect to output. This happens because production side will produce more products and hires more labors because of the cheaper cost of labor relatively with other countries in AEC. Moreover, the higher labor productivity contributes more efficiency per labor head leading to more output level, this change leads to the positive output responses.

5.3.3.2 Effects on Thailand

Table 5.17: Percentage change of sectoral output from BAU by varying minimum wage and labor productivity for Thailand (unit in percent change)

		Minimum Wage Increases			Government Subsidy			Minimum Wage Decreases		
	Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Grains&Crops	2.5	***-0.59***	***-2.15***	***-6.50***	0.04	-0.35	-1.66	1.05	2.78	8.74
	10	***0.06***	***-1.51***	***-5.90***	0.69	0.30	-1.04	1.71	3.45	9.46
	20	***0.91***	***-0.68***	***-5.10***	1.55	1.15	-0.21	2.58	4.34	10.40
LiveStk&Meat	2.5	-0.59	-2.13	-6.45	0.10	-0.13	-0.96	1.03	2.74	8.58
	10	0.04	-1.51	-5.85	0.74	0.51	-0.34	1.68	3.39	9.27
	20	0.87	-0.69	-5.07	1.57	1.34	0.48	2.52	4.25	10.18
Mining&Extractn	2.5	-0.42	-1.53	-4.55	-0.21	-0.93	-3.09	0.76	2.01	6.47
	10	0.05	-1.07	-4.13	0.26	-0.48	-2.68	1.24	2.51	7.03
	20	0.66	-0.47	-3.58	0.87	0.11	-2.14	1.87	3.17	7.76
Procfood	2.5	-0.50	-1.83	-5.55	0.01	-0.35	-1.54	0.89	2.34	7.33
	10	0.04	-1.30	-5.04	0.55	0.19	-1.00	1.43	2.90	7.91
	20	0.74	-0.60	-4.37	1.26	0.90	-0.30	2.15	3.63	8.67
Textiles&Clothing	2.5	-0.74	-2.68	-8.02	0.09	-0.28	-1.47	1.31	3.50	11.18
	10	0.05	-1.91	-7.29	0.90	0.53	-0.67	2.13	4.34	12.10
	20	1.10	-0.88	-6.34	1.96	1.59	0.38	3.21	5.45	13.31
LightMnfc	2.5	-0.70	-2.53	-7.58	0.03	-0.42	-1.84	1.23	3.28	10.41
	10	0.05	-1.80	-6.90	0.78	0.33	-1.10	2.00	4.06	11.26
	20	1.03	-0.84	-6.00	1.78	1.32	-0.12	3.00	5.09	12.37
HeavyMnfc	2.5	-0.54	-1.95	-5.89	-0.13	-0.79	-2.82	0.94	2.51	7.89
	10	0.03	-1.39	-5.36	0.44	-0.22	-2.26	1.53	3.10	8.52
	20	0.78	-0.65	-4.65	1.20	0.53	-1.52	2.29	3.88	9.35
Util&Constuct	2.5	-0.65	-2.33	-7.04	-0.45	-1.79	-5.91	1.13	2.99	9.42
	10	0.03	-1.67	-6.41	0.23	-1.12	-5.27	1.82	3.70	10.17
	20	0.92	-0.80	-5.58	1.12	-0.25	-4.43	2.72	4.62	11.15
OthServices	2.5	-0.49	-1.75	-5.26	0.18	0.20	0.23	0.84	2.25	7.13
	10	0.01	-1.27	-4.80	0.68	0.70	0.74	1.35	2.77	7.69
	20	0.66	-0.63	-4.20	1.34	1.35	1.39	2.01	3.45	8.42

Source: Result from the study's model

Table 5.17 shows percentage change from BAU of sectoral output of Thailand by varying unskilled labor productivity and minimum wage in Thailand. When minimum wage increases without subsidy, the producer's cost will be higher resulting lower labor demand and producer would decide to produce less than BAU scenarios, thus lower output.

According to Table 5.17, when minimum wage increases from 300 to 320 baht per day (6.67%) and unskilled labor productivity increases by 2.5%, these will mostly

affect textiles & clothing sector, which approximately 0.74% fall, because elasticity between labor and capital is high compared to other sectors, according to Table AE.2. In addition, according to Table AC.25, this sector is labor intensive sector compared to some sectors. Although grains & crops sector is more labor intensive sector than textiles & clothing sector, labor in grains & crops sector has lower elasticity between labor and capital than in textiles & clothing sector. This make sense in practice because labor in grains & crops sector is not likely earning a minimum wage.

For 6.67% minimum wage subsidy and 2.5% labor productivity increase scenarios, sectoral outputs decrease, while more subsidies on minimum wage will cause higher labor demand. It can be explained by the increase in household consumption due to higher income. For the decreased minimum wage and increased unskilled labor productivity scenarios, sectoral output increases in every sector since both are positive effect to output. This happens because production side will produce more products and hires more labors because of the cheaper cost of labor relatively with other countries in AEC. Moreover, the higher labor productivity contributes more efficiency per labor head leading to more output level, this change leads to the positive employment responses.

Table 5.18: Percentage change of sectoral employment from BAU by varying minimum wage and 2.5% increase in labor productivity for Thailand (unit in percent change)

		Minimum Wage Increases			Government Subsidy			Minimum Wage Decreases		
	Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Unskilled Labor	Grains&Crops	-0.84	-3.03	-9.09	0.25	0.11	-0.43	1.49	3.94	12.52
	LiveStk&Meat	-1.03	-3.70	-11.01	0.51	0.76	1.51	1.82	4.85	15.57
	Mining&Extractn	-0.73	-2.65	-7.89	-0.12	-0.89	-3.21	1.31	3.49	11.22
	Procfood	-1.56	-5.59	-16.34	0.80	1.24	2.56	2.80	7.51	24.70
	Textiles&Clothing	-1.91	-6.82	-19.66	0.84	1.10	1.86	3.44	9.29	31.10
	LightMnfc	-1.83	-6.55	-18.94	0.72	0.80	1.03	3.29	8.87	29.52
	HeavyMnfc	-1.71	-6.13	-17.81	0.53	0.30	-0.38	3.08	8.28	27.43
	Util&Constuct	-1.95	-6.99	-20.24	-0.24	-2.18	-8.35	3.51	9.46	31.44
	OthServices	-1.80	-6.48	-18.78	0.71	0.75	0.84	3.28	8.80	29.23
Skilled Labor	Grains&Crops	-0.52	-1.86	-5.60	0.11	-0.03	-0.57	0.88	2.35	7.37
	LiveStk&Meat	-0.44	-1.50	-4.50	0.24	0.50	1.25	0.68	1.85	5.83
	Mining&Extractn	-0.50	-1.79	-5.33	-0.22	-0.99	-3.31	0.87	2.33	7.49
	Procfood	-0.28	-0.86	-2.48	0.23	0.67	1.98	0.31	0.93	3.02
	Textiles&Clothing	-0.48	-1.54	-4.53	0.20	0.45	1.21	0.63	1.79	5.75
	LightMnfc	-0.40	-1.25	-3.69	0.08	0.16	0.39	0.48	1.40	4.47
	HeavyMnfc	-0.28	-0.81	-2.34	-0.12	-0.34	-1.02	0.28	0.85	2.79
	Util&Constuct	-0.41	-1.27	-3.86	-0.92	-2.85	-8.99	0.47	1.35	4.15
	OthServices	-0.26	-0.74	-2.16	0.02	0.06	0.15	0.25	0.76	2.46

Source: Result from the study's model

Table 5.18 shows percentage change from BAU of sectoral employment of Thailand by increased unskilled labor productivity 2.5% and varying minimum wage in Thailand. When minimum wage increases without subsidy, the producer's cost will be higher resulting lower labor demand and producer would decide to produce less than BAU scenarios, thus lower employment. In addition, the employment loss from a given minimum wage will be larger the more elastic is the demand for labor. On the other hand, 2.5% increased labor productivity contributes more efficiency per labor head leading to higher labor demand, this change leads to the positive employment responses.

According to Table 5.18, when Thailand increases 6.67% minimum wage with 2.5% of increased unskilled labor productivity, the net employments are negative in every sector for both unskilled and skilled labors because the negative effect from 6.67% increased minimum wage is outweigh the positive effect from 2.5% of increased unskilled labor productivity. Nevertheless, employment of unskilled labor decreases

more than employment of skilled labor in every sector and utilities & construction sector is mostly affected. Skilled labor will be affected indirectly from lower level of production but with relatively low amount since producer can shift to use skilled labor instead of unskilled labor under CES production-function assumption, but not perfectly substitute. The percentage change of each sector varies depending on elasticity of labors, labor intensive, and number of employed labor

The simulation result is in line with Carpio *et al.* (2012) and Carpi*o et al.* (2014) who claimed that the employment effects of minimum wage are significant and negative among firms and less educated labors or unskilled labor. However, our result shows there is negative effect on skilled labor as well while Carpio *et al.* (2012) found no effect of increased minimum wage on skilled labor.

For minimum wage subsidy scenario, when Thailand increases by 6.67% minimum wage with 2.5% of increased unskilled labor productivity, employments by sector are both rise and fall while more subsidies on minimum wage will cause higher labor demand. It can be explained by the increase in household consumption due to higher income. However, lower public investment causes some sectors employ less labor than BAU scenario includes mining & extraction sectors, heavy manufacturing, and utilities & construction. For decreased minimum wage scenario, when Thailand increases by 6.67% minimum wage with 2.5% of increased unskilled labor productivity, employments in every sector increase in both unskilled and skilled labor.

Table 5.19: Percentage change of sectoral employment from BAU by varying minimum wage and 10% increase in labor productivity for Thailand (unit in percent change)

		Minimum Wage Increases			Government Subsidy			Minimum Wage Decreases		
	Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Unskilled Labor	Grains&Crops	0.08	-2.14	-8.25	1.17	1.03	0.48	2.42	4.90	13.56
	LiveStk&Meat	0.08	-2.63	-10.03	1.63	1.89	2.65	2.96	6.02	16.87
	Mining&Extractn	0.07	-1.87	-7.17	0.69	-0.10	-2.46	2.14	4.34	12.17
	Procfood	0.15	-3.96	-14.89	2.55	2.99	4.33	4.58	9.37	26.85
	Textiles&Clothing	0.17	-4.84	-17.96	2.98	3.24	4.02	5.64	11.60	33.88
	LightMnfc	0.15	-4.65	-17.30	2.76	2.84	3.08	5.38	11.06	32.12
	HeavyMnfc	0.15	-4.35	-16.25	2.43	2.20	1.51	5.03	10.33	29.85
	Util&Constuct	0.17	-4.97	-18.49	1.92	-0.06	-6.34	5.74	11.80	34.21
	OthServices	0.21	-4.56	-17.12	2.77	2.81	2.90	5.39	11.02	31.86
Skilled Labor	Grains&Crops	-0.02	-1.36	-5.13	0.61	0.47	-0.07	1.38	2.86	7.91
	LiveStk&Meat	-0.11	-1.18	-4.19	0.58	0.84	1.59	1.01	2.19	6.19
	Mining&Extractn	0.00	-1.30	-4.88	0.28	-0.50	-2.86	1.39	2.86	8.08
	Procfood	-0.25	-0.83	-2.45	0.26	0.70	2.00	0.34	0.96	3.05
	Textiles&Clothing	-0.28	-1.34	-4.34	0.40	0.66	1.42	0.83	2.00	5.96
	LightMnfc	-0.29	-1.15	-3.58	0.19	0.27	0.50	0.59	1.51	4.58
	HeavyMnfc	-0.29	-0.83	-2.35	-0.13	-0.35	-1.03	0.26	0.84	2.77
	Util&Constuct	-0.32	-1.17	-3.74	-0.84	-2.76	-8.87	0.55	1.42	4.19
	OthServices	-0.28	-0.76	-2.17	0.00	0.04	0.13	0.22	0.74	2.43

Source: Result from the study's model

Table 5.19 shows percentage change from BAU of sectoral employment of Thailand by increased unskilled labor productivity by 10% and varying minimum wage in Thailand. When Thailand increases minimum wage by 6.67% with 10% increased unskilled labor productivity, total employment increases due to the increase in total output (0.03% Table 5.16). Employment of unskilled labor increases due to higher productivity effect outweigh increased minimum wage effect while employment of skilled labor still decreases. Some skilled labor may lost jobs to unskilled labor due to substitution effect because GDP is unchanged (Table 5.15).

According to Table 5.19, when Thailand minimum wage increases by 6.67% with 10% increased unskilled labor productivity, the net employments are positive in every sector for unskilled labor and positive in most sectors for skilled labor because the negative effect from 6.67% increased minimum wage is less than the positive effect from 10% of unskilled labor productivity increase. Employment of unskilled labor increases more than employment of skilled labor in every sector and utilities &

construction sector is mostly affected. Skilled labor will be affected indirectly from lower level of production but with relatively low amount since producer can shift to use skilled labor instead of unskilled labor under CES production-function assumption, but not perfectly substitute. The percentage change of each sector varies depending on elasticity of labors, labor intensive, and number of employed labor.

For minimum wage subsidy scenario, when Thailand increases minimum wage by 6.67% with 10% increased unskilled labor productivity, employments for unskilled labor increase in every sector and in most sectors for skilled labor, while more subsidies on minimum wage will cause higher labor demand. It can be explained by the increase in household consumption due to higher income. However, lower public investment causes some sectors employ less labor than BAU scenario includes heavy manufacturing and utilities & construction. For decreased minimum wage scenario, when Thailand increases minimum wage by 6.67% with 10% increased unskilled labor productivity, employments in every sector increase in both unskilled and skilled labor.

Table 5.20: Percentage change of sectoral employment from BAU by varying minimum wage and 20% increase in labor productivity for Thailand (unit in percent change)

		Minimum Wage Increases			Government Subsidy			Minimum Wage Decreases		
	Percentage	6.67	20	61	6.67	20	61	6.67	20	61
Unskilled Labor	Grains&Crops	1.28	-0.97	-7.16	2.38	2.24	1.68	3.65	6.16	14.92
	LiveStk&Meat	1.54	-1.21	-8.72	3.11	3.38	4.15	4.46	7.57	18.58
	Mining&Extractn	1.13	-0.84	-6.22	1.76	0.94	-1.48	3.23	5.47	13.43
	Procfood	2.41	-1.79	-12.97	4.86	5.32	6.68	6.95	11.84	29.72
	Textiles&Clothing	2.95	-2.21	-15.68	5.83	6.10	6.91	8.56	14.70	37.59
	LightMnfc	2.80	-2.13	-15.11	5.47	5.56	5.81	8.16	14.00	35.60
	HeavyMnfc	2.64	-1.98	-14.17	4.97	4.74	4.02	7.64	13.07	33.07
	Util&Constuct	2.99	-2.27	-16.14	4.80	2.78	-3.65	8.71	14.93	37.92
	OthServices	2.89	-2.01	-14.89	5.52	5.56	5.65	8.21	13.98	35.37
Skilled Labor	Grains&Crops	0.63	-0.72	-4.51	1.27	1.13	0.58	2.05	3.54	8.62
	LiveStk&Meat	0.33	-0.75	-3.77	1.02	1.28	2.04	1.46	2.64	6.66
	Mining&Extractn	0.67	-0.66	-4.28	0.95	0.14	-2.26	2.07	3.57	8.87
	Procfood	-0.21	-0.78	-2.41	0.30	0.74	2.04	0.39	1.01	3.09
	Textiles&Clothing	-0.01	-1.08	-4.09	0.67	0.93	1.69	1.10	2.27	6.25
	LightMnfc	-0.15	-1.00	-3.44	0.33	0.41	0.65	0.73	1.65	4.71
	HeavyMnfc	-0.31	-0.85	-2.37	-0.15	-0.37	-1.05	0.24	0.82	2.75
	Util&Constuct	-0.21	-1.05	-3.59	-0.73	-2.64	-8.73	0.65	1.51	4.24
	OthServices	-0.30	-0.78	-2.19	-0.03	0.01	0.10	0.20	0.71	2.39

Source: Result from the study's model

Table 5.20 shows percentage change from BAU of sectoral employment of Thailand by increased unskilled labor productivity by 20% and varying minimum wage in Thailand. When Thailand increases minimum wage by 6.67% with 20% increased unskilled labor productivity, total employment increases due to total output increases (0.78% Table 5.16). Employment of unskilled labor increases due to higher productivity effect outweigh increased minimum wage effect while employment of skilled labor still decreases in some sectors. Some skilled labors may lost jobs to unskilled labor due to substitution effect and some complement with unskilled labor because GDP is increased (Table 5.15).

According to Table 5.20, when Thailand increases minimum wage by 6.67% with 20% increased unskilled labor productivity, the net employments are positive in every sector for unskilled labor and positive in most sectors for skilled labor because the negative effect from 6.67% increased minimum wage is less than the positive effect from 20% of increased unskilled labor productivity. Employment of unskilled labor increases more than employment of skilled labor in every sector and utilities & construction sector is mostly affected. Skilled labor will be affected indirectly from lower level of production but with relatively low amount since producer can shift to use skilled labor instead of unskilled labor under CES production-function assumption, but not perfectly substitute. The percentage change of each sector varies depending on elasticity of labors, labor intensive, and number of employed labor.

For minimum wage subsidy scenario, when Thailand increases minimum wage by 6.67% with 20% increased unskilled labor productivity, employments for unskilled labor increase in every sector and in most sectors for skilled labor, while more subsidies on minimum wage will cause higher labor demand. It can be explained by the increase in household consumption due to higher income. However, lower public investment causes some sectors employ less labor than BAU scenario includes heavy manufacturing and utilities & construction. For decreased minimum wage scenario, when Thailand increases minimum wage by 6.67% with 20% increased unskilled labor productivity, employments in every sector increase in both unskilled and skilled labor.

5.3.4 Policy suggestions

Increased minimum wage will enhance the well-being of labor and strengthen domestic demand because labors have more income, thus more purchasing power. Moreover, it induces the adjustment more in the knowledge and skilled-based and businesses focus on hiring labors with knowledge and more experience to make it worth the cost of labor. However, large and sudden increases minimum wage will produce large adverse effects as predicted in the study because it causes lower employment due to higher production cost. Especially, small and medium-sized industries have large proportion of labor cost to total cost[43]. Although large industries use of many labors but compared to the total cost, there is a lower proportion than small and medium-sized industries. On the other hand, if real wages of Thailand does not grow, it is difficult to keep domestic demand growing steadily. In addition, overall unemployment rate in January 2012 at the level of 1%[44], thus Thailand can have higher minimum wage. Nevertheless, government should have a long-term plan for wage policy.

In order to minimize the potential adverse impacts, increased minimum wage must be done together with many dimensions. Firstly, government should support firms in the transition to higher minimum wage, particularly small and medium-sized firms. Secondly, government should giving compensations to displaced labors and retraining them to become more skill which they could re-employ in the future. Thirdly, government should gradually increase minimum wage in accordance with market conditions and should specify that wages are up a few percent per year for how many years in order for private firms to have a long-term plan. Lastly, increased labor productivity must be done in conjunction with the minimum wage policy, otherwise a rise in the minimum wage would only help some groups of labors but lead to inflation

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[43] According to the study project of SME I/O Table, the cost of labor and salary of SMEs, on average, accounted for 16.2% of the cost of all the inputs, so if minimum wage increase of 1 % would result in the cost of labor increased by 0.16 %. *Source: The Office of SMEs Promotion (OSMEP) http://www.sme.go.th/Lists/EditorInput/DispF.aspx?List=15dca7fb-bf2e-464e-97e5-440321040570&ID=1525*

[44] *Source: http://www.tradingeconomics.com/thailand/unemployment-rate*

and higher cost of living for everyone in the country including farmers. In addition, if wage grow faster than productivity, it will weaken the competitiveness of the country.

According to Table 5.15, if Thai government intends to increase minimum wage from 300 to 320 Baht per day or 6.67% increases for labor who earn minimum wage, unskilled labor productivity should increase at least 10% in order to have positive real GDP. However, to increase labor productivity by 10% in a year is not achievable, according to Table 5.1, but by 2.5% labor productivity increases per year is potentially possible for Thailand. Thus, it should take about 4 years to achieve 10% unskilled labor productivity increases in order to compensate real GDP loss from 6.67% increase in minimum wage. Moreover, if Thai government intends to increase minimum wage from 300 to 360 Baht or 20% increases, unskilled labor productivity should increase more than 20%. This should take more than 10 years to achieve over 20% unskilled labor productivity increases in order to compensate real GDP loss from 20% increase in minimum wage. Furthermore, if Thai government intends to increase minimum wage from 300 to 481 Baht or 61%, it should take long time to increase labor productivity to compensate real GDP loss from 61% increase in minimum wage. Therefore, Thai government should increase labor productivity for all labor classes to shorten time of compensation if Thai government wants to increase minimum wage to 481 Baht per day.

Increased minimum wage would help labors earn more quality of life and have more purchasing power which leads to more currency in circulation and better economy, thus government can collect more taxes and have more money to develop country. The study suggests that increased minimum wage should be coupled with increased labor productivity. The study also measures the effects of adjustment both minimum wage and labor productivity. The rest is for policy maker to decide how much minimum wage to increase in accordance with market conditions. In addition, policy maker should acknowledge the market before taking an action to avoid large adverse effects of increased minimum wage as predicted in the study.

5.4 Conclusion

The minimum wage in Thailand is an important topic for debate, with labor representatives seeking an increase in the minimum wage. Increased minimum wage will enhance the well-being of labor and strengthen domestic demand because labors have more income, thus more purchasing power. Moreover, it induces the adjustment more in the knowledge and skilled-based and businesses focus on hiring labors with knowledge and more experience to make it worth the cost of labor. However, a single economy that raises its minimum wage will raise its wages relative to competitors with adverse effects on economy because the higher cost of producing goods and services. This will enable the industries to increases product price, relocation of production to countries where labor is cheaper, especially in labor-intensive industries with high labor cost.

The result of the study indicates the negative correlation between minimum wage and both GDP and employment due to higher cost of production in Thailand. Therefore, whether solely increased minimum wage or subsidy wage policies are not appropriated for Thailand as a part of AEC because these policies would reduce investment as well as a disincentive to human capital accumulation. Although decreased minimum wage leads to increase in GDP, investment, and employment for both skilled and unskilled labors in every sector, it is politically hard to implement for policy makers to reduce minimum wage.

According to the results of the study, solely increase minimum wage could extremely affect the economy. In the response of increased minimum wage, productivity of labor who earn minimum wage should increase in order to compensate the negative impact of increased minimum wage policy. This is because the advantages of the productivity increase cause producers to become more competitive which may lead to substantial higher growth in economy. The study has measured the effects of adjustment both minimum wage and labor productivity. The rest is for policy maker to decide how much minimum wage to increase in accordance with market conditions. In addition, policy maker should acknowledge the market before taking an action to avoid large adverse effects of increased minimum wage as predicted in the study.

This chapter has provided results which support the findings of previous research in this field. Policies designed to support and enhance the condition of the Thai economy should be carefully constructed with full consideration of the connections between the wage policies, employment, and economy because of the likely significant effects of implementing particular wage policies upon the labor market and the wider economy as a whole.

For the further research, it is interesting to specify the nature of the interactions between the formal and informal sectors of the economy because it is likely to affect the implementation of particular wage policies upon the labor market and the wider economy as a whole.

Chapter 6

The Impact of Switching Cost and Labor Productivity on Thai Economy and the Relationship between AEC and Switching Cost[45]

Thailand has been gradually transforming its structure from the agricultural-based nation to the export-driven economy since 1950s. It is interesting to find out that whether there still exists of the seasonal migration of labor between agricultural and non-agricultural sectors during growing and harvesting period in Thailand. If this movement pattern exists and it conforms to the concept of Harris-Todaro's expected wage. Therefore, the value of switching cost between agricultural and non-agricultural sectors could be obtained.

Because the seasonal domestic migration is the unique characteristics of Thai labor market, the simulation in this chapter mainly concentrates on the improving Thailand's production capability through the reduction of switching cost which would allow more flexibility in sectoral migration and subsequently enhance the aggregate production of the country. The simulation result of this lowering switching cost is compared with the result of simulating the increasing labor productivity which is the most common recommendation towards the improvement of the production capability. Since one of the main objective of AEC is to become the production base, Thailand could benefit from this result by able to identify the appropriated use for these policies. Moreover, the relationship between AEC and switching cost is interesting to explore because AEC will change economic environment in Thailand by more or less inflows of migrant labors. If this relationship is quantified, the movement of labor could inform policy makers of the dynamic change in labor market.

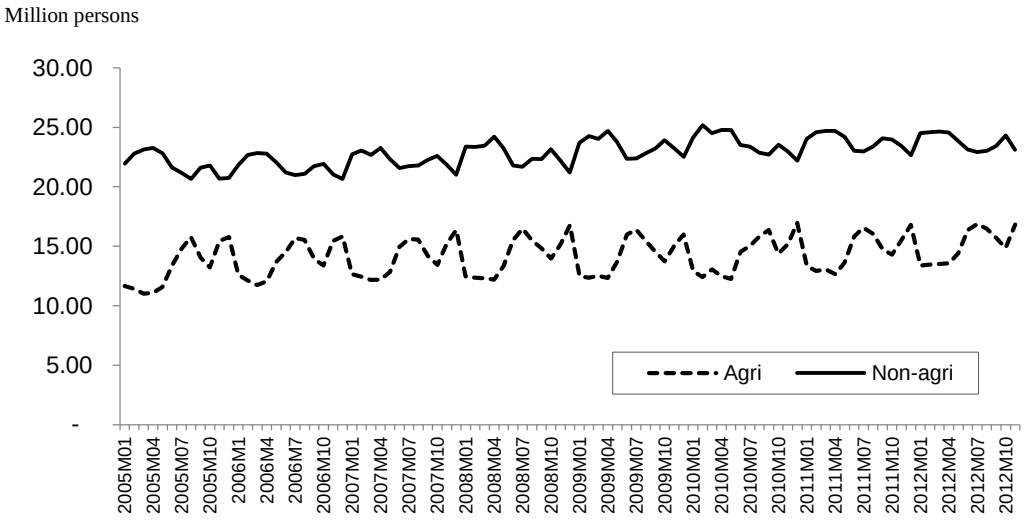
[45] This chapter has some parts from the paper of (Suttiwichienchot & Puttanapong, 2014).

This chapter is aimed at developing the static single-country CGE model for Thailand which incorporates the expected wage equilibrium equation in order to explore the effects of switching cost and labor productivity on Thai economy. This chapter also investigates the partial effect of the opening of AEC on switching cost.

6.1 Background

Thailand's economy has gradually been switching from a dependence upon agriculture focus to export driven economy as a result of the initial National Economic and Social Development Plan published in the 1950s. The result of this policy has been to increase GDP, while reducing the demand for agricultural labor and increasing the demand for labors in the manufacturing and services sectors. It also created one unique aspect to the Thai labor market, which is that there is a seasonal migration between agriculture and other sectors as people work in farming during the growing and harvesting seasons before seeking work in the cities during the non-farming season. Several researches studied this labor migration pattern, which persists to this day (Sussangkarn , 1987; Sussangkarn & Chalamwong, 1994; Ashakul, 1996), as can be seen in Figure 6.1. The agricultural season in Thailand typically runs from July to December, with a peak in July and August when the farmers must plant their crops, and another peak in November and December as those crops are gathered. This cycle logically mirrors employment patterns in other sectors as the labor switches between the two roles.

Figure 6.1: Seasonal employment in agricultural and non-agricultural sectors in Thailand during 2005 – 2012 (unit in million persons)



Source: The Labor Force Survey, Ministry of Labor, Thailand

In addition to this mirroring cyclical pattern, there is also a relationship between the wage levels in each sector, the employment levels in each sector, and the perceived cost of switching between sectors in Thailand. This relationship is described by Harris and Todaro (1970), who provided a mathematical explanation of migration in terms of wage expectations in the different sectors. Equation 18 shows that a labor earns the wage of $wage_{agri}$ when working in agricultural sector (*agri*), and this earning is adjusted by the probability of finding agricultural work ($prob(employment_{agri})$), forming the value of expected wage if she works in the agricultural sector ($prob(employment_{agri}) \cdot wage_{agri}$). Alternatively, this labor might earn an income from working in other sectors (the non-agricultural sectors or *nagri*) but this wage must also be adjusted by the probability of finding work in those sectors. Following Harris-Todaro's concept, the behavior of domestic migration between agricultural and non-agricultural sectors can be mathematically represented by the expected wage equilibrium as shown in Equation 18.

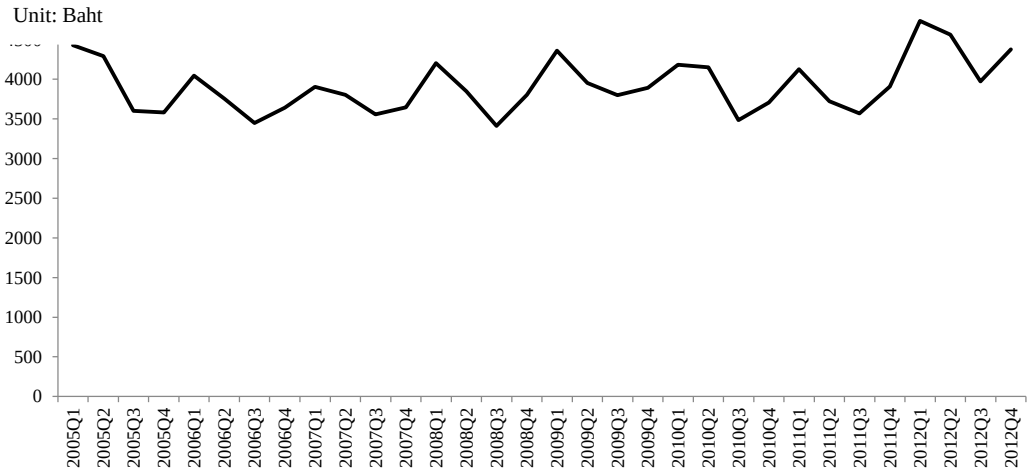
$$prob(employment_{agri}) \cdot wage_{agri} = \sum_{nagri}(prob(employment_{nagri}) \cdot wage_{nagri}) - switching\ cost \qquad (18)$$

where $prob\left(employment_{agri}\right) = \frac{employment_{agri}}{total\ labor\ supply}$,

and $prob\left(employment_{nagri}\right) = \frac{employment_{nagri}}{total\ labor\ supply}$

Equation 18 requires the input of historical data relating to sector employment, sector wages, and the overall supply of labor in the economy. When these are introduced, there remains a residual term to account for the cost of switching between sectors as labors migrate from agricultural to non-agricultural sectors. As shown in Figure 6.2, after deflating this series of switching cost (the series of nominal values of switching cost is deflated by using the series of Consumer Price Index (CPI) with the base year of 2005), its value shows the seasonal pattern and the consistent range of oscillation. Therefore, it can be seen that in Thailand, the domestic migration patterns of labors follow to the expected wage equilibrium under the Harris-Todaro concept.

Figure 6.2: The time series of the deflated switching cost during 2005 – 2012 (unit in Baht)



Source: Authors' calculation based on the date obtained from the Labor Force Survey, Ministry of Labor, Thailand.

From these findings of the consistent pattern of domestic migration which conforms to the concept of Harris-Todaro's expected wage, this chapter is aimed at developing the CGE model for Thailand which incorporates the expected wage equilibrium equation in order to explore the effects of switching cost and labor productivity on Thai economy.

Moreover, the effect of trade liberalization on the welfare of labors depends on magnitude of the costs labor faces in moving between sectors in response to trade liberalization (Artuc, Chaudhuri, & McLaren, 2007; Caneiro, 2014). The simulation model of Artuc *et al.* (2007) predicted high values of switching cost response to trade liberalization. Carneiro (2014) estimated costs of mobility and found that the switching cost ranged from 1.4 to 2.7 times annual average wages. The difference of these costs depending on labor demographics such as age and education.

Artuc *et al.* (2007) simulated the elimination of a 30% tariff on manufacturing and found that although there was a sharp movement in wage following a trade liberalization, the economy shows slow adjustment which completed in 8 years. Carneiro (2014) also found slow transition, about several years, of labor market following trade liberalization

6.2 Methodology

A review of the literature reveals that labor migration is determined by a number of factors related to society and the wider economy[46]. These include unemployment rates, the cost of migration, income gaps and the extent of the social networks created by migrant laborers. Personal factor such as gender, education level, and age also play a role (Xu & Li, 2008). The study's goal is to measure the impact of the exogenously changed which is the openness of AEC. For the sake of convenience, the study simplifies the behaviors of migrants to some degree in the model, it is shown in section 6.3.2.

The study assumes that migrations costs, expected wage levels in the target migrant destination, and the numbers of migrants traveling between the regions in the previous period will be factors influencing present migration levels. The following equations were therefore constructed to model migration.

The CGE model structure follows the static CGE model developed by Decaluwé *et al.* (2012), which enables adjustment of price and quantity of most goods and input

[46] Appendix H is the small assignment chapter examines the determinants of internal migration in Thailand by regression-based models.

factors. In this study, the full mathematical details of this model are available in Appendix A.

As previously stated, a consistent domestic migration pattern can be observed within Thailand, with the seasonal fluctuations shown to follow the concept of Harris-Todaro expected wage equilibrium. Therefore, the equation used in this study determines the sectoral wages and sectoral employment for the model. In particular, the introduction of the expected wage equilibrium modifies the labor market mechanism. Based on the name assigned to variables and parameters in the standard CGE model introduced by Decaluwe *et al.* (2012). The mathematical form is shown in Equation 19 and 20.

$$\frac{LD_{agri}}{LS} \cdot WTI_{agri} = \sum_{nagri} \frac{LD_{nagri}}{LS} \cdot WTI_{nagri} - \frac{SWCOST}{PIXCON} \quad (19)$$

$$LS = \sum_{nagri} LD_{nagri} + LD_{agri} \quad (20)$$

LD_{agri} denotes the agricultural sector demand for labor, while LD_{nagri} represents the demand for labor in non-agricultural sectors. The model uses the term *LS* to denote the total labor supply, while the sectoral wage is given by *WTI*. The value of the switching cost is denoted by *SWCOST* while *PIXCON* is the value used for the Consumer Price Index. In accordance with the data presented in Figure 6.2, the *SWCOST* value is fixed to represent the deflated switching cost stability. This equation allows the model to simultaneously adjust sectoral employment and sectoral wages to represent the real-life movements of labor outlined earlier in the first section. Because of its flexibility, the agricultural sector wage WTI_{agri} is designated to be endogenous. Meanwhile, the equation governing expected wages (Equation 20) is incorporated within the model to equate the total demand and total supply of labor.

The characteristic of internal migration seen in Thailand is unique, thus the model simulation mainly focuses on the improving Thailand's production capability through the reduction of switching cost which would allow more flexibility in sectoral migration. This would increase the aggregate levels of production across the economy as a whole. A comparison is made between the effects of a reduced switching cost and the effects of enhanced labor productivity, since these measures are the most frequently proposed strategies in order to improve production capabilities. The comparison of the

simulation results is shown in the following section. The static single GCD model is constructed under the following assumptions:

- The main objective of producers is profit maximization and optimized productivity under the condition of constant-return-to-scale.
- The goal of consumers is to maximize utility within a given budget, through the determination of the consumption of the optimum combination of imported and domestic products and services.
- The market for each product or service is assumed to reach equilibrium, while prices are considered to be equilibrating variables.
- The frictional substitution mechanism between domestic and export production is non-linear, as is the frictional mechanism of substitution governing the relationship between domestic and imported products.
- The institutions represented in the model include government, the aggregate corporation representation, five household groups and ROW.
- The main source of data for the study is the SAM of Thailand (2010), which incorporates 40 commodities, 40 production activities, the government, ROW and aggregate households.
- Labor and capital are each considered to exist in only one type.

For the investigation of the partial effect of the opening of AEC on switching cost. The study alters the switching cost to endogenous variable and alters the labor supply to exogenous variable. The study assumes that there are labor inflows to Thailand due to AEC varying between -30% and +30%, and the study uses the change in Thai export as a result of AEC to represent another shock.

6.3 Results

6.3.1 Impact of switching cost and labor productivity on Thai economy

Three sets of simulations are carried out. The first simulation reveals the effects of adjustments of macroeconomic indicators upon the national economy as a whole. The supply side factors involved were labor productivity and switching costs. The second simulation reveals the national effects of changing demand side policies, such as promoting exports or increasing government expenditure. The final simulation presents the national effects of adjusting the values for labor productivity and switching costs in combination, revealing a potent multiplier effect in action.

Table 6.1 presents the outcomes of six simulations in which the switching costs were changed, both positively and negatively in increments of 10%, 5%, 2.5%, -2.5%, -5%, and -10%. When switching costs are reduced, the effect is to reduce friction and permit greater mobility for laborers to migrate, with benefits felt across the economy. Equations 18 and 19 reveal that a reduction is the switching cost of 10% will result in labor supply rising by 11.46%. As a consequence, wages in the agricultural and non-agricultural sectors are reduced by 8.53%, while on average, agricultural sector demand rises by 4.04% and non-agricultural demand rises by 12.60%. This implies that labors are motivated to move to sectors with higher pay. In the alternative scenario, raising the cost of switching by 10% results in a labor supply cut of 9.35%. The effect of this upon demand is an average decrease of 3.38% in the agricultural sector and 10.14% in the non-agricultural sectors. .

Table 6.1 reveals the most important macro indicators which reveal the extent of economic expansion caused by greater supply side capacity; the outcome is a fall in the consumer price index while incomes and GDP rise along with private consumption and state income. In contrast, it can be seen that when switching costs rise, supply side capability is reduced, which causes higher rates of inflation and a decline in both private and government incomes and consumption, along with a fall in GDP. This particular GCE model is able to simulate non-linear reactions to changes in switching costs; the adjustment of other macroeconomic variables changes in different percentage proportions to that seen for switching costs. The data for this are presented in Table 6.1.

Furthermore, when the shock induces a positive response, the effect is greater than is the case when the impact is negative. The data therefore present a shock response which has non-linear characteristics.

Table 6.1: Simulation results from altering values of switching cost (selected macroeconomic indicators) (unit in thousand millions Baht)

	Private Consumption		Real GDP		CPI		Govt Income		Private Income	
	Value	Percent change	Value	Percent change	Index	Percent change	Value	Percent change	Value	Percent change
Base-case	5,810.61	0.00	9,128.53	0.00	1.000	0.00	1,964.33	0.00	9,441.26	0.00
Switching cost + 10.0%	5,803.27	-0.13	9,113.30	-0.17	1.019	1.94	1,946.93	-0.89	9,429.34	-0.13
Switching cost + 5.0%	5,806.62	-0.07	9,120.36	-0.09	1.010	0.99	1,955.33	-0.46	9,434.77	-0.07
Switching cost + 2.5%	5,808.53	-0.04	9,124.30	-0.05	1.005	0.50	1,959.75	-0.23	9,437.88	-0.04
Switching cost - 2.5%	5,812.87	0.04	9,133.06	0.05	0.995	-0.51	1,969.09	0.24	9,444.93	0.04
Switching cost - 5.0%	5,815.32	0.08	9,137.92	0.10	0.990	-1.03	1,974.02	0.49	9,448.92	0.08
Switching cost - 10.0%	5,820.84	0.18	9,148.68	0.22	0.979	-2.10	1,984.47	1.03	9,457.89	0.18

Source: Result from the study's model

The simulation outcomes when labor productivity is altered in increments of -10%, -5%, -2.5%, 2.5%, 5%, and 10% are shown in Table 6.2. As labor productivity rises, the effect upon the economy is broadly beneficial, and shows similarities to the effects of reducing the cost of switching between sectors.

When labor productivity is increased by 10%, the outcome is a wage increase in both agricultural and non-agricultural sectors of 1.47%, while agricultural sector demand drops by 5.78% and non-agricultural demand climbs by an average of 1.21%. The implication is that agricultural sector wages show greater sensitivity to changes than those in non-agricultural sectors. However, when labor productivity is reduced by 10%, the wages in the agricultural and non-agricultural sectors both fall by 1.55%, while agricultural sector demand rises by 6.98% but non-agricultural demand is reduced by 1.27%.

As labor productivity is increased, the capacity of the supply side of an economy is also boosted, while production costs fall. This causes an overall expansion of the economy, so that GDP increases along with government and private incomes and consumption. Meanwhile, the consumer price index drops. In contrast, when labor productivity declines, production falls leading to higher inflation rates and a reduction in GDP, along with government and private incomes and consumption.

It is interesting to note that in both simulations, the changes made to labor productivity and to switching costs can be seen to generate similar responses in the national economy. In particular, it is notable that the responses in each case are of very similar magnitudes, in terms of each of the macroeconomic variables measured. This means that when labor productivity increases by 5%, the outcome is almost identical to that achieved when switching costs reduces by 5%. Similarly, a 5% fall in labor productivity will replicate the outcome generated by a 5% rise in switching costs. It can therefore be concluded that the strategies of adjusting switching costs or labor productivity are effective substitutes for each other.

Table 6.2: Simulation results from altering values of labor productivity (selected macroeconomic indicators) (unit in thousand millions Baht)

	Private Consumption		**Real GDP**		**CPI**		**Govt Income**		**Private Income**	
	Value	Percent change	Value	Percent change	Index	Percent change	Value	Percent change	Value	Percent change
Base-case	5,810.61	0.00	9,128.53	0.00	1.000	0.00	1,964.33	0.00	9,441.26	0.00
Labor productivity – 10.0%	5,802.61	-0.14	9,111.87	-0.18	1.022	2.15	1,945.14	-0.98	9,428.26	-0.14
Labor productivity – 5.0%	5,806.42	-0.07	9,119.96	-0.09	1.010	1.04	1,954.87	-0.48	9,434.46	-0.07
Labor productivity – 2.5%	5,808.48	-0.04	9,124.20	-0.05	1.005	0.51	1,959.64	-0.24	9,437.79	-0.04
Labor productivity + 2.5%	5,812.81	0.04	9,132.95	0.05	0.995	-0.50	1,968.97	0.24	9,444.84	0.04
Labor productivity + 5.0%	5,815.08	0.08	9,137.44	0.10	0.990	-0.98	1,973.54	0.47	9,448.52	0.08
Labor productivity + 10.0%	5,819.77	0.16	9,146.62	0.20	0.981	-1.91	1,982.51	0.93	9,456.15	0.16

Source: Result from the study's model

Table 6.3 shows the simulation results obtained from altering the government spending with the same adjustment as conducted in the case of labor productivity. With the higher government spending, demand is increased leading to the expansion of the economy where the real GDP, private income, private consumption, and government income increase with the increased CPI. On the contrary, the decreasing government spending will cause the lowered demand leading to lower inflation and the decrease in the real GDP, private income, private consumption, and government income.

Table 6.3: Simulation results from altering values of government spending (selected macroeconomic indicators) (unit in thousand millions Baht)

	Private Consumption		Real GDP		CPI		Govt Income		Private Income	
	Value	Percent change	Value	Percent change	Index	Percent change	Value	Percent change	Value	Percent change
Base-case	5,810.61	0.000	9,128.53	0.000	1.000	0.000	1,964.33	0.000	9,441.26	0.000
Government spending – 10.0%	5,749.29	-1.055	9,031.01	-1.068	0.996	-0.389	1,942.65	-1.104	9,341.62	-1.055
Government spending – 5.0%	5,779.94	-0.528	9,079.75	-0.534	0.998	-0.193	1,953.50	-0.552	9,391.42	-0.528
Government spending – 2.5%	5,795.27	-0.264	9,104.13	-0.267	0.999	-0.096	1,958.92	-0.276	9,416.34	-0.264
Government spending + 2.5%	5,825.95	0.264	9,152.93	0.267	1.001	0.095	1,969.75	0.276	9,466.19	0.264
Government spending + 5.0%	5,841.30	0.528	9,177.34	0.535	1.002	0.189	1,975.16	0.551	9,491.12	0.528
Government spending + 10.0%	5,872.01	1.057	9,226.19	1.070	1.004	0.375	1,985.97	1.102	9,541.02	1.057

Source: Result from the study's model

Table 6.4 shows the simulation results obtained from altering the export with the same adjustment as conducted in the case of labor productivity. The increasing export leads to the same positive economy-wide impacts as in the case of increased government spending. With the higher export, demand is increased leading to the expansion of the economy where the real GDP, private income, private consumption, and government income increase with the increased CPI. On the contrary, the decreasing export will cause the lowered demand leading to lower inflation and the decrease of the real GDP, private income, private consumption, and government income.

Table 6.4: Simulation results from altering values of export (selected macroeconomic indicators) (unit in thousand millions Baht)

	Private Consumption		Real GDP		CPI		Govt Income		Private Income	
	Value	Percent change	Value	Percent change	Index	Percent change	Value	Percent change	Value	Percent change
Base-case	5,810.61	0.00	9,128.53	0.00	1.000	0.00	1,964.33	0.00	9,441.26	0.00
Export – 10.0%	5,362.42	-7.71	8,414.90	-7.82	0.976	-2.44	1,810.91	-7.81	8,713.02	-7.71
Export – 5.0%	5,587.25	-3.84	8,772.85	-3.90	0.988	-1.19	1,887.91	-3.89	9,078.34	-3.84
Export – 2.5%	5,699.11	-1.92	8,950.97	-1.95	0.994	-0.59	1,926.19	-1.94	9,260.09	-1.92
Export + 2.5%	5,921.75	1.91	9,305.54	1.94	1.006	0.58	2,002.34	1.93	9,621.85	1.91
Export + 5.0%	6,032.55	3.82	9,482.02	3.87	1.011	1.14	2,040.21	3.86	9,801.87	3.82
Export + 10.0%	6,253.13	7.62	9,833.42	7.72	1.022	2.24	2,115.56	7.70	10,160.28	7.62

Source: Result from the study's model

Interestingly, if both lowering switching cost and improving the labor productivity are implemented together, they will generate more positive effects to the economy than separately implement each one. Table 6.5 shows the effect of this combination into the model and measures the net effects (combination policies – base-case) on private consumption, real GDP, CPI, government income, and private consumption for each altering value of switching cost and labor productivity. The study only simulates the positive shock because the economic response from the combined policies, if they are implemented, is the main focused.

Table 6.5: Simulation results from altering values of switching cost and labor productivity and their combination effect (selected macroeconomic indicators) (unit in thousand millions Baht)

	Private Consumption	Real GDP	CPI	Govt Income	Private Income
	Value	Value	Index	Value	Value
Base-case	5,810.61	9,128.53	1.000	1,964.33	9,441.26
Switching cost - 2.5% and labor productivity + 2.5%	5,815.20	9,137.67	0.990	1,973.78	9,448.72
Net effect	4.589	9.147	-0.010	9.441	7.457
Switching cost - 5.0% and labor productivity + 5.0%	5,820.28	9,147.59	0.980	1,983.44	9,456.97
Net effect	9.671	19.067	-0.020	19.107	15.714
Switching cost - 10.0% and labor productivity + 10.0%	5,831.89	9,169.71	0.960	2,003.49	9,475.84
Net effect	21.281	41.187	-0.040	39.160	34.578

Source: Result from the study's model

Table 6.6 shows the effect of the reduction of switching cost and increase in labor productivity individually on private consumption, real GDP, CPI, government income, and private consumption. Then both value of the reduction of switching cost and increase in labor productivity are summed in order to compare them to the combination one.

Table 6.6: Magnitudes of impacts caused by altering values of switching cost and labor productivity and their effect (selected macroeconomic indicators) (unit in thousand millions Baht)

	Private Consumption	Real GDP	CPI	Govt Income	Private Income
	Value	Value	Index	Value	Value
Net effect of switching cost - 2.5%	2.261	4.534	-0.005	4.753	3.675
Net effect of labor productivity + 2.5%	2.204	4.420	-0.005	4.635	3.581
Sum	***4.466***	***8.954***	***-0.010***	***9.388***	***7.256***
Net effect of switching cost - 5.0%	4.713	9.392	-0.010	9.686	7.659
Net effect of labor productivity + 5.0%	4.471	8.915	-0.010	9.209	7.265
Sum	***9.185***	***18.306***	***-0.020***	***18.895***	***14.924***
Net effect of switching cost - 10.0%	10.234	20.156	-0.021	20.138	16.629
Net effect of labor productivity + 10.0%	9.166	18.089	-0.019	18.176	14.893
Sum	***19.400***	***38.245***	***-0.040***	***38.314***	***31.522***

Source: Result from the study's model

Table 6.7 shows the additional effect (or multiplier effect) of the combination policy (combination policy – sum of switching cost and labor productivity). For the combination of lowering switching cost by -2.5% and improving labor productivity by +2.5%, real GDP will gain more 193 million baht or 2.161% than implement both switching cost by -2.5% and labor productivity by +2.5% separately. In addition, GDP will gain more 14.596% in the case of lowering switching cost by -10.0% and improving labor productivity by +10.0%. Interestingly, the more magnitude of both policies implements, the more multiplier effect, especially on real GDP.

Table 6.7: Comparison of magnitudes of impacts caused by altering values of switching cost and labor productivity and their additional effect (selected macroeconomic indicators) (unit in thousand millions Baht)

	Private Consumption	Real GDP	CPI	Govt Income	Private Income
	Value	Value	Index	Value	Value
Switching cost - 2.5% and labor productivity + 2.5%	0.124	0.193	0.000	0.053	0.201
Surplus	***2.769%***	***2.161%***	***-0.251%***	***0.565%***	***2.769%***
Switching cost - 5.0% and labor productivity + 5.0%	0.486	0.760	0.000	0.212	0.790
Surplus	***10.871%***	***8.531%***	***-1.012%***	***2.300%***	***10.871%***
Switching cost - 10.0% and labor productivity + 10.0%	1.881	2.942	0.000	0.846	3.055
Surplus	***18.375%***	***14.596%***	***-1.821%***	***4.200%***	***18.375%***

Source: Result from the study's model

The comparison of similarity from changes in labor productivity and the switching cost is concluded in Table 6.1 and Table 6.2. The magnitudes of macroeconomic responses are almost identical to the same percentage of changes of either labor productivity or switching cost. Also, as previously mentioned, the simulation results indicate the asymmetric responses of the economy to the same magnitudes of shocks imposing in the different direction. The results from Table 6.1 to Table 6.4 exhibit that the positive responses have the greater magnitude than those of negative ones excepting the export promotion case (Table 6.4). This evidence implies the caution and policy recommendation towards the important to implement. From Table 6.6 to Table 6.7 exhibit the finding of multiplier effect.

6.3.2 Relationship between AEC and switching Cost

In this section, the study will investigate the partial effect of the opening of AEC on switching cost by incorporate with the result from the dynamic multi-countries CGE model.

Table 6.8: Percentage change of Thai export from BAU (Scenario D)

	Change in export from BAU (percentage)							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Thailand	0.81	1.06	1.39	1.66	1.91	2.15	2.39	2.62

Source: A part of result from Table 4.33

Table 6.8 illustrates the percentage change of Thai export under AEC. The result was achieved from Table 4.33.

Table 6.9: Percentage change of switching cost from BAU by varying export

		Export (percent change)							
	BAU (thousand million Baht)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
		0.81	1.06	1.39	1.66	1.91	2.15	2.39	2.62
Value of Switching Cost	0.929	0.938	0.941	0.945	0.948	0.950	0.953	0.956	0.958
Percent Change		***0.97***	***1.27***	***1.67***	***1.99***	***2.29***	***2.58***	***2.87***	***3.14***
Percent Growth		0.97	0.30	0.39	0.32	0.29	0.28	0.28	0.27

Source: Result from the study's model

Table 6.9 shows percentage change of switching cost by varying export. Percent change of export represents shock from AEC forecasting for 8 years, as shown in Table 6.8. In BAU scenario, there is no AEC, the switching cost between agricultural and non-agricultural sectors equals to 0.929 thousand million Baht. The result from Table 6.9 shows the positive relationship between Thai export and switching cost. More export will lead to higher switching cost. At the first year of AEC, there is 0.81% more export comparing to BAU leads to 0.97% more switching cost comparing to BAU scenario. While at year 8, there is 2.62% more export comparing to BAU leads to 3.14% more switching cost comparing to BAU scenario. This indicates that better economic situation, switching cost is higher because labor prefer not to change job. This result is in line with Artuc *et al.* (2007) and Carneiro (2014) studies who found that switching cost is high response to trade liberalization. This effects also positive to firms' business cost because firms do not have to pay frequently for retraining program.

Table 6.10: Percentage change of real GDP from BAU by varying switching cost

	BAU (thousand million Baht)	Switching Cost (percent change)							
		0.97	1.27	1.67	1.99	2.29	2.58	2.87	3.14
Value of GDP	9,129	9,127	9,126	9,126	9,125	9,125	9,124	9,124	9,123
Percent Change		***-0.02***	***-0.02***	***-0.03***	***-0.04***	***-0.04***	***-0.05***	***-0.05***	***-0.06***
Percent Growth		-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00

Source: Result from the study's model

Table 6.10 shows percentage change of real GDP by varying switching cost. Percent change of switching cost represents shock from AEC forecasting for 8 years, as shown in Table 6.9. The result from Table 6.10 shows the negative relationship between switching cost and Thai real GDP. More switching cost will lead to lower real GDP. At the first year of AEC, there is 0.97% more switching cost comparing to BAU leads to 0.02% less real GDP comparing to BAU scenario. While at year 8, there is 3.14% more switching cost comparing to BAU leads to 0.06% less real GDP comparing to BAU scenario. This is in the line with Table 6.1 which indicates switching cost has a negative effect on real GDP.

Table 6.11: Percentage change of consumption from BAU by varying switching cost

	BAU (thousand million Baht)	Switching Cost (percent change)							
		0.97	1.27	1.67	1.99	2.29	2.58	2.87	3.14
Value of Consumption	5,811	5,810	5,810	5,809	5,809	5,809	5,808	5,808	5,808
Percent Change		***-0.01***	***-0.02***	***-0.02***	***-0.03***	***-0.03***	***-0.04***	***-0.04***	***-0.04***
Percent Growth		-0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.00

Source: Result from the study's model

Table 6.11 shows percentage change of consumption by varying switching cost for Thailand. Percent change of switching cost represents shock from AEC forecasting for 8 years, as shown in Table 6.9. The result from Table 6.11 shows the negative relationship between switching cost and consumption in Thailand. More switching cost will lead to lower consumption. At the first year of AEC, there is 0.97% more switching cost comparing to BAU leads to 0.01% less consumption comparing to BAU scenario. While at year 8, there is 3.14% more switching cost comparing to BAU leads to 0.04% less consumption comparing to BAU scenario. This is in the line with Table 6.1 which indicates switching cost has a negative effect on consumption.

Table 6.12: Percentage change of CPI from BAU by varying switching cost

	BAU (index)	Switching Cost (percent change)							
		0.97	1.27	1.67	1.99	2.29	2.58	2.87	3.14
CPI	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01
Percent Change		***0.20***	***0.26***	***0.33***	***0.40***	***0.46***	***0.52***	***0.57***	***0.63***
Percent Growth		0.20	0.06	0.08	0.06	0.06	0.06	0.06	0.05

Source: Result from the study's model

Table 6.12 shows percentage change of CPI by varying switching cost for Thailand. Percent change of switching cost represents shock from AEC forecasting for 8 years, as shown in Table 6.9. The result from Table 6.12 shows the positive relationship between switching cost and CPI in Thailand. More switching cost will lead to more CPI. At the first year of AEC, there is 0.97% more switching cost comparing to BAU leads to 0.20% more CPI comparing to BAU scenario. While at year 8, there

is 3.14% more switching cost comparing to BAU leads to 0.63% more CPI comparing to BAU scenario. This is in the line with Table 6.1 which indicates switching cost has a positive effect on CPI.

6.4 Conclusion

This chapter delivers 4 main contributions. First, it shows the empirical evidence that there exists the systematic pattern of domestic migration in Thailand's labor market, which conforms to Harris-Todaro's theory of expected wage equilibrium. Moreover, the empirical analysis shows that there exists the consistent range of switching cost, which is the cost incurs when labors move from agricultural sector to non-agricultural sectors. Secondly, it incorporates the Harris-Todaro's equation into the standard static single country CGE model. Thirdly, it shows the multiplier effect when using both the reduction of switching and the increasing labor productivity which are supply side policy and related to labor market. The result obtained from the simulations exhibits that Thai economy responds to the reduction of switching cost at the same rate as to the increasing labor productivity. Interestingly, the simulation result also indicates the asymmetric response of the economy to the changes of switching cost and those of labor productivity, where the positive response is greater than that of negative one. Based on these key findings, the government programs supporting the reduction of switching cost and increasing labor productivity are the top-priority tasks and should implement both of them in order to sustain the economic growth. The last point, the result indicates that better economic situation which is affected from AEC, switching cost is higher because labor prefers not to change job. This effects also positive to firms' business cost because firms do not have to pay frequently for training program.

Chapter 7

Conclusion and Discussion

AEC would benefit to member countries by gain more trade activities, minimize transaction costs, attract FDI, improve supply chain, and enhance activities including capital and labor movements throughout the region. However, estimating the economic effects from exhibiting some barriers to flows of goods, services and investment are difficult. Other complicated aspects for evaluation include the limitless movement of labor, comprehensive assistance in capital market expansion, and the inferences of ASEAN for an increase of influence for international negotiations.

The central conclusion of this study is that the effect of the AEC is large. It could enhance real GDP of ASEAN economies by approximately 20.58 Billion US dollar or 3.27% from business-as-usual (BAU) case. Moreover, every ASEAN country will have better growth path after AEC by growing at 5.16% per year under AEC but 4.70% per year without AEC. Most of these benefit results from the integration effects of zero tariff (scenario A), more investment from other regions (scenario B), and cheaper trade cost (scenario C).

The main objective of AEC is to be a production base, thus it tends to have the greatest important effects on manufacturing sector. Weakened barriers to trade and investments would produce better interdependence, robust production networks, superior economies of scale, and broader access to product diversities (Petri *et al.*, 2012). Deeper integration would empower ASEAN to achieve completely the production advantages offered by its diverse affiliation of member countries. This would create substantial productivity advances. Therefore, Thailand should plan its position to yield the advantage of manufacturing network because resources are likely to move toward manufacturing as efficiency increases.

The study suggests 2 main sectors that Thai government should focus in different issues. For the issue of boosting Thai economy, manufacturing sectors are chosen to focus because, according to the study results, manufacturing sectors produce

the highest output and it corresponds with the main objective of AEC to become a single market and production base. According to Table 4.41, light manufacturing and heavy manufacturing sectors of Thailand are the majority output production account for 44% before and after AEC. For the issue of aging society, agricultural sector is chosen because the agricultural sector has a central role in the reinforcement and stabilization of the local economy.

For the first issue, heavy manufacturing sector employs less labor but produces more output which indicates that these sectors substituted labor by using more capital and become more capital intensive sector after AEC. Thailand should focus in both light and heavy manufacturing sectors because, firstly, they produces the highest output (241.05 Billion US dollar, Table 4.41), secondly, there is a potential to absorb more productive labors since light manufacturing and heavy manufacturing sectors employ less labors by 3.51% and 0.20% after AEC. If Thai government strongly promotes the R&D investment, increasing labor productivity, improve infrastructure network, light manufacturing and heavy manufacturing sector have potential to produce more output and employ more labor which lead to more export and more consumption, thus generating greater GDP. Lastly, with the benefits that cannot measure such as a larger economies of scale, extensive access to product varieties, and stronger production networks.

Scale effects correlated with superior regional manufacture and trade could provide benefits to the products of this sector, which possess a high trade value. In addition, relatively low protection in manufacturing sectors would provide room for improving productivity, and increasing specialization (Petri *et al.*, 2012). Productivity increases in the manufacturing sectors could reinforce Thailand's comparative advantage in several significant manufacturing subsectors, with the effect of increased exports to both ASEAN partners and world markets.

Overall, AEC has a negative effect on employment of domestic labor since the average employment growth (averaged for first 8 years) of domestic labor (0.61%) is lower than BAU case (0.65%). In contrast, AEC has a positive effect on employment of migrant labor in every sector and the employment growth of migrant labor is higher than of domestic labor in every sector. This indicates that, in the long run, the share of migrant labor in every sector would keep on increasing and every sector in Thailand

would rely on migrant labors. In addition, Thailand would have 334,154 more migrant labors after AEC which are dominated by labors from Cambodia, Lao PDR, and Myanmar, accounting for 89.9%.

The most important drivers of the international migration of labor into Thailand include the income disparity between Thailand and other countries in the region, the slowing growth of Thai labor workforce, and developments to the infrastructure connecting assorted locations in the Greater Mekong Sub-region. Moreover, a large demand for low-skilled labors in labor intensive production draws migrant labor to arise through the borders and labor in Thailand (Pholphirul, 2012). This movement fulfills the shortage of labor in Thailand.

However, Cambodia, Lao PDR, and Myanmar countries are liberalizing their trade and developing their countries which in turn contribute to economic growth. Therefore, these countries are trying to attract their labors back home because these labors are considered as experience labors. If Thailand wants to sustain its economy and prevent the shock of large outflow of migrant labors, increase productivity of labor is the solution to sustain Thai economy in the long run.

For the second issue, Thailand is becoming an aging society. NESDB forecasts that from 2010 to 2040, labor supply in Thailand would have average growth by -0.613% (from 2010 to 2040). Converting from labor intensive to additional knowledge and technology intensive production-processes is a possible solution for the crisis of an aging population, which could readdress the advancement corridor of human resources with improved focus on information and abilities.

In development strategy of the Eleventh National Economic and Social Development Plan of Thailand for 2012 – 2016 suggests the increase labor productivity in agriculture sector because the agricultural sector has a central role in the reinforcement and stabilization of the local economy. Furthermore, it continues to be a significant source of income, safeguarding the customary way of life, while diminishing the effects of global warming and food safety.

The study simulates the effect of lower labor supply growth. The result find that 0.613% reduction in labor supply growth would reduce real GDP by 0.06%. The study's model found that in order to real GDP of Thailand in the long run, productivity of labor in agricultural sector should increase by at least 5%. Therefore, Thai government should

implement policies that enhance the human capital or improve the knowledge of labor in this sector in order to prevent from the shortage of Thai and migrant labors supply in the future.

For the effect of minimum wage policies on economy and employment, the minimum wage in Thailand is an important topic for debate, with labor representatives seeking an increase in the minimum wage. Increased minimum wage will enhance the well-being of labor and strengthen domestic demand because labors have more income, thus more purchasing power. Moreover, it induces the adjustment more in the knowledge and skilled-based and businesses focus on hiring labors with knowledge and more experience to make it worth the cost of labor. However, a single economy that raises its minimum wage will raise its wages relative to competitors with adverse effects on economy because the higher cost of producing goods and services. This will enable the industries to increases product price, relocation of production to countries where labor is cheaper, especially in labor-intensive industries with high labor cost.

The result of the study indicates the negative correlation between minimum wage and both GDP and employment due to higher cost of production in Thailand. Therefore, whether solely increased minimum wage or subsidy wage policies are not appropriated for Thailand as a part of AEC because these policies would reduce investment as well as a disincentive to human capital accumulation. Although decreased minimum wage leads to increase in GDP, investment, and employment for both skilled and unskilled labors in every sector, it is politically hard to implement for policy makers, who want votes from the public, to reduce minimum wage.

According to the results of the study, solely increase minimum wage could extremely affect the economy. In the response of increased minimum wage, productivity of labor who earn minimum wage should increase in order to compensate the negative impact of increased minimum wage policy. This is because the advantages of the productivity increase cause producers to become more competitive which may lead to substantial higher growth in economy. The study has measured the effects of adjustment both minimum wage and labor productivity. The rest is for policy maker to decide how much minimum wage to increase in accordance with market conditions. In

addition, policy maker should acknowledge the market before taking an action to avoid large adverse effects of increased minimum wage as predicted in the study.

For the impact of switching cost and labor productivity on Thai economy and the relationship between AEC and switching cost, the empirical evidence shows there exists the systematic pattern of domestic migration in Thailand's labor market, which conforms to Harris-Todaro's theory of expected wage equilibrium. Moreover, the empirical analysis shows that there exists the consistent range of switching cost, which is the cost incurs when labors move from agricultural sector to non-agricultural sectors. Based on these key findings, the government programs supporting the reduction of switching cost and increasing labor productivity are the top-priority tasks and should implement both of them in order to sustain the economic growth. In addition, the simulation result also indicates that better economic situation which is from AEC, switching cost is higher because labor prefers not to change job. This effects also positive to firms' business cost because firms do not have to pay frequently for retraining program.

The advantages of incorporation will grow as the ASEAN markets continue in expansion. Inter-industry connections will be characterized as the European single market due to greater trade volume. In addition to the benefits captured in our model, this step should result in additional and sustained benefits for the future. Provided regional incorporation improves ASEAN's influence and permits it to collaborate on agreements with major trade partners, there could be even more potential advantages.

Limitations:

Myanmar is one of the major trading partner and the major source of migrant labor to Thailand. However, SAM of Myanmar is unavailable in GTAP version 8 database. Second limitation of the study is the assumption of FDI due to AEC. The study assumes FDI inflows to each ASEAN country by 1% of its BAU GDP, this assumption would underestimate the actual flows of FDI. However, this study aims to show the least optimistic for FDI due to AEC.

Future work:

There are some possible further improvements for the study. Firstly, include remittance in order to measure the effect of emigration. The effect of immigration is an immediate impact but the effect of emigration is the long term impact to Thai economy. The benefits of emigration is remittance itself and future labor productivity gain since migrants who return home with skills, experiences, and money to work or set up their own businesses (Jones & Kittisuksathit, 2003). Secondly, expand the model to cooperate with ASEAN and other partner countries to become regional economic partnership including ASEAN plus Australia, China, India, Japan, Korea, and New Zealand because trade agreements with more advanced countries should benefit to ASEAN by capital intensive and technology based imports exchanged for labor intensive exports.

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APPENDIX

Appendix A[47]: Static single country CGE model

A1. Equations

No.	Equation	Description
	Production equations	
1	$VA_j = v_j XS_j$	Value added for output (perfectly complementary)
2	$CI_j = io_j XS_j$	Total intermediate consumption (perfectly complementary)
3	$VA_j = A_{z,t}^{VA} B_j^{VA} [(\beta_j^{VA} LDC_j^{-\rho_j^{VA}} + (1-\beta_j^{VA}) KDC_j^{-\rho_j^{VA}}]^{-\frac{1}{-\rho_j^{VA}}}$	Value added for factors of production[48]
4	$LDC_j = [\frac{\beta_j^{VA}}{(1-\beta_j^{VA})} \frac{RC_j}{WC_j}]^{\sigma_j^{VA}} KDC_j$	Demand for labor relative to capital
5	$LDC_j = B_j^{LD} [\sum_l \beta_{l,j}^{LD} LD_{l,j}^{-\rho_j^{LD}}]^{-\frac{1}{\rho_j^{LD}}}$	Imperfect substitutability between different types of labor[49]
6	$LD_{l,j} = [\frac{\beta_{l,j}^{LD} WC_j}{WTI_{l,j}}]^{\sigma_j^{LD}} (B_j^{LD})^{\sigma_j^{LD}-1} LDC_j$	Labor demand with cost minimization
7	$KDC_j = B_j^{KD} [\sum_k \beta_{k,j}^{KD} KD_{k,j}^{-\rho_j^{KD}}]^{-\frac{1}{\rho_j^{KD}}}$	Imperfect substitutability between different types of capital[50]
8	$KD_{k,j} = [\frac{\beta_{k,j}^{KD} RC_j}{RTI_{k,j}}]^{\sigma_j^{KD}} (B_j^{KD})^{\sigma_j^{KD}-1} KDC_j$	Capital demand with cost minimization
9	$DI_{i,j} = aij_{i,j} CI_j$	Intermediate demand (perfectly complementary)
	Income and savings equations	
10	$YH_h = YHL_h + YHK_h + YHTR_h$	Total household income
11	$YHL_h = \sum_l \lambda_{h,l}^{WL} (W_l \sum_j LD_{l,j})$	Household labor income
12	$YHK_h = \sum_k \lambda_{h,k}^{RK} (\sum_j R_{k,j} KD_{k,j})$	Household capital income
13	$YHTR_h = \sum_{ag} TR_{h,ag}$	Transfer income is the sum of all transfers received by type h households
14	$YDH_h = YH_h - TDH_h - TR_{gvt,h}$	Household disposable income

[47] These equations construct the model of static single-country CGE in chapter 6. Most equations are based on Decaluwé *et al.* (2012)

[48] $\rho_j^{VA} = \frac{1-\sigma_j^{VA}}{\sigma_j^{VA}}$

[49] $\rho_j^{LD} = \frac{1-\sigma_j^{LD}}{\sigma_j^{LD}}$

[50] $\rho_j^{KD} = \frac{1-\sigma_j^{KD}}{\sigma_j^{KD}}$

No.	Equation	Description
15	$CTH_z = YDH_z - SH_z - \sum_{agng} TR_{agng,h}$	Household consumption
16	$SH_z = PIXCON_z^{\eta} sh0_z + sh1_z YDH_z$	Household savings
17	$YF_f = YFK_f - YFTR_f$	Business income consists of its share of capital income and transfer received from other agents
18	$YFK_f = \sum_k \lambda_{f,k}^{RK} (\sum_j R_{k,j} KD_{k,j})$	Capital income
19	$YFTR_f = \sum_{ag} TR_{f,ag}$	Transfer received from other agents
20	$YDF_f = YF_f + TDF_f$	Deducting business income taxes from total income yields the disposable income of each type of business
21	$SF_f = YDF_f - \sum_{ag} TR_{ag,f}$	Business savings are the residual that remains after subtracting transfers to other agents from disposable income
22	$YG = YGK + TDHT + TDFT + TPRODN + TPRCTS + YGTR$	Total government income are from various sources
23	$YGK = \sum_k \lambda_{gvt,k}^{RK} (\sum_j R_{k,j} KD_{k,j})$	Government capital income
24	$TDHT = \sum_h TDH_h$	Total government revenue from household income taxes
25	$TDFT = \sum_f TDF_f$	Total government revenue from business income taxes
26	$TPRODN = TIWT + TIKT + TIPT$	Total government revenue from other taxes on production
27	$TIWT = \sum_{l,j} TIW_{l,j}$	Total government revenue from payroll taxes
28	$TIKT = \sum_{k,j} TIK_{k,j}$	Total taxes on capital
29	$TIPT = \sum_j TIP_j$	Total taxes on production
30	$TPRCTS = TICT + TIMT + TIXT$	Total taxes on products and on imports
31	$TICT = \sum_i TIC_i$	Total government receipts of indirect taxes on commodities
32	$TIMT = \sum_i TIM_i$	Total government revenue from import duties
33	$TIXT = \sum_i TIX_i$	Total government revenue from export taxes
34	$YGTR = \sum_{agng} TR_{gvt,agng}$	Government transfer income
35	$TDH_h = PIXCON^{\eta} ttdh0_h + ttdh1_h YH_h$	Income taxes paid by households are described as a linear function of total income
36	$TDF_f = PIXCON^{\eta} ttdf0_f + ttdf1_f YFK_f$	Government revenue from business income taxes are described as a linear function of total income
37	$TIW_{l,j} = ttiw_{l,j} W_l LD_{l,j}$	Taxes on labor distinguishes tax rates by industry
38	$TIK_{k,j} = ttik_{k,j} R_{k,j} KD_{k,j}$	Taxes on capital distinguishes tax rates by industry

No.	Equation	Description
39	$TIP_j = ttip_j PP_j XST_j$	Taxes apply on the total value of production
40	$TIC_i = ttic_i\{(PL_i + \sum_{ij} PC_{ij}\, tmrg_{ij,i})DD_i + [(1 + ttim_i)PWM_i\, e + \sum_{ij} PC_{ij}\, tmrg_{ij,i})IM_{ij}]\}$	Government receipts of indirect taxes on commodities of imported and non-imported products at local price
41	$TIM_i = ttim_i PWM_i\, e\, IM_i$	Government revenues from duties levied on imports of commodity at world price
42	$TIX_i = ttix_i(PE_i + \sum_{ij} PC_{ij}\, tmrg^X_{ij,i})EXD_i$	Government revenues from export taxes
43	$SG = YG - \sum_{agng} TR_{agng,gvt} - G$	The current government budget surplus or deficit (positive or negative savings) is the difference between its revenue and its current expenditures on goods and services
44	$YROW = e\sum_i PWM_i IM_i + \sum_k \lambda^{RK}_{row,k}(\sum_j R_{k,j}\, KD_{k,j}) + \sum_{agd} TR_{row,agd}$	The rest of the world receives payments for the value of imports, part of the income of capital, and transfers from domestic agents
45	$SROW_z = YROW_z - \sum_{ij} PE_i^{FOB} EXD_i - \sum_{agd} TR_{agd,row}$	Foreign spending in the domestic economy consists of the value of exports, and transfers to domestic agents. The difference between foreign receipts and spending is the amount of rest-of-the-world savings
46	$SROW_z = -CAB_z$	Rest-of-the-world savings are equal in absolute value to the current account balance, but of opposite sign
47	$TR_{agng,h} = \lambda^{TR}_{agng,h} YDH_h$	Household transfers to non-government agents
48	$TR_{gvt,h} = PIXCON^{\eta} tr0_h + tr1_h YH_h$	Household transfers to government
49	$TR_{ag,f} = \lambda^{TR}_{ag,f} YDF_f$	Business transfers are simply proportional to disposable income
50	$TR_{agng,gvt} = PIXCON^{\eta} TR^0_{agng,gvt}$	Government transfers to non-government agents
51	$TR_{agd,row} = PIXCON^{\eta} row$	Rest-of-the-world transfer to domestic agents
	Demand	
52	$PC_i C_{i,h} = PC_i C^{MIN}_{i,h} + \gamma^{LES}_{i,h}(CTH_h - \sum_{ij} PC_{ij} C^{MIN}_{ij,h})$	Household demand for each good is determined by utility maximization subject to the budget constraint
53	$GFCF = IT - \sum_i PC_i\, VSTK_i$	GFCF expenditure, obtained by subtracting the cost of changes in inventories from total investment expenditure
54	$PC_i INV_i = \gamma^{INV}_i GFCF$	Gross fixed capital formation expenditure is distributed among commodities in fixed shares
55	$PC_i CG_i = \gamma^{GVT}_i G$	Government current expenditures on goods and services are distributed among commodities in fixed shares
56	$DIT_i = \sum_j DI_{i,j}$	Intermediate demand for each commodity is the sum of industry demands

No.	Equation	Description
57	$\mathrm{MRGN_i} = \sum_{ij} \mathrm{tmrg_{i,ij} DD_{ij}} - \sum_{ij} \mathrm{tmrg_{i,ij} IM_{ij}} - \sum_{agd} \mathrm{tmrg^X_{i,ij} EXD_{ij}}$	Margin rates are applied to the volume of domestic production and imports to determine the quantities of these margin services required to distribute commodities to buyers
Producer supplies of products and international trade		
58	$\mathrm{XST_j} = \mathrm{B_i^{XT}}[\sum_i \beta_{j,i}^{XT} \mathrm{XS_{j,i}^{\rho_j^{XT}}}]^{\frac{1}{\rho_j^{XT}}}$	Production describes how industries combine inputs to produce total aggregate output [51]
59	$\mathrm{XS_{j,i}} = \frac{\mathrm{XST_j}}{(\mathrm{B_j^{XT}})^{1+\sigma_j^{XT}}} [\frac{\mathrm{P_{i,j}}}{\beta_{j,i}^{XT} \mathrm{PT_j}}]^{\sigma_j^{XT}}$	Producers allocate output among products so as to maximize sales revenue, given product prices, subject to equation 58
60	$\mathrm{XS_{j,i}} = \mathrm{B_{j,i}^X}[\beta_{j,i}^X \mathrm{EX_{j,i}^{\rho_{j,i}^X}} + (1 - \beta_{j,i}^X)\mathrm{DS_{j,i}^{\rho_{j,i}^X}}]^{\frac{1}{\rho_{j,i}^X}}$	The output of every product of an industry is shared out among markets (domestic or export) [52]
61	$\mathrm{EX_{j,i}} = [\frac{1-\beta_{j,i}^X}{\beta_{j,i}^X} \frac{\mathrm{PE_i}}{\mathrm{PL_i}}]^{\sigma_{j,i}^X} \mathrm{DS_{j,i}}$	Relative supply functions are derived from the first-order conditions of revenue maximizing subject to the CET aggregator function (equation 60)
62	$\mathrm{EXD_i} = \mathrm{EXD_i^0} (\frac{e\ \mathrm{PWX_i}}{\mathrm{PE_i^{FOB}}})^{\sigma_i^{XD}}$	Share of the world market depends on the price-elasticity of export demand
63	$\mathrm{Q_i} = \mathrm{B_i^X}[\beta_i^M \mathrm{IM_i^{-\rho_i^M}} + (1 - \beta_i^M)\mathrm{DD_i^{-\rho_i^M}}]^{\frac{-1}{\rho_i^M}}$	Commodities demanded on the domestic market are composite goods, combinations of locally produced goods and imports [53]
64	$\mathrm{IM_i} = [\frac{\beta_i^M}{1-\beta_i^M} \frac{\mathrm{PD_i}}{\mathrm{PM_i}}]^{\sigma_i^{M2}} \mathrm{DD_i}$	Demand functions of imports
Prices		
65	$\mathrm{PP_j} = \frac{\mathrm{PVA_j VA_j} + \mathrm{PCI_j CI_j}}{\mathrm{XST_j}}$	The unit cost of an industry's output is a weighted sum of the prices of value added and aggregate intermediate consumption
66	$\mathrm{PT_j} = (1 + \mathrm{ttip_j})\mathrm{PP_j}$	The basic price of production is obtained from the unit cost by adding taxes on production
67	$\mathrm{PCI_j} = \frac{\sum_i \mathrm{PC_i DI_{i,j}}}{\mathrm{CI_j}}$	The price of aggregate intermediate consumption is a combination of the commodity prices of the industry's intermediate inputs
68	$\mathrm{PVA_j} = \frac{\mathrm{WC_j LDC_j} + \mathrm{RC_j KDC_j}}{\mathrm{VA_j}}$	The price of value added is a combination of the prices of composite labor and composite capital
69	$\mathrm{WC_j} = \frac{\sum_l \mathrm{WTI_{l,j} LD_{l,j}}}{\mathrm{LDC_j}}$	The price of an industry's composite labor is a weighted sum of the wage rates (including payroll taxes) of the different categories of labor used by that industry
70	$\mathrm{WTI_{l,j}} = \mathrm{W_l}(1 + \mathrm{ttiw_{l,j}})$	Wages paid by industry differ from wages received by labors by the amount of payroll taxes

[51] $\rho_i^{XT} = \frac{1-\sigma_i^{XT}}{\sigma_i^{XT}}$

[52] $\rho_i^X = \frac{1-\sigma_i^X}{\sigma_i^X}$

[53] $\rho_i^M = \frac{1-\sigma_i^M}{\sigma_i^M}$

No.	Equation	Description
71	$RC_j = \frac{\sum_k RTI_{k,j} KD_{k,j}}{KDC_j}$	The price of an industry's composite capital is a weighted sum of the rental rates of the different types of capital used by that industry
72	$RTI_{k,j} = R_{k,j}(1 + ttik_{k,j})$	Rental rate by industry differ from rent received by capital by the amount of taxes
73	$R_{k,j} = RK_k$	The allocation of capital between industries is the result of the arbitrage process that makes the rental rate received by owners equal across industries
74	$PT_j = \frac{\sum_i P_{j,i} XS_{j,i}}{XST_j}$	The weight assigned to each market is proportional to the quantity sold on that market
75	$P_i = \frac{PE_i EX_{j,i} + PL_i DS_{j,i}}{XS_{j,i}}$	The basic price is a weighted sum of the price obtained on each market
76	$PE_i^{FOB} = (PE_i + \sum_{ij} PC_{ij} tmrg_{ij,i}^{X})(1 + ttix_i)$	The FOB price paid by purchasers on the export market is different from the one received by the producer, since margins and export taxes must be added on
77	$PD_i = (1 + ttic_i)(PL_i + \sum_{ij} PC_i tmrg_{ij,i})$	The price paid for the local product is the sum of the price received by the producer, margins, and indirect taxes
78	$PM_i = (1 + ttic_i)(1 + ttim_i)e\ PWM_i + \sum_{ij} PC_{ij} tmrg_{ij,i})$	The price paid for the imported product is the world price, translated into the local currency, plus taxes and duties on imports, margins, and domestic indirect taxes
79	$PC_i = \frac{PM_i IM_i + PD_i DD_i}{Q_i}$	The price of the composite is a weighted sum of the price paid for domestically produced, and imported goods
80	$PIXGDP = \sqrt{\frac{\sum_j PVA_j VA0_j}{\sum_j PVA0_j VA0_j} \frac{\sum_j PVA_j VA_j}{\sum_j PVA0_j VA_j}}$	Five price indexes have been defined: the GDP deflator
81	$PIXCON = \frac{\sum_i PC_i C_{i,h}^O}{\sum_{ij} PC_{ij}^O C_{ij,h}^O}$	The consumer price index
82	$PIXINV = \prod_i (\frac{PC_i}{PC_i^O})^{\gamma_i^{INV}}$	The investment price index
83	$PIXGVT = \prod_i (\frac{PC_i}{PC_i^O})^{\gamma_i^{GVT}}$	The public expenditures price index
Equilibrium		
84	$Q_i = \sum_h C_{i,h} + CG_i + INV_i + VSTK_i + DIT_i + MRGN_i$	Equation defines the equilibrium between the supply and demand of each commodity on the domestic market[54]
85	$\sum_j LD_{l,j} = LS_l$	Equation ensure the equilibrium between total demand for each factor and available supply
86	$\sum_j KD_{k,j} = KS_k$	Equation ensure the equilibrium between total demand for each factor and available supply
87	$IT = \sum_h SH_h + \sum_f SF_f + SG_z + SROW$	Total investment expenditure must be equal to the sum of agents' savings
88	$\sum_j DS_{j,i} = DD_i$	The sum of supplies of every commodity by local producers must be equal to domestic demand for that commodity produced locally
89	$\sum_j EX_{j,i} = EXD_i$	Supply to the export market of each good must be matched by demand

[54] Walras' Law applies to each region, one of the supply-demand equilibrium conditions is redundant for each region

No.	Equation	Description
Gross domestic product		
90	$GDP^{BP} = \sum_{j} PVA_j VA_j + TIPT$	GDP at basic prices is equal to payments made to factors, plus taxes on production other than taxes on labor or capital already included in factor costs
91	$GDP^{MP} = GDP^{BP} + TPRCTS$	GDP at market prices exceeds GDP at basic prices by exactly the amount of taxes on products and imports
92	$GDP^{IB} = \sum_{l,j} W_l LD_{l,j} + \sum_{k,j} R_{k,j} KD_{k,j} + TPRODN + TPRCTS$	GDP at market prices from the income perspective is equal to the sum total of income paid to labor and to capital, plus taxes on products and imports plus other taxes on production
93	$GDP_z^{FD} = \sum_{i} PC_i \left[\sum_{h} C_{i,h} + CG_i + INV_i + VSTK_i\right] + \sum_{ij} PE_i^{FOB} EXD_i - e \sum_{ij} PWM_i IM_i$	GDP at market prices from the final demand perspective is the sum of net final expenditures: household consumption, current public expenditures on goods and services, investment expenditures, plus the value of exports, minus the value of imports
Labor movement		
94	$\frac{LD_{l,agr}}{LS_l} WTI_{l,agr,t} = \sum_{nagr} \frac{LD_{l,agr}}{LS_l} WTI_{l,nagr} - \frac{SWCOST_l}{PIXCON}$	Labor moves from agricultural to non-agricultural sectors depending on probability to find a job and wage of non-agricultural sector minus switching cost

A2. Sets

No.	Equation	Description
	Industries and commodities	
1	j, jj ∈ J = {sec1, …, sec40}	All industries
2	bus ∈ BUS = {sec2, …, sec31,sec33,…,sec40} ⊂ J	Private sector industries
3	pub ∈ BUS = {sec32} ⊂ J	Public sector industries
4	i, ij ∈ I = {com1,…,com40}	All commodities
5	i1 ∈ I1 = {com2,…,com40} ⊂ I	All commodities except agriculture
	Factors of production	
6	f ∈ F = {lab, cap}	Labor categories
7	l ∈ L = {lab,} ⊂ F	Labor categories
8	k ∈ K = {cap } ⊂ F	Capital categories
	Agents	
9	ag ∈ AG = {HH,firm,gvt,row}	Agents: household, firm, government, and rest-of-the-world
10	agd ∈ AGD = {HH,firm,gvt} ⊂ AG	Domestic agents
11	agng ∈ AGNG = { HH,firm,row } ⊂ AG	All regions except reference region
9	hh ∈ HH = {HH } ⊂ AG	Household
10	f ∈ F = {firm } ⊂ AG	Firm
11	gvt ∈ GVT = {gvt } ⊂ AG	Government
12	row ∈ ROW = {row} ⊂ AG	Rest-of-the-world

A3. Variables

No.	Variable	Description
		Volume variables
1	$C_{i,h}$	Consumption of commodity i by type h households
2	$C_{i,h}^{MIN}$	Minimum consumption of commodity i by type h households
3	CG_i	Public consumption of commodity i
4	CI_j	Total intermediate consumption of industry j
5	DD_i	Domestic demand for commodity i produced locally
6	$DI_{i,j}$	Intermediate consumption of commodity i by industry j
7	DIT_i	Total intermediate consumption for commodity i
8	DS_i	Supply of commodity i by sector j to the domestic market
9	$EX_{j,i}$	Quantity of product i exported by sector j
10	EXD_i	World demand for exports of product i
11	IM_i	Quantity of product i imported
12	INV_i	Final demand of commodity i for investment purposes
13	$KD_{k,j}$	Demand for type k capital by industry j
14	KDC_j	Industry j demand for composite capital
15	KS_k	Supply of type k capital
16	$LD_{l,j}$	Demand for type l labor by industry j
17	LDC_j	Demand for composite labor by industry j in region z in period t
18	LS_l	Supply of type l labor
19	$MRGN_i$	Domestic production of commodity i as a trade or transport margin

No.	Variable	Description
20	Q_i	Quantity demanded of composite commodity i
21	VA_j	Value added of industry j
22	$VSTK_i$	Inventory change of commodity i
23	$XS_{j,i}$	Industry j production of commodity i
24	XST_j	Total aggregate output of industry j
Price variables		
25	e	Exchange rate; price of foreign currency in terms of local currency
26	$P_{j,i}$	Basic price of industry j's production of commodity i
27	PC_i	Purchaser price of composite commodity i (including all taxes and margins)
28	PCI_j	Intermediate consumption price index of industry j
29	PD_i	Price of local product i sold on the domestic market (including all taxes and margins)
30	PE_i	Price received for export commodity I (excluding export taxes)
31	PE_i^{FOB}	FOB price of exported commodity I (in local currency)
32	PIXCON	Consumer price index
33	PIXGDP	GDP deflator
34	PIXGVT	Public expenditure price index
35	PIXINV	Investment price index
36	PL_i	Price of local product i (excluding all taxes on products)
37	PM_i	Price of imported product i (including all taxes and tariffs)
38	PP_j	Industry j unit cost, including taxes directly related to the use of capital and labor but excluding other taxes on production
39	PT_j	Basic price of industry j's output

No.	Variable	Description
40	PVA_j	Price of industry j value added (including taxes on production directly related to the use of capital and labor)
41	PWM_i	World price of imported product i (expressed in foreign currency)
42	PWX_i	World price of exported product i (expressed in foreign currency)
43	$R_{k,j}$	Rental rate paid for type k capital in industry j
44	RC_j	Rental rate of industry j composite capital
45	RK_k	Rental rate of type k capital (if capital is mobile)
46	$RTI_{k,j}$	Rental rate paid by industry j for type k capital, including capital taxes
47	$SWCOST_l$	Switching cost of type l labor
48	W_l	Wage rate of type l labor
49	WC_j	Wage rate of industry j composite labor
50	$WTI_{l,j}$	Wage rate paid by industry j for type l labor, including payroll taxes
Nominal (value) variables		
51	CAB	Current account balance
52	CTH_h	Consumption budget of type h households
53	G	Current government expenditures on goods and services
54	GDP^{BP}	GDP at basic prices
55	GDP^{FD}	GDP at purchasers' prices from the perspective of final demand
56	GDP^{IB}	GDP at market prices (income-based)
57	GDP^{MP}	GDP at market prices
58	$GFCF$	Gross fixed capital formation
59	IT	Total investment expenditures

No.	Variable	Description
60	SF_f	Savings of type f businesses
61	SG	Government savings
62	SH_h	Savings of type h households
63	SROW	Rest-of-the-world savings
64	TDF_f	Income taxes of type f businesses
65	TDFT	Total government revenue from business income taxes
66	TDH_h	Income taxes of type h households
67	TDHT	Total government revenue from household income taxes
68	TIC_i	Government revenue from indirect taxes on product i
69	TICT	Total government receipts of indirect taxes on commodities
70	$TIK_{k,j}$	Government revenue from taxes on type k capital used by industry j
71	TIKT	Total government revenue from taxes on the use of capital
72	TIM_i	Government revenue from import duties on product i
73	TIMT	Total government revenue from import duties
74	TIP_j	Government revenue from taxes on industry j production (excluding taxes directly related to the use of capital and labor)
75	TIPT	Total government revenue from production taxes (excluding taxes directly related to the use of capital and labor)
76	$TIW_{l,j}$	Government revenue from payroll taxes on type l labor in industry j
77	TIWT	Total government revenue from payroll taxes
78	TIX_i	Government revenues from export taxes on product i
79	TIXT	Total government revenue from export taxes

No.	Variable	Description
80	TPRCTS	Total government revenue from taxes on products and imports
81	TPRODN	Total government revenue from taxes on production
82	$TR_{ag,agj}$	Transfer from agent agj to agent ag
83	YDF_f	Disposable income of type f businesses
84	YDH_h	Disposable income of type h households
85	YF_f	Total income of type f businesses
86	YFK_f	Capital income of type f businesses
87	$YFTR_f$	Transfer income of type f businesses
88	YG	Total government income
89	YGK	Government capital income
90	YGTR	Government transfer income
91	YH_h	Total income of type h households
92	YHK_h	Capital income of type h households
93	YHL_h	Labor income of type h households
94	$YHTR_h$	Transfer income of type h households
95	YROW	Rest-of-the-world income
Rate and intercepts		
96	$sh0_h$	Intercept (type h household savings)
97	$sh1_h$	Slope (type h household savings)
98	$tr0_h$	Intercept (transfer by type h households to government)
99	$tr1_h$	Marginal rate of transfer by type h households to government

No.	Variable	Description
100	$ttdf0_f$	Intercept (income taxes type f businesses)
101	$ttdf1_f$	Marginal rate of transfer of type f businesses
102	$ttdh0_h$	Intercept (income taxes type h households)
103	$ttdh1_h$	Marginal household income tax rate of type h households
104	$ttic_i$	Tax rate on commodity i
105	$ttik_{k,j}$	Tax rate on type k capital used in industry j
106	$ttim_i$	Rate of taxes and duties on imports of commodity i
107	$ttip_j$	Tax rate on the production of industry j
108	$ttiw_{l,j}$	Tax rate on type l labor compensation in industry j
109	$ttix_i$	Export tax rate on exported commodity i
		Parameters
110	$aij_{i,j}$	Input-output coefficient
111	B_j^{KD}	Scale parameter (CES – composite capital)
112	B_j^{LD}	Scale parameter (CES – composite labor)
113	B_i^{M}	Scale parameter (CES – composite commodity)
114	B_j^{VA}	Scale parameter (CES – value added)
115	$B_{j,i}^{X}$	Scale parameter (CET – export and local sales)
116	B_j^{XT}	Scale parameter (CET – total output)
117	$\beta_{k,j}^{KD}$	Share parameter (CET – composite capital)
118	$\beta_{l,j}^{LD}$	Share parameter (CET – composite labor)
119	β_i^{M}	Share parameter (CES – composite commodity)

No.	Variable	Description
120	β_j^{VA}	Share parameter (CES – value added)
121	$\beta_{j,i}^{X}$	Share parameter (CET – export and local sales)
122	$\beta_{j,i}^{XT}$	Share parameter (CET – total output)
123	η	Price-elasticity of indexed transfers and parameters
124	γ_i^{GVT}	Share of commodity i in total current public expenditures on goods and services
125	γ_i^{INV}	Share of commodity i in total investment expenditures
126	$\gamma_{i,h}^{LES}$	Marginal share of commodity i type h household consumption budget
127	io_j	Coefficient (Leontief – intermediate consumption)
128	$\lambda_{ag,k}^{RK}$	Share of type k capital income received by agent ag
129	$\lambda_{ag,agj}^{TR}$	Share parameter (transfer function)
130	$\lambda_{h,l}^{WL}$	Share of type l labor income received by type h households
131	ρ_j^{KD}	Elasticity parameter (CES – composite capital); $-1 < \rho_j^{KD} < \infty$
132	ρ_j^{LD}	Elasticity parameter (CES – composite labor); $-1 < \rho_j^{KLD} < \infty$
133	ρ_i^{M}	Elasticity parameter (CES – composite commodity); $-1 < \rho_i^{M} < \infty$
134	ρ_j^{VA}	Elasticity parameter (CES – value added); $-1 < \rho_j^{VA} < \infty$
135	$\rho_{j,i}^{X}$	Elasticity parameter (CES – exports and local sales); $-1 < \rho_i^{X} < \infty$
136	ρ_j^{XT}	Elasticity parameter (CES – total output); $-1 < \rho_i^{XT} < \infty$
137	σ_j^{KD}	Elasticity of substitution (CES – composite capital); $0 < \sigma_j^{KD} < \infty$
138	σ_j^{LD}	Elasticity of substitution (CES – composite labor); $0 < \sigma_j^{LD} < \infty$
139	σ_i^{M}	Elasticity of substitution (CES – composite commodity); $0 < \sigma_i^{M} < \infty$

No.	Variable	Description
140	σ_j^{VA}	Elasticity of substitution (CES – value added); $0 < \sigma_j^{VA} < \infty$
141	$\sigma_{j,i}^{X}$	Elasticity of transformation (CET – exports and local sales); $0 < \sigma_i^{X} < \infty$
142	σ_i^{XD}	Price elasticity of the world demand for exports of product i
143	σ_j^{XT}	Elasticity of transformation (CET – total output); $0 < \sigma_i^{XT} < \infty$
144	$tmrg_{i,ij}$	Rate of margin I applied to commodity ij
143	$tmrg_{i,ij}^{X}$	Rate of margin I applied to export commodity ij
145	v_j	Coefficient (Leontief – value added)

Appendix B[55]: Dynamic multi-countries CGE model

B1. Equations

No.	Equation	Description
	Production equations	
1	$VA_{j,z,t} = v_{j,z} XS_{j,z,t}$	Value added for output (perfectly complementary)
2	$CI_{j,z,t} = io_{j,z} XS_{j,z,t}$	Total intermediate consumption (perfectly complementary)
3	$VA_{j,z,t} = A_{z,t}^{VA} B_{j,z}^{VA} [(\beta_{j,z}^{VA} LDC_{j,z,t}^{-\rho_{j,z}^{VA}} + (1-\beta_{j,z}^{VA}) KDC_{j,z,t}^{-\rho_{j,z}^{VA}}]^{-\frac{1}{\rho_{j,z}^{VA}}}$	Value added for factors of production [56]
4	$LDC_{j,z,t} = [\frac{\beta_{j,z}^{VA}}{(1-\beta_{j,z}^{VA})} \frac{RC_{j,t}}{WC_{j,z,t}}]^{\sigma_{j,z}^{VA}} KDC_{j,z,t}$	Demand for labor relative to capital
5	$LDC_{j,z,t} = B_{j,z}^{LD} [\sum_l \beta_{l,j,z}^{LD} LD_{l,j,z,t}^{-\rho_{j,z}^{LD}}]^{-\frac{1}{\rho_{j,z}^{LD}}}$	Imperfect substitutability between different types of labor [57]
6	$LD_{l,j,z,t} = [\frac{\beta_{l,j,z}^{LD} WC_{j,z,t}}{WTI_{l,j,z,t}}]^{\sigma_{j,z}^{LD}} (B_{j,z}^{LD})^{\sigma_{j,z}^{LD}-1} LDC_{j,z,t}$	Labor demand with cost minimization
7	$KDC_{j,z,t} = B_{j,z}^{KD} [\sum_k \beta_{k,j,z}^{KD} KD_{k,j,z,t}^{-\rho_{j,z}^{KD}}]^{-\frac{1}{\rho_{j,z}^{KD}}}$	Imperfect substitutability between different types of capital [58]
8	$KD_{k,j,z,t} = [\frac{\beta_{k,j,z}^{KD} RC_{j,z,t}}{RTI_{k,j,z,t}}]^{\sigma_{j,z}^{KD}} (B_{j,z}^{KD})^{\sigma_{j,z}^{KD}-1} KDC_{j,z,t}$	Capital demand with cost minimization
9	$DI_{i,j,z,t} = aij_{i,j,z} CI_{j,z,t}$	Intermediate demand (perfectly complementary)
	Income and savings equations	
10	$YH_{z,t} = YHL_{z,t} + YHK_{z,t}$	Total household income
11	$YHL_{z,t} = \sum_l W_{l,z,t} \sum_j LD_{l,j,z,t}$	Household labor income
12	$YHK_{z,t} = \sum_j R_{k,j,z,t} KD_{k,j,z,t}$	Household capital income
13	$YDH_{z,t} = YH_{z,t} - TDH_{z,t}$	Household disposable income
14	$CTH_{z,t} = YDH_{z,t} - SH_{z,t}$	Household consumption
15	$SH_{z,t} = PIXCON_{z,t}^{\eta} sh0_{z,t} + sh1_{z,t} YDH_{z,t}$	Household savings

[55] These equations construct the model of dynamic multi-countries CGE in chapter 4 and chapter 5. Most equations are based on Robichaud *et al.* (2013)

[56] $\rho_j^{VA} = \frac{1-\sigma_j^{VA}}{\sigma_j^{VA}}$

[57] $\rho_j^{LD} = \frac{1-\sigma_j^{LD}}{\sigma_j^{LD}}$

[58] $\rho_j^{KD} = \frac{1-\sigma_j^{KD}}{\sigma_j^{KD}}$

No.	Equation	Description
16	$YG_{z,t} = TDH_{z,t} + TPRODN_{z,t} + TPRCTS_{z,t}$	Government income from a variety of taxes
17	$TPRODN_{z,t} = TIWT_{z,t} + TIKT_{z,t} + TIPT_{z,t}$	Other taxes on production
18	$TIWT_{z,t} = \sum_{l,j} TIW_{l,j,z,t}$	Total payroll taxes
19	$TIKT_{z,t} = \sum_{k,j} TIK_{k,j,z,t}$	Total taxes on capital
20	$TIPT_{z,t} = \sum_{j} TIP_{j,z,t}$	Total taxes on production
21	$TPRCTS_{z,t} = TICT_{z,t} + TIMT_{z,t} + TIXT_{z,t}$	Total taxes on products and on imports
22	$TICT_{z,t} = \sum_{i} TIC_{i,z,t}$	Total government receipts of indirect taxes on commodities
23	$TIMT_{z,t} = \sum_{i,zj} TIM_{i,zj,z,t}$	Total government revenue from import duties
24	$TIXT_{z,t} = \sum_{i,zj} TIX_{i,z,zj,t}$	Total government revenue from export taxes
25	$TDH_{z,t} = PIXCON_{z,t}^{\eta} ttdh0_{z,t} + ttdh1_{z,t} YH_{z,t}$	Income taxes paid by households are described as a linear function of total income
26	$TIW_{l,j,z,t} = ttiw_{l,j,z,t} W_{l,z,t} LD_{l,j,z,t}$	Taxes on labor distinguishes tax rates by industry
27	$TIK_{k,j,z,t} = ttik_{k,j,z,t} R_{k,j,z,t} KD_{k,j,z,t}$	Taxes on capital distinguishes tax rates by industry
28	$TIP_{j,z,t} = ttip_{j,z,t} PP_{j,z,t} XS_{j,z,t}$	Taxes apply on the total value of production
29	$TIC_{i,z,t} = ttic_{i,z,t}\{PL_{i,z,t} DD_{i,z,t} + \sum_{zj}[(1 + ttim_{i,zj,z,t})(PWM_{i,zj,z,t} + \sum_{ij} PWMG_{ij,t}\, tmrg_{ij,i,zj,z}) e_{z,t} IM_{i,zj,z,t}]\}$	Government receipts of indirect taxes on commodities of imported and non-imported products at local price
30	$TIM_{i,zj,z,t} = ttim_{i,zj,z,t}(PWM_{i,zj,z,t} + \sum_{ij} PWMG_{ij,t}\, tmrg_{ij,i,zj,z}) e_{z,t} IM_{i,zj,z,t}$	Government revenues from duties levied on imports of commodity at world price
31	$TIX_{i,z,zj,t} = ttix_{i,z,zj,t} PE_{i,z,zj,t} EX_{i,z,zj,t}$	Government revenues from export taxes
32	$SG_{z,t} = YG_{z,t} - G_{z,t}$	The current government budget surplus or deficit (positive or negative savings) is the difference between its revenue and its current expenditures on goods and services
33	$YROW_{z,t} = e_{z,t}\{\sum_{i,zj} IM_{i,zj,z,t}[PWM_{i,zj,z,t} + \sum_{ij} PWMG_{ij,t}\, tmrg_{ij,i,zj,z}]\}$	The rest of the world receives payments for the value of the region's imports, including international transport margins
34	$SROW_{z,t} = YROW_{z,t} - e_{z,t} \sum_{i,zj} PWX_{i,z,zj,t} EX_{i,z,zj,t} - e_{z,t} \sum_{i} PWMG_{i,t} MRGN_{i,z,t}$	The difference between foreign receipts and spending is the amount of rest-of-the-world savings
35	$SROW_{z,t} = -CAB_{z,t}$	Rest-of-the-world savings are equal in absolute value to the current account balance, but of opposite sign

No.	Equation	Description
	Domestic demand	
36	$PC_{i,z,t}C_{i,z,t} = PC_{i,z,t}C_{i,z,t}^{MIN} + \gamma_{i,z}^{LES}(CTH_{z,t} - \sum_{ij} PC_{ij,z,t}C_{ij,z,t}^{MIN})$	Household demand for each good is determined by utility maximization subject to the budget constraint
37	$PC_{i,z,t}INV_{i,z,t} = \gamma_{i,z}^{INV}IT_{z,t}$	Gross fixed capital formation expenditure is distributed among commodities in fixed shares
38	$PC_{i,z,t}CG_{i,z,t} = \gamma_{i,z}^{GVT}G_{z,t}$	Government current expenditures on goods and services are distributed among commodities in fixed shares
39	$DIT_{i,z,t} = \sum_{j} DI_{i,j,z,t}$	Intermediate demand for each commodity is the sum of industry demands
	Producer supplies of products and international trade	
40	$XS_{i,z,t} = B_{i,z}^{X1}[\beta_{i,z}^{EX\_X1}EXT_{i,z,t}^{\rho_{i,z}^{X1}} + \beta_{i,z}^{D\_X1}DS_{i,z,t}^{\rho_{i,z}^{X1}} + (1 - \beta_{i,z}^{EX\_X1} - \beta_{i,z}^{D\_X1})MRGN_{i,z,t}^{\rho_{i,z}^{X1}}]^{\frac{1}{\rho_{i,z}^{X1}}}$	The product outlets considered are exports, supply to the domestic market, and supply of international transport margin services [59]
41	$EXT_{i,z,t} = [\frac{\beta_{i,z}^{D\_X1}}{\beta_{i,z}^{EX\_X1}}\frac{PET_{i,z,t}}{PL_{i,z,t}}]^{\sigma_{i,z}^{X1}}DS_{i,z,t}$	Relative supply functions are derived from the first-order conditions of revenue maximizing subject to the CET aggregator function (equation 40)
42	$MRGN_{i,z,t} = [\frac{\beta_{i,z}^{D\_X1}}{(1 - \beta_{i,z}^{EX\_X1} - \beta_{i,z}^{D\_X1})}\frac{e_{z,t}PWMG_{i,t}}{PL_{i,z,t}}]^{\sigma_{i,z}^{X1}}DS_{i,z,t}$	Relative supply functions are derived from the first-order conditions of revenue maximizing subject to the CET aggregator function (equation 40)
43	$EXT_{i,z,t} = B_{i,z}^{X2}[\sum_{zj} \beta_{i,z,zj}^{X2}EX_{i,z,zj,t}^{\rho_{i,z}^{X2}}]^{\frac{1}{\rho_{i,z}^{X2}}}$	Exports of every commodity are shared out among destination regions [60]
44	$EX_{i,z,zj,t} = \frac{EXT_{i,z,t}}{(B_{i,z}^{X2})^{1+\sigma_{i,z}^{X2}}}[\frac{PE_{i,z,zj,t}}{\beta_{i,z,zj}^{X2}PET_{i,z,t}}]^{\sigma_{i,z}^{X2}}$	Demand functions of exports to individual regions are derived from the first-order conditions of maximizing the firm's total revenue (equation 43)
45	$Q_{i,z,t} = B_{i,z}^{M1}[\beta_{i,z}^{M1}IMT_{i,z,t}^{-\rho_{i,z}^{M1}} + (1 - \beta_{i,z}^{M1})DD_{i,z,t}^{-\rho_{i,z}^{M1}}]^{\frac{-1}{\rho_{i,z}^{M1}}}$	Commodities demanded on the domestic market are composite goods, combinations of locally produced goods and composite imports
46	$IMT_{i,z,t} = [\frac{\beta_{i,z}^{M1}}{1 - \beta_{i,z}^{M1}}\frac{PD_{i,z,t}}{PMT_{i,z,t}}]^{\sigma_{i,z}^{X1}}DD_{i,z,t}$	Buyers minimize expenses, subject to the CES aggregation function (equation 45)
47	$IMT_{i,z,t} = B_{i,z}^{M2}[\sum_{zj} \beta_{i,zj,z}^{M2}IM_{i,zj,z,t}^{\rho_{i,z}^{M2}}]^{\frac{1}{\rho_{i,z}^{M2}}}$	Composite imports are a combination of imports from different regions
48	$IM_{i,zj,z,t} = \frac{IMT_{i,z,t}}{(B_{i,z}^{M2})^{1-\sigma_{i,z}^{M2}}}[\frac{\beta_{i,zj,z}^{M2}PMT_{i,z,t}}{PM_{i,zj,z,t}}]^{\sigma_{i,z}^{M2}}$	Demand functions of imports from individual regions are derived from the first-order conditions of expenditure minimizing subject to the CES aggregator function (equation 47)
	Prices	
49	$PP_{j,z,t} = \frac{PVA_{j,z,t}VA_{j,z,t} + PCI_{j,z,t}CI_{j,z,t}}{XS_{j,z,t}}$	The unit cost of an industry's output is a weighted sum of the prices of value added and aggregate intermediate consumption

[59] $\rho_{i,z}^{X1} = \frac{1-\sigma_{i,z}^{X1}}{\sigma_{i,z}^{X1}}$

[60] $\rho_{i,z}^{X2} = \frac{1-\sigma_{i,z}^{X2}}{\sigma_{i,z}^{X2}}$

No.	Equation	Description
50	$P_{j,z,t} = (1 + ttip_{j,z,t})PP_{j,z,t}$	The basic price of production is obtained from the unit cost by adding taxes on production
51	$PCI_{j,z,t} = \frac{\sum_i PC_{i,z,t}DI_{i,j,z,t}}{CI_{j,z,t}}$	The price of aggregate intermediate consumption is a combination of the commodity prices of the industry's intermediate inputs
52	$PVA_{j,z,t} = \frac{WC_{j,z,t}LDC_{j,z,t} + RC_{j,z,t}KDC_{j,z,t}}{VA_{j,z,t}}$	The price of value added is a combination of the prices of composite labor and composite capital
53	$WC_{j,z,t} = \frac{\sum_l WTI_{l,j,z,t}LD_{i,j,z,t}}{LDC_{j,z,t}}$	The price of an industry's composite labor is a weighted sum of the wage rates (including payroll taxes) of the different categories of labor used by that industry
54	$WTI_{l,j,z,t} = W_{l,z,t}(1 + ttiw_{l,j,z,t})$	Wages paid by industry differ from wages received by labors by the amount of payroll taxes
55	$RC_{j,z,t} = \frac{\sum_k RTI_{k,j,z,t}KD_{k,j,z,t}}{KDC_{j,z,t}}$	The price of an industry's composite capital is a weighted sum of the rental rates of the different types of capital used by that industry
56	$RTI_{k,j,z,t} = R_{k,j,z,t}(1 + ttik_{k,j,z,t})$	Rental rate by industry differ from rent received by capital by the amount of taxes
57	$P_{i,z,t} = \frac{PET_{i,z,t}EXT_{i,z,t} + PL_{i,z,t}DS_{i,z,t} + e_{z,t}PWMG_{i,t}MRGN_{i,z,t}}{XS_{i,z,t}}$	The basic price is a weighted sum of the price obtained on each market
58	$PET_{i,z,t} = \frac{\sum_{zj} PE_{i,z,zj,t}EX_{i,z,zj,t}}{EXT_{i,z,t}}$	The price obtained on export markets is a weighted sum of prices obtained from exports to the different other regions
59	$PE_{i,z,zj,t}(1 + ttix_{i,z,zj,t}) = e_{z,t}PWX_{i,z,zj,t}$	The world price of a commodity exported is equal to the exported price, plus export taxes
60	$PD_{i,z,t} = (1 + ttic_{i,z,t})PL_{i,z,t}$	The price paid for the local product is the sum of the price received by the producer and indirect taxes
61	$PM_{i,zj,z,t} = (1 + ttic_{i,z,t})(1 + ttim_{i,zj,z,t})e_{z,t}(PWM_{i,zj,z,t} + \sum_{ij} PWMG_{i,t}tmrg_{ij,i,zj,z})$	The price of imports translates into region z's currency, plus taxes and duties on imports, margins, and domestic indirect taxes
62	$PMT_{i,z,t} = \frac{\sum_{zj} PM_{i,zj,z,t}IM_{i,zj,z,t}}{IMT_{i,z,t}}$	The price of composite imports is a weighted sum of prices of imports from different origins
63	$PC_{i,z,t} = \frac{PMT_{i,z,t}IMT_{i,z,t} + PD_{i,z,t}DD_{i,z,t}}{Q_{i,z,t}}$	The price of the composite is a weighted sum of the price paid for domestically produced, and imported goods
64	$PIXGDP_{z,t} = \sqrt{\frac{\sum_j (PVA_{j,z,t} + \frac{TIP_{j,z,t}}{VA_{j,z,t}})VA^O_{j,z}}{\sum_j PVA^O_{j,z}VA^O_{j,z} + TIP^O_{j,z}} \frac{\sum_j PVA_{j,z,t}VA_{j,z,t} + TIP_{j,z,t}}{\sum_j (PVA^O_{j,z} + \frac{TIP^O_{j,z}}{VA^O_{j,z}})VA_{j,z,t}}}$	Five price indexes have been defined: the GDP deflator
65	$PIXGDP^W_t = \sqrt{\frac{\sum_{j,z} (PVA_{j,z,t} + \frac{TIP_{j,z,t}}{VA_{j,z,t}}) \frac{VA^O_{j,z}}{e_{z,t}}}{\sum_{j,z} \frac{PVA^O_{j,z}VA^O_{j,z} + TIP^O_{j,z}}{e^O_z}} \frac{\sum_{j,z} \frac{PVA_{j,z,t}VA_{j,z,t} + TIP_{j,z,t}}{e_{z,t}}}{\sum_{j,z} (PVA^O_{j,z} + \frac{TIP^O_{j,z}}{VA^O_{j,z}}) \frac{VA_{j,z,t}}{e^O_z}}}$	The world GDP deflator
66	$PIXCON_{z,t} = \frac{\sum_i PC_{i,z,t}C^O_{ij,z}}{\sum_{ij} PC^O_{ij,z}C^O_{ij,z}}$	The consumer price index
67	$PIXINV_{z,t} = \prod_i (\frac{PC_{i,z,t}}{PC^O_{i,z}})^{\gamma^{INV}_{i,z}}$	The investment price index

No.	Equation	Description
68	$PIXGVT_{z,t} = \prod_i \left(\frac{PC_{i,z,t}}{PC^O_{i,z}}\right)^{\gamma_i^{GVT}}$	The public expenditures price index
	Equilibrium	
69	$Q_{i,z,t} = C_{i,z,t} + CG_{i,z,t} + INV_{i,z,t} + DIT_{i,z,t}$	The equilibrium between the supply and demand of each commodity on the domestic market [61]
70	$KS_{k,z,t} = \sum_j KD_{k,j,z,t}$	Sum over all industries j of the quantity of type k capital demanded in region z is equal to the quantity supplied
71	$IT_{z,t} = SH_{z,t} + SG_{z,t} - CAB_{z,t}$	Total investment expenditure must be equal to the sum of agents' savings minus capital balance
72	$DEP_{z,t} = PK_{z,t}\delta_z \sum_k KS_{k,z,t}$	The amount of depreciation is the sum of capital consumption allowances for all types of capital in all industries
73	$DS_{i,z} = DD_{i,z}$	The supply of every commodity by local producers must be equal to domestic demand for that commodity produced locally
74	$EX_{i,z,zj,t} = IM_{i,z,zj,t}$	In international trade, the quantity of each commodity exported from region z to region zj must be the same as the quantity imported from region z by region zj
75	$PWX_{i,z,zj,t} = PWM_{i,z,zj,t}$	The corresponding world market prices must be the same
76	$\sum_z MRGN_{i,z,t} = \sum_{z,zj,ij} tmrg_{i,ij,zj,z} IM_{ij,zj,z,t}$	The world supply of type i margin services must equal the sum of demands associated with all bilateral zj, z trade flows of all ij commodities
77	$\sum_z \frac{SROW_{z,t}}{e_{z,t}} = 0$	The worldwide sum of foreign savings expressed in the common international currency must be zero
	Gross domestic product	
78	$GDP^{BP}_{z,t} = \sum_j PVA_{j,z,t} VA_{j,z,t} + TIPT_{z,t}$	GDP at basic prices is equal to payments made to factors, plus taxes on production other than taxes on labor or capital already included in factor costs
79	$GDP^{MP}_{z,t} = GDP^{BP}_{z,t} + TPRCTS_{z,t}$	GDP at market prices exceeds GDP at basic prices by exactly the amount of taxes on products and imports
80	$GDP^{IB}_{z,t} = \sum_{l,j} W_{l,z,t} LD_{l,j,z,t} + \sum_{k,j} R_{k,j,z,t} KD_{k,j,z,t} + TPRCTS_{z,t} + TPRODN_{z,t}$	GDP at market prices from the income perspective is equal to the sum total of income paid to labor and to capital, plus taxes on products and imports plus other taxes on production
81	$GDP^{FD}_{z,t} = \sum_i PC_{i,z,t}(C_{i,z,t} + CG_{i,z,t} + INV_{i,z,t}) + \sum_{i,zj} e_{z,t} PWX_{i,z,zj,t} EX_{i,z,zj,t} + \sum_i e_{z,t} PWMG_{i,t} MRGN_{i,z,t} - \sum_{i,zj} e_{z,t} IM_{i,zj,z,t}(PWM_{i,zj,z,t} + \sum_{ij} PWMG_{ij,t} tmrg_{ij,i,zj,z})$	GDP at market prices from the final demand perspective is the sum of net final expenditures expenditures: household consumption, current public expenditures on goods and services, investment expenditures, plus the value of exports, including exports of services as margins, minus the value of imports, including margins

[61] Walras' Law applies to each region, one of the supply-demand equilibrium conditions is redundant for each region

No.	Equation	Description
82	$GDP_t^{BP\_W} = \sum_z \frac{GDP_{z,t}^{BP}}{e_{z,t}}$	The world GDP at basic prices is simply the sum of regional GDPs expressed in terms of the international currency
	Dynamic equations	
83	$KD_{k,j,z,t+1} = KD_{k,j,z,t}(1-\delta_z) + IND_{k,j,z,t}$	The capital accumulation rule
84	$IT_{z,t} = PK_{z,t} \sum_{k,j} IND_{k,j,z,t}$	The volume of new capital investment
85	$PK_{z,t} = \frac{1}{A_z^K} \prod_i [\frac{PC_{i,z,t}}{\gamma_{i,z}^{INV}}]^{\gamma_{i,z}^{INV}}$	The price of investment (the replacement cost of capital)
86	$IND_{k,bus,z,t} = \emptyset_{k,bus,z} [\frac{R_{k,bus,z,t}}{U_{z,t}}]^{\sigma_{k,bus,z}^{INV}} KD_{k,bus,z,t}$	Investment demand is proportional to the existing stock of capital; and the proportion varies according to the ratio of the rental rate, including taxes, to the user cost of that capital
87	$U_{z,t} = PK_{z,t}(\delta_z + IR_{z,t})$	The user cost of capital depends on the price of new capital, the rate of depreciation, and the rate of interest
	Real variables computed from price indices	
88	$CABX_{z,t} = \frac{CAB_{z,t}}{e_{z,t} PIXGDP_t^W}$	Current account balance is computed in terms of the international currency
89	$CTH_{z,t}^{REAL} = \frac{CTH_{z,t}}{PIXCON_{z,t}}$	Real household consumption
90	$G_{z,t}^{REAL} = \frac{G_{z,t}}{PIXGVT_{z,t}}$	Real government expenditures
91	$GDP_{z,t}^{BP\_REAL} = \frac{GDP_{z,t}^{BP}}{PIXGDP_{z,t}}$	Real GDP at basic prices
92	$GDP_t^{BP\_W\_REAL} = \frac{GDP_t^{BP\_W}}{PIXGDP_t^W}$	Real world GDP at basic prices
93	$GDP_{z,t}^{MP\_REAL} = \frac{GDP_{z,t}^{MP}}{PIXCON_{z,t}}$	Real GDP at market prices
94	$IT_{z,t}^{REAL} = \frac{IT_{z,t}}{PIXINV_{z,t}}$	Real gross fixed capital formation
	Migration[62]	
95	$LD_{l,j,z,t} = B_{l,j,z}^{LD1} [(\beta_{l,j,z}^{LD1} DL_{j,z,t}^{-\rho_{j,z}^{LD1}} + (1-\beta_{l,j,z}^{LD1}) ML_{l,j,z,t}^{-\rho_{j,z}^{LD1}}]^{-\frac{1}{-\rho_{j,z}^{LD1}}}$	Value added for factors of production[63]
96	$DL_{l,j,z,t} = [\frac{\beta_{l,j,z}^{LD1}}{(1-\beta_{l,j,z}^{LD1})} \frac{WML_{l,j,z,t}}{WDL_{l,j,z,t}}]^{\sigma_{j,z}^{LD1}} ML_{l,j,z,t}$	Demand for domestic labor relative to migrant labor
97	$ML_{l,j,z,t} = B_{l,j,z}^{LD2} [\sum_{zj} \beta_{l,jzj,,z}^{LD2} LIM_{l,j,zj,z,t}^{-\rho_{j,z}^{LD2}}]^{-\frac{1}{\rho_{j,z}^{LD2}}}$	Imperfect substitutability between different types of migrant labor[64]
98	$LIM_{l,j,zj,z,t} = [\frac{\beta_{l,j,z}^{LD2} WML_{l,j,z,t}}{WLIM_{l,j,zj,z,t}}]^{\sigma_{j,z}^{LD2}} (B_{l,j,z}^{LD2})^{\sigma_{j,z}^{LD2}-1} ML_{l,j,z,t}$	Migrant labor demand with cost minimization
99	$WTI_{l,j,z,t} LD_{l,j,z,t} = WDL_{l,j,z,t} DL_{l,j,z,t} + WML_{l,j,z,t} ML_{l,j,z,t}$	Wage rate paid by industry is a weighted sum of the price paid for domestically labor, and migrant labor
100	$LS_{l,z,t} = \sum_j DL_{l,j,z,t} + \sum_{l,j} LIM_{l,j,zj,z,t}$	Labor demand is equal to the sum of domestic and migrant labors

[62] Equations 95-98 are production equations, equation 99 is price equation, and equation 100 is equilibrium equation.

[63] $\rho_j^{LD1} = \frac{1-\sigma_j^{LD1}}{\sigma_j^{LD1}}$

[64] $\rho_j^{LD2} = \frac{1-\sigma_j^{LD2}}{\sigma_j^{LD2}}$

B2. Sets

No.	Equation	Description
	Industries and commodities	
1	j, jj ∈ J = {Grains&Crops, LiveStk&Meat, Mining&Extractn, Procfood, Textiles&Clothing, Lightmnfc, Heavymnfc, Util&Constuct, Othservices}	All industries
2	bus ∈ BUS = {Grains&Crops, LiveStk&Meat, Mining&Extractn, Procfood, Textiles&Clothing, Lightmnfc, Heavymnfc, Util&Constuct} ⊂ J	Private sector industries
3	pub ∈ BUS = {Othservices} ⊂ J	Public sector industries
4	i, ij ∈ I = {Grains&Crops, LiveStk&Meat, Mining&Extractn, procfood, Textiles&Clothing, Lightmnfc, Heavymnfc, Util&Constuct, Othservices}	All commodities
5	i1 ∈ I1 = {LiveStk&Meat, Mining&Extractn, Procfood, Textiles&Clothing, Lightmnfc, Heavymnfc, Util&Constuct, Othservices} ⊂ I	All commodities except agriculture
	Factors of production	
6	f ∈ F = {ulab, slab, cap, land, natr}	Labor categories
7	l ∈ L = {ulab, slab} ⊂ F	Labor categories
8	k ∈ K = {cap, land, natr} ⊂ F	Capital categories
	Regions	
9	z, zj ∈ Z = {tha, mal, idn, lao, phi, vie, sin, cam, ROASEAN, ROW}	All regions
10	zr ∈ ZR = {ROW} ⊂ Z	Reference region
11	z1 ∈ Z1 = {tha, mal, idn, lao, phi, vie, sin, cam, ROASEAN} ⊂ Z	All regions except reference region
	Periods	
12	t ∈ T = {T_1,…, T_t}	Reference region

B3. Variables

No.	Variable	Description
Volume variables		
1	$C_{i,z,t}$	Consumption of commodity i by households in region z in period t
2	$C_{i,z,t}^{MIN}$	Minimum consumption of commodity i by households in region z in period t
3	$CABX_{z,t}$	Current account balance of region z in terms of the international currency in period t
4	$CG_{i,z,t}$	Public consumption of commodity i in region z (volume) in period t
5	$CI_{j,z,t}$	Total intermediate consumption by industry j in region z in period t
6	$CTH_{z,t}^{REAL}$	Real household consumption in region z in period t
7	$DD_{i,z,t}$	Domestic demand for commodity i produced locally in region z in period t
8	$DI_{i,j,z,t}$	Intermediate consumption of commodity i by industry j in region z in period t
9	$DIT_{i,z,t}$	Total intermediate consumption of commodity i in region z in period t
10	$DL_{l,j,z,t}$	Domestic labor type l of industry j in country z
11	$DS_{i,z,t}$	Supply of commodity i produced locally to the domestic market in region z in period t
12	$EX_{i,z,zj,t}$	Quantity of product i exported from region z to region zj in period t
13	$EXT_{i,z,t}$	Supply of composite commodity i by region z to the export market in period t
14	$G_{z,t}^{REAL}$	Real government expenditures in region z in period t
15	$GDP_{z,t}^{BP\_REAL}$	Real GDP at basic prices in region z in period t
16	$GDP_{z,t}^{BP\_W\_REAL}$	Real world GDP at basic prices in period t
17	$GDP_{z,t}^{MP\_REAL}$	Real GDP at market prices in region z in period t
18	$IM_{i,zj,z,t}$	Quantity of product i imported from region zj by region z in period t
19	$IMT_{i,z,t}$	Quantity demanded of imports of composite commodity i by region z from all other regions in period t

No.	Variable	Description
20	$IND_{k,j,z,t}$	Volume of new type k capital investment to industry j in region z in period t
21	$INV_{i,z,t}$	Final demand of commodity i in region z for investment purposes in period t
22	$IT_{z,t}^{REAL}$	Real gross fixed capital formation in region z in period t
23	$KD_{k,j,z,t}$	Demand for type k capital by industry j in region z in period t
25	$KDC_{k,z,t}$	Demand for composite capital by industry j in region z in period t
26	$KS_{k,z,t}$	Supply of type k capital in region z in period t
27	$LD_{l,j,z,t}$	Demand for type l labor by industry j in region z in period t
28	$LDC_{l,z,t}$	Demand for composite labor by industry j in region z in period t
29	$LIM_{l,j,zj,z,t}$	imported labor type l of industry j from region zj in country z
30	$LS_{l,z,t}$	Supply of type l labor in region z in period t
31	$ML_{l,j,z,t}$	Imported labor type l of industry j in region z
32	$MRGN_{i,z,t}$	Domestic production of commodity i in region z exported as international margin services in period t
33	$Q_{i,z,t}$	Quantity demanded of composite commodity i in region z in period t
34	$VA_{j,z,t}$	Value added of industry j in region z in period t
35	$XS_{j,z,t}$	Total output of industry j in region z in period t
Price variables		
36	$e_{z,t}$	Exchange rate; price of international currency in terms of region z's local currency in period t
37	$IR_{z,t}$	Interest rate in region z in period t
38	$P_{j,z,t}$	Basic price of industry j production in region z in period t
39	$PC_{j,z,t}$	Purchaser price of composite commodity i (including all taxes and margins), in region z in period t
40	$PCI_{j,z,t}$	Price index of intermediate consumption by industry j in region z in period t

No.	Variable	Description
41	$PD_{i,z,t}$	Price of local product i sold on region z's domestic market (including all taxes) in period t
42	$PE_{i,z,zj,t}$	Price received for commodity i exported by region z to region zj (excluding export taxes) in period t
43	$PET_{i,z,t}$	Border price of composite commodity i exported by region z to all other regions in period t
44	$PIXCON_{z,t}$	Consumer price index in region z in period t
45	$PIXGDP_{z,t}$	GDP deflator for region z in period t
46	$PIXGDP_{t}^{W}$	World GDP deflator in period t
47	$PIXGVT_{z,t}$	Public expenditure price index in region z in period t
48	$PIXINV_{z,t}$	Investment price index in region z in period t
49	$PK_{z,t}$	Price of new private capital in region z in period t
50	$PL_{i,z,t}$	Price of local product i in region z (excluding all taxes on products) in period t
51	$PM_{i,zj,z,t}$	Price of commodity i imported from region zj by region z (including margins and all taxes and duties) in period t
52	$PMT_{i,z,t}$	Price of composite commodity i imported by region z (including all taxes, duties and margins) in period t
53	$PP_{j,z,t}$	Unit cost of industry j in region z including taxes directly related to the use of capital and labor but excluding other taxes on production in period t
54	$PVA_{j,z,t}$	Price of industry j value added in region z in period t
55	$PWM_{i,zj,z,t}$	World price of commodity i imported from region zj by region z (expressed in international currency) in period t
56	$PWMG_{i,t}$	World price of margin i (expressed in international currency) in period t
57	$PWX_{i,z,zj,t}$	World price of commodity i exported by region z to region zj (expressed in international currency) in period t
58	$R_{k,j,z,t}$	Rental rate paid for type k capital by industry j in region z in period t
59	$RC_{j,z,t}$	Rental rate of industry j composite capital in region z in period t
60	$RTI_{k,j,z,t}$	Rental rate paid by industry j for type k capital in region z, including capital taxes in period t
61	$U_{z,t}$	User cost of capital in region z in period t

No.	Variable	Description
62	$W_{l,z,t}$	Wage rate of type l labor in region z in period t
63	$WC_{j,z,t}$	Wage rate of industry j composite labor in region z in period t
64	$WDL_{l,j,z,t}$	Wage rate paid by industry j for type l domestic labor in region z
65	$WLIM_{l,j,zj,z,,t}$	Wage rate paid by industry j for type l imported labor from region zj in region z
66	$WML_{l,j,z,t}$	Wage rate paid by industry j for type l imported labor in region z
67	$WTI_{l,j,z,t}$	Wage rate paid by industry j for type l labor in region z, including payroll taxes in period t
Nominal (value) variables		
68	$CAB_{z,t}$	Current account balance of region z in period t
69	$CTH_{z,t}$	Household consumption budget in region z in period t
70	$DEP_{z,t}$	Amount of depreciation (capital consumption allowance) in region z in period t
71	$G_{z,t}$	Current government expenditure on goods and services in region z in period t
72	$GDP_{z,t}^{BP}$	GDP at basic prices in region z in period t
73	$GDP_{t}^{BP\_W}$	World GDP at basic prices in period t
74	$GDP_{z,t}^{FD}$	GDP at purchasers' prices from the perspective of final demand in region z in period t
75	$GDP_{z,t}^{IB}$	GDP at market prices (income-based) in region z in period t
76	$GDP_{z,t}^{MP}$	GDP at market prices in region z in period t
77	$IT_{z,t}$	Total investment expenditures in region z in period t
78	$SG_{z,t}$	Government savings in region z in period t
79	$SH_{z,t}$	Household savings in region z in period t
80	$SROW_{z,t}$	Rest-of-the-world savings with respect to region z in period t
81	$TDH_{z,t}$	Household income taxes in region z in period t

No.	Variable	Description
82	$TIC_{i,z,t}$	Government receipts of indirect taxes on commodity i in region z in period t
83	$TICT_{z,t}$	Total government receipts of indirect taxes on commodities in region z in period t
84	$TIK_{k,j,z,t}$	Government revenue from taxes on type k capital used by industry j of region z in period t
85	$TIKT_{z,t}$	Total government revenue from taxes on the use of capital in region z in period t
86	$TIM_{i,zj,z,t}$	Government revenue from duties levied on imports of commodity I from region zj by region z in period t
87	$TIMT_{z,t}$	Total government revenue from import duties in region z in period t
88	$TIP_{j,z,t}$	Government revenue from taxes on industry j production in region z (excluding taxes directly related to the use of capital and labor) in period t
89	$TIPT_{z,t}$	Total government revenue from production taxes in region z (excluding taxes directly related to the use of capital and labor) in period t
90	$TIW_{l,j,z,t}$	Government revenue from payroll taxes on type l labor in industry j of region z in period t
91	$TIWT_{z,t}$	Total government revenue from payroll taxes in region z in period t
92	$TIX_{i,z,zj,t}$	Government revenues from export taxes on commodity i exported by region z to region zj in period t
93	$TIXT_{z,t}$	Total government revenue from export taxes in region z in period t
94	$TPRCTS_{z,t}$	Total government revenue from taxes on products and imports in region z in period t
95	$TPRODN_{z,t}$	Total government revenue from taxes on production in region z in period t
96	$YDH_{z,t}$	Household disposable income in region z in period t
97	$YG_{z,t}$	Total government income in region z in period t
98	$YH_{z,t}$	Total household income in region z in period t
99	$YHK_{z,t}$	Household capital income in region z in period t
100	$YHL_{z,t}$	Household labor income in region z in period t
101	$YROW_{z,t}$	Rest-of-the-world income in region z in period t

No.	Variable	Description
Rate, intercepts and other variable parameters		
102	$A^{VA}_{z,t}$	Multifactor productivity in period t
103	$sh0_{z,t}$	Intercept (household savings) in period t
104	$sh1_{z,t}$	Slope (household savings) in period t
105	$ttdh0_{z,t}$	Intercept (household income taxes) in period t
106	$ttdh1_{z,t}$	Marginal household income tax rate in period t
107	$ttic_{i,z,t}$	Tax rate on commodity i in region z in period t
108	$ttik_{k,j,z,t}$	Tax rate on type k capital used by industry j in region z in period t
109	$ttim_{i,zj,z,t}$	Rate of taxes and duties on imports of commodity i from region zj by region z in period t
110	$ttip_{j,z,t}$	Tax rate on the production of industry j in period t
111	$ttiw_{l,j,z,t}$	Tax rate on wages and salaries paid to labor category l in industry j in period t
112	$ttix_{i,z,zj,t}$	Export tax rate on commodity i exported to region zj by region z in period t
Parameters		
113	$aij_{i,j,t}$	Input-output coefficient
114	A^{K}_{z}	Scale parameter (new capital implicit production function
115	$B^{KD}_{j,z}$	Scale parameter (CES – composite capital)
116	$B^{LD}_{j,z}$	Scale parameter (CES – composite labor)
117	$B^{M1}_{i,z}$	Scale parameter (CES – composite good)
118	$B^{M2}_{i,z}$	Scale parameter (CES – composite import)
119	$B^{VA}_{j,z}$	Scale parameter (CES – value added)
120	$B^{X1}_{i,z}$	Scale parameter (CET – composite supply)
121	$B^{X2}_{i,z}$	Scale parameter (CET – composite export supply

No.	Variable	Description
122	$\beta^{KD}_{k,j,z}$	Share parameter (CET – composite capital)
123	$\beta^{LD}_{l,j,z}$	Share parameter (CET – composite labor)
124	$\beta^{M1}_{i,z}$	Share parameter (CES – composite good)
125	$\beta^{M2}_{i,zj,z}$	Share parameter (CES – composite import)
126	$\beta^{VA}_{j,z}$	Share parameter (CES – value added)
127	$\beta^{D\_X1}_{i,z}$	Domestic market share parameter (CET – composite supply)
128	$\beta^{EX\_X1}_{i,z}$	Export share parameter (CET – composite supply)
129	$\beta^{X2}_{i,z,zj}$	Share parameter of region zj in exports of commodity i from region z (CET – composite export supply)
130	δ_z	Depreciation rate of capital in region z
131	η	Price-elasticity of indexed transfers and parameters
132	$frisch_{i,z}$	Frisch parameter (LES function); used in calibration
133	$\gamma^{GVT}_{i,z}$	Share of commodity i in region z total current public expenditures on goods and services
134	$\gamma^{INV}_{i,z}$	Share of commodity i in region z total investment expenditures
135	$\gamma^{LES}_{i,z}$	Marginal share of commodity i in region z household consumption budget
136	$io_{j,z}$	Coefficient (Leontief – intermediate consumption)
137	$\varphi_{k,j,z}$	Scale parameter (allocation of investment to industries)
138	$\rho^{KD}_{j,z}$	Elasticity parameter (CES – composite capital); $-1 < \rho^{KD}_{j,z} < \infty$
139	$\rho^{LD}_{j,z}$	Elasticity parameter (CES – composite labor); $-1 < \rho^{LD}_{j,z} < \infty$
140	$\rho^{M1}_{i,z}$	Elasticity parameter (CES – composite good); $-1 < \rho^{M1}_{i,z} < \infty$
141	$\rho^{M2}_{i,z}$	Elasticity parameter (CES – composite imports); $-1 < \rho^{M2}_{i,z} < \infty$
142	$\rho^{VA}_{j,z}$	Elasticity parameter (CES – value added); $-1 < \rho^{VA}_{j,z} < \infty$

No.	Variable	Description
143	$\rho_{i,z}^{X1}$	Elasticity parameter (CES – composite supply); $-1 < \rho_{i,z}^{X1} < \infty$
144	$\rho_{i,z}^{X2}$	Elasticity parameter (CES – composite export supply); $-1 < \rho_{i,z}^{X2} < \infty$
145	$\sigma_{k,bus,z}^{INV}$	Elasticity of investment demand relative to Tobin's q
146	$\sigma_{j,z}^{KD}$	Elasticity of substitution (CES – composite capital); $0 < \sigma_{j,z}^{KD} < \infty$
147	$\sigma_{j,z}^{LD}$	Elasticity of substitution (CES – composite labor); $0 < \sigma_{j,z}^{LD} < \infty$
148	$\sigma_{i,z}^{M1}$	Elasticity of substitution (CES – composite good); $0 < \sigma_{i,z}^{M1} < \infty$
149	$\sigma_{i,z}^{M2}$	Elasticity of substitution (CES – composite import); $0 < \sigma_{i,z}^{M2} < \infty$
150	$\sigma_{j,z}^{VA}$	Elasticity of substitution (CES – value added); $0 < \sigma_{j,z}^{VA} < \infty$
151	$\sigma_{i,z}^{X1}$	Elasticity of transformation (CET – composite supply); $0 < \sigma_{i,z}^{X1} < \infty$
152	$\sigma_{i,z}^{X2}$	Elasticity of transformation (CET – composite export supply); $-1 < \sigma_{i,z}^{X2} < \infty$
153	$tmrg_{ij,i,zj,z}$	Rate of type ij margin services applied to imports of commodity i from region zj by region z
154	$v_{j,z}$	Coefficient (Leontief – value added)
Variables that are fixed in the default closure		
155	$A_{z,t}^{VA}$	Multifactor productivity in period t
156	$C_{i,z,t}^{MIN}$	Minimum consumption of commodity i by households in region z in period t
157	$CABX_{z,t}$	Current account balance of region z in terms of the international currency in period t
158	$e_{z,t}$	Exchange rate; price of international currency in terms of region z's local currency in period t
159	$G_{z,t}^{REAL}$	Real government expenditures in region z in period t
160	$IND_{k,pub,z,t}$	Volume of new type k capital investment to public sector industry pub in region z in period t
161	$KD_{k,j,z,t}$	Supply of type k capital to industry j in region z in period t: determined in the preceding period (t–1) under the accumulation rule
162	$LS_{l,j,z,t}$	Supply of type l labor in region z in period t

No.	Variable	Description
163	$PIXGDP_{zr,t}$	GDP deflator of the reference region (numeraire) in period t
164	$sh0_{z,t}$	Intercept (household savings) in period t
165	$sh1_{z,t}$	Slope (household savings) in period t
166	$ttdh0_{z,t}$	Intercept (household income taxes) in period t
167	$ttdh1_{z,t}$	Marginal household income tax rate in period t
168	$ttic_{i,z,t}$	Tax rate on commodity i in region z in period t
169	$ttik_{k,j,z,t}$	Tax rate on type k capital used by industry j in region z in period t
170	$ttim_{i,zj,z,t}$	Rate of taxes and duties on imports of commodity i from region zj by region z in period t
171	$ttip_{j,z,t}$	Tax rate on the production of industry j in period t
172	$ttiw_{l,j,z,t}$	Tax rate on wages and salaries paid to labor category l in industry j in period t
173	$ttix_{i,z,zj,t}$	Export tax rate on commodity i exported to region zj by region z in period t
174	$WLIM_{l,j,zj,z,,t}$	Wage rate paid by industry j for type l imported labor from region zj in region z

Appendix C: Other results

C1. Scenario A

Table AC.1: Percentage change from BAU case of labor income (Scenario A)

	Change in labor income, % from BAU							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	2.53	1.89	1.24	0.54	-0.20	-1.00	-1.87	-2.83
Indonesia	0.28	0.20	0.14	0.07	0.01	-0.04	-0.09	-0.13
Lao PDR	2.30	1.99	1.73	1.45	1.17	0.89	0.60	0.29
Malaysia	0.96	0.88	0.81	0.73	0.64	0.57	0.50	0.42
Philippines	0.54	0.37	0.19	0.02	-0.15	-0.31	-0.48	-0.66
Singapore	1.99	1.94	2.00	2.05	2.07	2.07	2.07	2.07
Thailand	1.15	1.09	0.99	0.90	0.81	0.70	0.59	0.47
Vietnam	1.52	1.81	2.01	2.16	2.28	2.37	2.44	2.51
ROASEAN	-0.57	-1.16	-1.75	-2.32	-2.87	-3.38	-3.82	-4.18
ROW	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01

Table AC.2: Percentage growth of real GDP (Scenario A)

	% Growth of GDP							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	4.78	2.71	2.77	2.77	2.77	2.69	2.65	2.61
Indonesia	-2.27	3.57	3.85	4.12	4.23	4.22	4.40	4.57
Lao PDR	0.04	5.54	5.91	5.81	5.63	5.37	5.29	5.22
Malaysia	2.56	3.24	3.63	4.34	4.96	4.69	4.70	4.70
Philippines	3.65	3.11	4.09	3.83	3.80	3.32	3.29	3.26
Singapore	6.43	2.74	3.18	3.34	3.35	3.10	3.12	3.15
Thailand	3.13	1.45	2.75	2.62	2.44	2.26	2.27	2.27
Vietnam	-0.68	3.13	3.27	3.20	3.13	3.03	3.06	3.09
ROASEAN	-2.99	7.87	8.31	8.61	9.14	9.31	9.62	9.88
ROW	1.85	1.86	1.86	1.86	1.85	1.85	1.85	1.85

Table AC.3: Percentage growth of Consumption (Scenario A)

	% Growth of consumption							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	8.32	4.04	3.79	3.88	3.86	3.85	3.79	3.72
Indonesia	3.53	3.19	3.00	2.87	2.74	2.60	2.46	2.31
Lao PDR	8.77	6.75	6.61	6.64	6.64	6.63	6.63	6.62
Malaysia	7.12	7.08	6.66	6.31	6.79	7.76	7.63	7.51
Philippines	5.95	4.73	4.79	4.98	5.05	5.11	5.12	5.14
Singapore	5.65	3.24	3.33	3.37	3.32	3.25	3.23	3.24
Thailand	5.79	3.67	3.38	3.67	3.78	3.77	3.77	3.77
Vietnam	4.12	3.98	3.90	3.86	3.85	3.87	3.89	3.91
ROASEAN	4.73	6.51	6.08	5.76	5.48	5.18	4.82	4.43
ROW	1.86	1.93	1.92	1.91	1.91	1.90	1.90	1.90

Table AC.4: Percentage growth of export (Scenario A)

	% Growth of export							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	5.60	3.66	3.75	3.52	3.51	3.46	3.44	3.41
Indonesia	14.01	4.56	4.67	4.79	4.89	5.02	5.12	5.24
Lao PDR	14.40	7.85	7.92	7.87	7.86	7.83	7.82	7.82
Malaysia	3.55	4.17	3.55	2.64	3.34	5.77	5.81	5.82
Philippines	4.24	3.97	3.12	3.95	4.03	4.52	4.52	4.53
Singapore	4.76	4.42	4.69	4.73	4.77	4.74	4.75	4.74
Thailand	4.98	3.32	1.15	2.20	2.65	2.61	2.57	2.52
Vietnam	10.23	4.36	4.45	4.50	4.53	4.54	4.57	4.59
ROASEAN	12.69	8.98	9.44	9.76	10.14	10.42	10.65	10.86
ROW	0.76	2.33	3.22	3.38	3.34	2.76	2.77	2.77

Table AC.5: Percentage growth of sectoral employment (Scenario A)

	% Growth of sectoral employment							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
All	1.73	1.29	0.73	0.96	1.07	0.98	0.85	0.78
Grains&Crops	2.32	1.86	0.59	1.37	1.66	1.60	1.48	1.39
LiveStk&Meat	2.50	2.25	1.40	1.77	1.94	1.93	1.84	1.78
Mining&Extractn	-1.10	1.04	-0.29	0.29	0.45	0.28	0.08	-0.13
Procfood	2.78	2.05	-0.80	0.32	0.94	0.99	1.02	1.08
Textiles&Clothing	3.06	3.44	-0.73	0.67	1.49	1.73	1.62	1.56
LightMnfc	1.12	2.35	-0.03	0.67	1.12	1.23	1.14	1.11
HeavyMnfc	4.31	1.94	-0.57	0.52	1.13	0.98	0.96	1.00
Util&Constuct	-11.10	-7.94	10.82	2.73	-0.65	-0.60	-0.44	-0.25
OthServices	1.94	1.47	0.72	1.01	1.10	0.98	0.78	0.63

Table AC.6: Percentage growth of sectoral output (Scenario A)

	% Growth of sectorial output							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
All	3.32	2.63	2.34	2.71	2.82	2.78	2.75	2.72
Grains&Crops	3.83	2.47	1.58	2.33	2.54	2.47	2.42	2.36
LiveStk&Meat	3.55	2.63	2.01	2.68	2.87	2.83	2.79	2.73
Mining&Extractn	2.80	0.80	0.43	0.93	1.07	1.01	0.95	0.84
Procfood	4.09	2.89	1.70	2.40	2.61	2.53	2.47	2.40
Textiles&Clothing	3.57	3.24	1.56	2.41	2.76	2.80	2.74	2.67
LightMnfc	2.65	2.75	1.67	2.31	2.53	2.53	2.47	2.40
HeavyMnfc	4.39	2.88	1.77	2.50	2.72	2.60	2.53	2.45
Util&Constuct	-2.24	-1.33	4.32	2.52	1.57	1.49	1.48	1.47
OthServices	3.21	3.22	3.23	3.37	3.46	3.53	3.57	3.60

C2. Scenario B

Table AC.7: Percentage change from BAU case of labor income (Scenario B)

	Change in labor income, % from BAU							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	0.55	0.74	0.92	1.09	1.27	1.45	1.63	1.81
Indonesia	1.80	2.16	2.49	2.79	3.07	3.32	3.54	3.73
Lao PDR	1.80	1.93	2.10	2.29	2.49	2.70	2.92	3.14
Malaysia	0.54	0.73	0.92	1.10	1.25	1.38	1.50	1.61
Philippines	1.05	1.23	1.43	1.61	1.79	1.98	2.19	2.41
Singapore	0.52	0.54	0.57	0.61	0.63	0.65	0.68	0.70
Thailand	0.74	0.87	1.04	1.18	1.33	1.48	1.64	1.81
Vietnam	0.77	0.75	0.73	0.71	0.70	0.69	0.69	0.68
ROASEAN	2.03	2.71	3.36	3.96	4.49	4.94	5.30	5.52
ROW	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01

Table AC.8: Percentage growth of real GDP (Scenario B)

	% Growth of GDP							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	3.22	2.93	2.99	3.05	3.08	3.03	3.03	3.02
Indonesia	-1.04	3.92	4.19	4.45	4.55	4.52	4.68	4.82
Lao PDR	0.68	5.48	5.94	5.93	5.80	5.58	5.53	5.48
Malaysia	2.17	3.43	3.83	4.55	5.14	4.83	4.83	4.83
Philippines	4.44	3.36	4.38	4.10	4.09	3.61	3.61	3.60
Singapore	4.87	2.79	3.17	3.33	3.35	3.11	3.14	3.16
Thailand	2.91	1.63	2.99	2.84	2.67	2.50	2.53	2.54
Vietnam	-1.89	3.02	3.19	3.16	3.10	3.01	3.05	3.08
ROASEAN	-1.48	8.48	8.98	9.28	9.78	9.88	10.08	10.19
ROW	1.85	1.86	1.86	1.85	1.85	1.85	1.85	1.85

Table AC.9: Percentage growth of consumption (Scenario B)

	% Growth of consumption							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	5.07	4.69	4.43	4.52	4.51	4.51	4.48	4.45
Indonesia	3.28	3.41	3.21	3.07	2.91	2.76	2.60	2.44
Lao PDR	7.25	7.18	7.01	7.01	6.98	6.95	6.93	6.91
Malaysia	5.99	7.26	6.84	6.49	6.96	7.88	7.74	7.60
Philippines	5.31	4.95	5.03	5.21	5.29	5.34	5.36	5.38
Singapore	4.54	3.30	3.30	3.35	3.33	3.26	3.25	3.26
Thailand	4.84	3.78	3.54	3.81	3.91	3.91	3.92	3.92
Vietnam	2.76	3.95	3.89	3.87	3.85	3.88	3.90	3.92
ROASEAN	3.73	6.96	6.52	6.19	5.86	5.49	5.06	4.58
ROW	1.86	1.93	1.92	1.91	1.91	1.90	1.90	1.90

Table AC.10: Percentage growth of export (Scenario B)

	% Growth of export							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	3.22	4.22	4.38	4.18	4.19	4.17	4.16	4.15
Indonesia	11.59	4.90	5.00	5.12	5.21	5.33	5.42	5.52
Lao PDR	10.51	7.90	8.11	8.13	8.16	8.16	8.17	8.19
Malaysia	2.63	4.38	3.77	2.84	3.53	5.95	5.98	5.97
Philippines	2.52	4.21	3.37	4.21	4.30	4.80	4.82	4.83
Singapore	4.06	4.53	4.71	4.76	4.82	4.78	4.79	4.78
Thailand	3.55	3.63	1.43	2.49	2.95	2.91	2.87	2.84
Vietnam	9.16	4.74	4.79	4.80	4.80	4.78	4.78	4.79
ROASEAN	11.24	9.66	10.12	10.43	10.79	11.01	11.16	11.26
ROW	2.04	2.41	3.28	3.43	3.39	2.82	2.82	2.83

Table AC.11: Percentage growth of sectoral employment (Scenario B)

	% Growth of sectoral employment							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
All	1.74	1.28	0.73	0.96	1.06	0.98	0.84	0.77
Grains&Crops	2.06	2.06	0.80	1.56	1.83	1.77	1.66	1.57
LiveStk&Meat	2.30	2.25	1.41	1.78	1.95	1.95	1.85	1.79
Mining&Extractn	-1.31	1.30	0.02	0.61	0.78	0.63	0.44	0.24
Procfood	2.09	1.87	-1.00	0.13	0.74	0.80	0.82	0.88
Textiles&Clothing	1.81	3.37	-0.79	0.60	1.41	1.64	1.51	1.45
LightMnfc	0.51	2.15	-0.22	0.48	0.91	1.03	0.92	0.89
HeavyMnfc	3.64	1.77	-0.74	0.36	0.96	0.82	0.77	0.81
Util&Constuct	-6.13	-8.22	9.70	1.99	-1.20	-1.07	-0.88	-0.65
OthServices	1.93	1.57	0.82	1.11	1.19	1.08	0.86	0.72

Table AC.12: Percentage growth of sectoral output (Scenario B)

	% Growth of sectorial output							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
All	3.31	2.96	2.66	3.04	3.15	3.12	3.10	3.08
Grains&Crops	3.29	2.79	1.96	2.68	2.90	2.88	2.88	2.86
LiveStk&Meat	3.43	3.13	2.47	3.12	3.28	3.24	3.20	3.16
Mining&Extractn	2.83	1.42	1.10	1.65	1.82	1.80	1.77	1.70
Procfood	3.52	3.26	2.08	2.77	2.98	2.92	2.88	2.84
Textiles&Clothing	3.31	3.70	2.01	2.87	3.23	3.28	3.24	3.19
LightMnfc	2.86	3.20	2.11	2.75	2.98	2.97	2.92	2.87
HeavyMnfc	3.95	3.32	2.23	2.95	3.18	3.07	3.01	2.95
Util&Constuct	0.58	-0.66	4.66	3.00	2.10	2.03	2.02	2.01
OthServices	3.23	3.30	3.29	3.43	3.53	3.59	3.63	3.66

C3. Scenario C

Table AC.13: Percentage change from BAU case of labor income (Scenario C)

	Change in labor income, % from BAU							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	2.42	2.63	2.83	3.03	3.23	3.44	3.65	3.87
Indonesia	0.97	1.06	1.16	1.25	1.35	1.44	1.54	1.62
Lao PDR	5.39	5.67	6.07	6.49	6.94	7.40	7.88	8.37
Malaysia	2.50	2.70	2.93	3.14	3.32	3.50	3.69	3.90
Philippines	1.53	1.59	1.67	1.76	1.87	1.98	2.09	2.22
Singapore	2.73	2.77	2.93	3.07	3.16	3.25	3.33	3.42
Thailand	1.71	1.82	1.94	2.08	2.22	2.38	2.55	2.73
Vietnam	2.42	2.53	2.65	2.77	2.92	3.07	3.22	3.38
ROASEAN	1.71	2.28	2.83	3.38	3.96	4.49	4.97	5.39
ROW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table AC.14: Percentage growth of real GDP (Scenario C)

	% Growth of GDP							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	6.84	3.94	3.65	3.80	3.82	3.85	3.84	3.83
Indonesia	5.47	5.12	5.03	5.01	5.00	4.99	5.00	5.01
Lao PDR	8.83	6.93	6.77	6.78	6.78	6.76	6.75	6.73
Malaysia	4.31	3.85	3.69	3.57	4.13	5.10	5.11	5.16
Philippines	5.05	4.00	4.11	4.32	4.43	4.52	4.56	4.60
Singapore	6.35	3.53	3.62	3.63	3.57	3.52	3.50	3.53
Thailand	4.49	2.64	2.44	2.73	2.86	2.89	2.92	2.95
Vietnam	4.02	4.00	3.90	3.85	3.84	3.86	3.88	3.89
ROASEAN	7.26	9.38	9.12	9.01	8.93	8.84	8.69	8.53
ROW	1.87	1.91	1.89	1.88	1.88	1.87	1.87	1.87

Table AC.15: Percentage growth of consumption (Scenario C)

	% Growth of consumption							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	7.03	4.65	4.39	4.49	4.48	4.49	4.46	4.43
Indonesia	3.69	3.26	3.07	2.94	2.80	2.66	2.52	2.37
Lao PDR	8.95	7.15	6.99	7.01	7.00	6.98	6.97	6.96
Malaysia	8.13	7.24	6.84	6.50	6.96	7.89	7.74	7.64
Philippines	5.96	4.83	4.91	5.10	5.19	5.25	5.27	5.29
Singapore	6.66	3.30	3.40	3.42	3.35	3.29	3.27	3.29
Thailand	5.79	3.75	3.50	3.78	3.89	3.90	3.91	3.91
Vietnam	4.21	4.00	3.94	3.92	3.91	3.94	3.96	3.99
ROASEAN	4.96	6.81	6.37	6.06	5.77	5.44	5.04	4.59
ROW	1.85	1.94	1.92	1.91	1.91	1.90	1.90	1.90

Table AC.16: Percentage growth of export (Scenario C)

	% Growth of export							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	3.56	4.16	4.30	4.10	4.12	4.09	4.08	4.07
Indonesia	14.02	4.65	4.77	4.90	5.00	5.13	5.24	5.35
Lao PDR	11.87	7.98	8.14	8.13	8.15	8.14	8.15	8.16
Malaysia	3.54	4.37	3.78	2.86	3.55	5.96	5.96	6.00
Philippines	3.69	4.05	3.20	4.05	4.14	4.65	4.67	4.69
Singapore	4.84	4.55	4.83	4.83	4.85	4.82	4.81	4.82
Thailand	4.44	3.55	1.36	2.42	2.88	2.84	2.81	2.78
Vietnam	9.72	4.66	4.73	4.75	4.76	4.75	4.77	4.78
ROASEAN	12.01	9.40	9.94	10.28	10.68	10.94	11.14	11.28
ROW	0.53	2.41	3.30	3.44	3.40	2.81	2.82	2.83

Table AC.17: Percentage growth of sectoral employment (Scenario C)

	% Growth of sectoral employment							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
All	1.71	1.29	0.74	0.95	1.05	0.98	0.84	0.76
Grains&Crops	2.23	2.00	0.73	1.49	1.77	1.71	1.60	1.51
LiveStk&Meat	2.34	2.25	1.41	1.76	1.93	1.93	1.83	1.77
Mining&Extractn	-1.93	1.02	-0.29	0.26	0.43	0.28	0.08	-0.11
Procfood	2.70	1.93	-0.90	0.19	0.79	0.86	0.87	0.92
Textiles&Clothing	1.84	3.38	-0.76	0.58	1.37	1.62	1.48	1.42
LightMnfc	0.21	2.24	-0.14	0.53	0.95	1.07	0.96	0.92
HeavyMnfc	4.50	1.81	-0.68	0.40	1.00	0.86	0.82	0.85
Util&Constuct	-8.86	-8.00	10.31	2.42	-0.86	-0.76	-0.60	-0.40
OthServices	1.83	1.56	0.79	1.06	1.16	1.05	0.84	0.69

Table AC.18: Percentage growth of sectoral output (Scenario C)

	% Growth of sectorial output							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
All	3.32	2.87	2.57	2.95	3.07	3.05	3.03	3.02
Grains&Crops	3.36	2.67	1.84	2.58	2.81	2.79	2.79	2.78
LiveStk&Meat	3.44	2.99	2.34	3.00	3.19	3.15	3.12	3.09
Mining&Extractn	2.67	1.05	0.75	1.28	1.44	1.43	1.41	1.34
Procfood	3.68	3.15	1.98	2.68	2.89	2.84	2.81	2.77
Textiles&Clothing	3.31	3.56	1.86	2.72	3.08	3.14	3.1	3.06
LightMnfc	2.75	3.08	1.98	2.62	2.85	2.86	2.81	2.76
HeavyMnfc	4.18	3.22	2.12	2.85	3.09	2.98	2.93	2.87
Util&Constuct	-0.41	-0.83	4.62	2.92	2.02	1.96	1.97	1.97
OthServices	3.18	3.28	3.27	3.41	3.51	3.57	3.61	3.65

C4. Scenario D

Table AC.19: Percentage change from BAU case of labor income (Scenario D)

	Change in labor income, % from BAU							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	5.54	5.30	5.05	4.76	4.43	4.07	3.65	3.17
Indonesia	3.09	3.45	3.80	4.13	4.44	4.72	4.98	5.21
Lao PDR	9.51	9.63	9.93	10.27	10.65	11.04	11.44	11.85
Malaysia	4.10	4.41	4.75	5.05	5.29	5.53	5.77	6.01
Philippines	3.18	3.25	3.33	3.43	3.55	3.68	3.83	3.98
Singapore	5.45	5.46	5.74	5.97	6.11	6.22	6.32	6.42
Thailand	3.71	3.90	4.08	4.26	4.47	4.68	4.90	5.12
Vietnam	4.84	5.27	5.60	5.88	6.14	6.39	6.63	6.87
ROASEAN	3.12	3.80	4.43	5.01	5.56	6.04	6.44	6.75
ROW	0.00	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02

Table AC.20: Percentage growth of real GDP (Scenario D)

	% Growth of GDP							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	11.57	3.63	3.34	3.46	3.46	3.45	3.40	3.34
Indonesia	5.74	5.30	5.19	5.16	5.13	5.11	5.09	5.09
Lao PDR	10.66	6.98	6.79	6.79	6.78	6.75	6.73	6.71
Malaysia	5.16	3.94	3.80	3.67	4.20	5.15	5.14	5.18
Philippines	5.84	4.09	4.18	4.38	4.48	4.56	4.60	4.64
Singapore	7.63	3.49	3.73	3.71	3.58	3.53	3.49	3.51
Thailand	5.59	2.70	2.51	2.79	2.91	2.94	2.97	2.99
Vietnam	6.11	4.15	4.01	3.93	3.90	3.92	3.93	3.94
ROASEAN	8.47	9.49	9.19	9.05	8.95	8.83	8.66	8.48
ROW	1.86	1.91	1.89	1.88	1.88	1.87	1.87	1.87

Table AC.21: Percentage growth of consumption (Scenario D)

	% Growth of consumption							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	11.00	4.38	4.11	4.19	4.18	4.16	4.11	4.06
Indonesia	3.96	3.44	3.23	3.08	2.93	2.78	2.62	2.46
Lao PDR	10.65	7.18	7.01	7.00	6.99	6.96	6.94	6.93
Malaysia	9.13	7.34	6.96	6.61	7.04	7.94	7.77	7.66
Philippines	6.82	4.91	4.98	5.16	5.24	5.29	5.31	5.33
Singapore	8.19	3.25	3.52	3.51	3.37	3.30	3.26	3.27
Thailand	6.98	3.82	3.57	3.85	3.94	3.95	3.95	3.96
Vietnam	5.96	4.12	4.02	3.97	3.95	3.98	4.00	4.01
ROASEAN	6.12	6.91	6.44	6.10	5.79	5.44	5.01	4.55
ROW	1.85	1.93	1.92	1.91	1.91	1.90	1.90	1.90

Table AC.22: Percentage growth of export (Scenario D)

	% Growth of export							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cambodia	5.01	3.88	3.98	3.75	3.74	3.70	3.67	3.64
Indonesia	13.34	4.91	5.04	5.16	5.26	5.38	5.48	5.58
Lao PDR	13.00	8.17	8.30	8.27	8.27	8.24	8.22	8.21
Malaysia	3.71	4.52	3.94	3.02	3.67	6.03	6.01	6.03
Philippines	3.80	4.26	3.42	4.24	4.32	4.80	4.80	4.80
Singapore	5.07	4.70	5.15	5.10	5.03	4.99	4.96	4.95
Thailand	4.99	3.67	1.53	2.55	2.98	2.95	2.90	2.86
Vietnam	9.89	4.57	4.66	4.70	4.72	4.71	4.73	4.74
ROASEAN	12.23	9.60	10.11	10.44	10.81	11.04	11.21	11.33
ROW	1.01	2.41	3.32	3.45	3.39	2.80	2.80	2.80

Table AC.23: Percentage growth of sectoral employment (Scenario D)

	% Growth of sectoral employment							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
All	1.73	1.26	0.74	0.95	1.04	0.98	0.83	0.76
Grains&Crops	3.07	2.23	0.93	1.65	1.89	1.80	1.66	1.56
LiveStk&Meat	2.23	2.26	1.45	1.79	1.95	1.95	1.84	1.79
Mining&Extractn	-2.53	0.96	-0.29	0.23	0.38	0.23	0.02	-0.18
Procfood	3.46	1.89	-0.90	0.17	0.73	0.82	0.81	0.88
Textiles&Clothing	0.07	3.32	-0.68	0.61	1.37	1.64	1.47	1.42
LightMnfc	-1.67	2.10	-0.19	0.46	0.86	1.01	0.87	0.85
HeavyMnfc	4.78	1.68	-0.73	0.36	0.94	0.84	0.79	0.84
Util&Constuct	-7.09	-8.26	9.50	1.91	-1.24	-1.10	-0.93	-0.70
OthServices	1.73	1.58	0.84	1.10	1.17	1.08	0.85	0.71

Table AC.24: Percentage growth of sectoral output (Scenario D)

	% Growth of sectorial output							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
All	3.35	2.96	2.67	3.03	3.13	3.10	3.07	3.04
Grains&Crops	3.71	3.12	2.17	2.85	3.01	2.94	2.90	2.85
LiveStk&Meat	3.40	3.12	2.48	3.10	3.26	3.21	3.17	3.12
Mining&Extractn	2.52	0.99	0.73	1.23	1.40	1.38	1.36	1.28
Procfood	3.89	3.34	2.17	2.83	3.02	2.95	2.89	2.84
Textiles&Clothing	2.69	3.58	1.96	2.78	3.12	3.18	3.13	3.08
LightMnfc	2.08	3.06	2.01	2.62	2.84	2.84	2.78	2.73
HeavyMnfc	4.26	3.35	2.26	2.97	3.19	3.08	3.00	2.94
Util&Constuct	0.22	-0.72	4.54	2.90	2.00	1.94	1.92	1.91
OthServices	3.14	3.29	3.29	3.42	3.51	3.59	3.62	3.65

Table AC.25: Capital and labor ratio and average percentage change from BAU case

Capitals/Labors	BAU (Million US Dollar)	Scenario D (Million US Dollar)	Average % change
All	11.14	11.18	0.37
Grains&Crops	8.36	8.40	0.46
LiveStk&Meat	9.38	9.52	1.50
Mining&Extractn	24.03	24.33	1.26
Procfood	16.17	16.41	1.53
Textiles&Clothing	11.34	11.78	3.87
LightMnfc	11.71	12.20	4.16
HeavyMnfc	15.72	16.00	1.79
Util&Constuct	13.65	13.66	0.12
OthServices	8.84	8.83	-0.16

Appendix D

Table AD.1: Total output change of ASEAN countries from BAU by varying wage (unit in Billion US Dollar)

	SIM1	SIM2	SIM3	SIM4	SIM5	SIM6	SIM7	SIM8	SIM9
Cambodia	-0.002	-0.006	-0.016	-0.001	-0.002	-0.006	0.002	0.007	0.017
Indonesia	0.105	0.312	0.764	0.04	0.119	0.299	-0.106	-0.32	-0.818
Lao PDR	-0.006	-0.017	-0.04	-0.002	-0.006	-0.016	0.006	0.017	0.043
Malaysia	0.023	0.068	0.167	0.003	0.009	0.022	-0.023	-0.07	-0.177
Philippines	0.023	0.067	0.164	0.008	0.025	0.062	-0.023	-0.069	-0.175
Singapore	0.049	0.145	0.355	0.005	0.015	0.037	-0.049	-0.149	-0.38
Thailand	-1.883	-5.564	-13.594	-0.568	-1.699	-4.261	1.903	5.743	14.714
Vietnam	0.012	0.035	0.086	0.005	0.014	0.035	-0.012	-0.036	-0.092
ROASEAN	-0.038	-0.111	-0.27	-0.009	-0.026	-0.064	0.038	0.115	0.294
ROW	0.235	0.693	1.685	0.095	0.284	0.714	-0.238	-0.72	-1.852

Table AD.2: Total investment change of ASEAN countries from BAU by varying wage (unit in Billion US Dollar)

	SIM1	SIM2	SIM3	SIM4	SIM5	SIM6	SIM7	SIM8	SIM9
Cambodia	-0.001	-0.002	-0.005	0.000	-0.001	-0.002	0.001	0.002	0.006
Indonesia	0.022	0.064	0.157	0.009	0.025	0.064	-0.022	-0.066	-0.168
Lao PDR	-0.002	-0.005	-0.012	-0.001	-0.002	-0.005	0.002	0.005	0.013
Malaysia	0.003	0.008	0.021	0.000	0.001	0.002	-0.003	-0.009	-0.022
Philippines	0.003	0.009	0.023	0.001	0.004	0.009	-0.003	-0.010	-0.024
Singapore	0.009	0.027	0.066	0.001	0.003	0.007	-0.009	-0.028	-0.071
Thailand	-0.232	-0.686	-1.680	-0.302	-0.901	-2.253	0.234	0.705	1.800
Vietnam	0.002	0.005	0.012	0.001	0.002	0.005	-0.002	-0.005	-0.012
ROASEAN	-0.012	-0.034	-0.084	-0.003	-0.010	-0.025	0.012	0.036	0.091
ROW	-0.043	-0.128	-0.317	-0.015	-0.046	-0.114	0.044	0.131	0.331

Table AD.3: Sectoral output change of Thailand from BAU by varying wage (unit in Billion US Dollar)

	SIM1	SIM2	SIM3	SIM4	SIM5	SIM6	SIM7	SIM8	SIM9
Grains&Crops	-0.091	-0.269	-0.659	-0.021	-0.065	-0.166	0.092	0.278	0.712
LiveStk&Meat	-0.037	-0.110	-0.269	-0.006	-0.017	-0.043	0.038	0.113	0.290
Mining&Extractn	-0.037	-0.110	-0.267	-0.024	-0.072	-0.178	0.038	0.114	0.294
ProcFood	-0.088	-0.260	-0.636	-0.023	-0.070	-0.177	0.089	0.267	0.684
Textiles&Clothing	-0.104	-0.306	-0.746	-0.019	-0.058	-0.147	0.105	0.318	0.816
HeavyMnfc	-0.116	-0.343	-0.837	-0.028	-0.083	-0.210	0.118	0.355	0.911
LightMnfc	-0.735	-2.171	-5.309	-0.334	-0.996	-2.493	0.742	2.238	5.730
Util&Constuct	-0.152	-0.448	-1.097	-0.117	-0.349	-0.871	0.153	0.462	1.184
OthServices	-0.523	-1.545	-3.773	0.004	0.011	0.024	0.529	1.597	4.094

Appendix E

E1. Elasticities

Elasticity of substitution indicates the percentage changes in the input factor ratio caused by a 1% change in relative input prices. The larger the elasticity, the more flexibly the input share is adjusted. With a large elasticity of transformation, the ratio tends to be more sensitive to a change in relative price.

Table AE. 1: Elasticity of investment demand

	Elasticity (investment demand)									
Sigma_INV	Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Singapore	Thailand	Vietnam	ROASEAN	ROW
Capital										
Grains&Crops	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1
LiveStk&Meat	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1
Mining&Extractn	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1
Procfood	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1
Textiles&Clothing	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1
LightMnfc	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1
HeavyMnfc	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1
Util&Constuct	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1
OthServices	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1
Land										
Grains&Crops	2	2	2	2	2	2	2	2	2	2
LiveStk&Meat	2	2	2	2	2	2	2	2	2	2
Mining&Extractn	2	2	2	2	2	2	2	2	2	2
Procfood	2	2	2	2	2	2	2	2	2	2
Textiles&Clothing	2	2	2	2	2	2	2	2	2	2
LightMnfc	2	2	2	2	2	2	2	2	2	2
HeavyMnfc	2	2	2	2	2	2	2	2	2	2
Util&Constuct	2	2	2	2	2	2	2	2	2	2
OthServices	2	2	2	2	2	2	2	2	2	2
Natural resource										
Grains&Crops	2	2	2	2	2	2	2	2	2	2
LiveStk&Meat	2	2	2	2	2	2	2	2	2	2
Mining&Extractn	2	2	2	2	2	2	2	2	2	2
Procfood	2	2	2	2	2	2	2	2	2	2
Textiles&Clothing	2	2	2	2	2	2	2	2	2	2
LightMnfc	2	2	2	2	2	2	2	2	2	2
HeavyMnfc	2	2	2	2	2	2	2	2	2	2
Util&Constuct	2	2	2	2	2	2	2	2	2	2
OthServices	2	2	2	2	2	2	2	2	2	2

Table AE.2: Elasticity of value-added

Elasticity (CES - value added)										
Sigma_VA	Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Singapore	Thailand	Vietnam	ROASEAN	ROW
Grains&Crops	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275
LiveStk&Meat	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516
Mining&Extractn	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
Procfood	1.120	1.120	1.120	1.120	1.120	1.120	1.120	1.120	1.120	1.120
Textiles&Clothing	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260
LightMnfc	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260
HeavyMnfc	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260
Util&Constuct	1.365	1.365	1.365	1.365	1.365	1.365	1.365	1.365	1.365	1.365
OthServices	1.361	1.361	1.361	1.361	1.361	1.361	1.361	1.361	1.361	1.361

Table AE.3: Elasticity of composite capital

Elasticity (CES - composite capital)										
Sigma_KD	Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Singapore	Thailand	Vietnam	ROASEAN	ROW
Grains&Crops	0.550	0.550	0.550	0.550	0.550	0.550	0.550	0.550	0.550	0.550
LiveStk&Meat	1.033	1.033	1.033	1.033	1.033	1.033	1.033	1.033	1.033	1.033
Mining&Extractn	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
Procfood	2.240	2.240	2.240	2.240	2.240	2.240	2.240	2.240	2.240	2.240
Textiles&Clothing	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520
LightMnfc	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520
HeavyMnfc	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520
Util&Constuct	2.729	2.729	2.729	2.729	2.729	2.729	2.729	2.729	2.729	2.729
OthServices	2.722	2.722	2.722	2.722	2.722	2.722	2.722	2.722	2.722	2.722

Table AE.4: Elasticity of composite labor

Elasticity (CES - composite labor)										
Sigma_LD	Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Singapore	Thailand	Vietnam	ROASEAN	ROW
Grains&Crops	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275
LiveStk&Meat	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516
Mining&Extractn	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
Procfood	1.120	1.120	1.120	1.120	1.120	1.120	1.120	1.120	1.120	1.120
Textiles&Clothing	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260
LightMnfc	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260
HeavyMnfc	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260	1.260
Util&Constuct	1.365	1.365	1.365	1.365	1.365	1.365	1.365	1.365	1.365	1.365
OthServices	1.361	1.361	1.361	1.361	1.361	1.361	1.361	1.361	1.361	1.361

Table AE.5: Elasticity of second level composite labor

Elasticity (CES - composite labor between domestic and imported labors)										
Sigma_LD1	Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Singapore	Thailand	Vietnam	ROASEAN	ROW
Grains&Crops	0.412	0.412	0.412	0.412	0.412	0.412	0.412	0.412	0.412	0.412
LiveStk&Meat	0.774	0.774	0.774	0.774	0.774	0.774	0.774	0.774	0.774	0.774
Mining&Extractn	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Procfood	1.680	1.680	1.680	1.680	1.680	1.680	1.680	1.680	1.680	1.680
Textiles&Clothing	1.890	1.890	1.890	1.890	1.890	1.890	1.890	1.890	1.890	1.890
LightMnfc	1.890	1.890	1.890	1.890	1.890	1.890	1.890	1.890	1.890	1.890
HeavyMnfc	1.890	1.890	1.890	1.890	1.890	1.890	1.890	1.890	1.890	1.890
Util&Constuct	2.047	2.047	2.047	2.047	2.047	2.047	2.047	2.047	2.047	2.047
OthServices	2.041	2.041	2.041	2.041	2.041	2.041	2.041	2.041	2.041	2.041

Table AE.6: Elasticity of imported labor

Elasticity (CES - composite imported labor)										
Sigma_LD2	Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Singapore	Thailand	Vietnam	ROASEAN	ROW
Grains&Crops	0.550	0.550	0.550	0.550	0.550	0.550	0.550	0.550	0.550	0.550
LiveStk&Meat	1.033	1.033	1.033	1.033	1.033	1.033	1.033	1.033	1.033	1.033
Mining&Extractn	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
Procfood	2.240	2.240	2.240	2.240	2.240	2.240	2.240	2.240	2.240	2.240
Textiles&Clothing	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520
LightMnfc	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520
HeavyMnfc	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520	2.520
Util&Constuct	2.729	2.729	2.729	2.729	2.729	2.729	2.729	2.729	2.729	2.729
OthServices	2.722	2.722	2.722	2.722	2.722	2.722	2.722	2.722	2.722	2.722

Table AE.7: Elasticity of composite commodity

Elasticity (CES - composite commodity)										
Sigma_M1	Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Singapore	Thailand	Vietnam	ROASEAN	ROW
Grains&Crops	2.569	2.569	2.569	2.569	2.569	2.569	2.569	2.569	2.569	2.569
LiveStk&Meat	3.131	3.131	3.131	3.131	3.131	3.131	3.131	3.131	3.131	3.131
Mining&Extractn	5.124	5.124	5.124	5.124	5.124	5.124	5.124	5.124	5.124	5.124
Procfood	2.140	2.140	2.140	2.140	2.140	2.140	2.140	2.140	2.140	2.140
Textiles&Clothing	3.729	3.729	3.729	3.729	3.729	3.729	3.729	3.729	3.729	3.729
LightMnfc	3.349	3.349	3.349	3.349	3.349	3.349	3.349	3.349	3.349	3.349
HeavyMnfc	3.392	3.392	3.392	3.392	3.392	3.392	3.392	3.392	3.392	3.392
Util&Constuct	2.131	2.131	2.131	2.131	2.131	2.131	2.131	2.131	2.131	2.131
OthServices	1.900	1.900	1.900	1.900	1.900	1.900	1.900	1.900	1.900	1.900

Table AE.8: Elasticity of composite import

Elasticity (CES - composite import)										
Sigma_M2	Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Singapore	Thailand	Vietnam	ROASEAN	ROW
Grains&Crops	5.051	5.051	5.051	5.051	5.051	5.051	5.051	5.051	5.051	5.051
LiveStk&Meat	7.282	7.282	7.282	7.282	7.282	7.282	7.282	7.282	7.282	7.282
Mining&Extractn	11.666	11.666	11.666	11.666	11.666	11.666	11.666	11.666	11.666	11.666
Procfood	4.396	4.396	4.396	4.396	4.396	4.396	4.396	4.396	4.396	4.396
Textiles&Clothing	7.454	7.454	7.454	7.454	7.454	7.454	7.454	7.454	7.454	7.454
LightMnfc	6.978	6.978	6.978	6.978	6.978	6.978	6.978	6.978	6.978	6.978
HeavyMnfc	7.094	7.094	7.094	7.094	7.094	7.094	7.094	7.094	7.094	7.094
Util&Constuct	4.673	4.673	4.673	4.673	4.673	4.673	4.673	4.673	4.673	4.673
OthServices	3.800	3.800	3.800	3.800	3.800	3.800	3.800	3.800	3.800	3.800

Table AE.9: Elasticity of total output

Elasticity (CET - total output)										
Sigma_X1	Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Singapore	Thailand	Vietnam	ROASEAN	ROW
Grains&Crops	2	2	2	2	2	2	2	2	2	2
LiveStk&Meat	2	2	2	2	2	2	2	2	2	2
Mining&Extractn	2	2	2	2	2	2	2	2	2	2
Procfood	2	2	2	2	2	2	2	2	2	2
Textiles&Clothing	2	2	2	2	2	2	2	2	2	2
LightMnfc	2	2	2	2	2	2	2	2	2	2
HeavyMnfc	2	2	2	2	2	2	2	2	2	2
Util&Constuct	2	2	2	2	2	2	2	2	2	2
OthServices	2	2	2	2	2	2	2	2	2	2

Table AE.10: Elasticity of composite export

Elasticity (CET - composite export)										
Sigma_X2	Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Singapore	Thailand	Vietnam	ROASEAN	ROW
Grains&Crops	3	3	3	3	3	3	3	3	3	3
LiveStk&Meat	3	3	3	3	3	3	3	3	3	3
Mining&Extractn	3	3	3	3	3	3	3	3	3	3
Procfood	3	3	3	3	3	3	3	3	3	3
Textiles&Clothing	3	3	3	3	3	3	3	3	3	3
LightMnfc	3	3	3	3	3	3	3	3	3	3
HeavyMnfc	3	3	3	3	3	3	3	3	3	3
Util&Constuct	3	3	3	3	3	3	3	3	3	3
OthServices	3	3	3	3	3	3	3	3	3	3

Table AE.11: Income elasticity of consumption

Income elasticity of consumption										
Sigma_Y	Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Singapore	Thailand	Vietnam	ROASEAN	ROW
Grains&Crops	1	1	1	1	1	1	1	1	1	1
LiveStk&Meat	1	1	1	1	1	1	1	1	1	1
Mining&Extractn	1	1	1	1	1	1	1	1	1	1
Procfood	1	1	1	1	1	1	1	1	1	1
Textiles&Clothing	1	1	1	1	1	1	1	1	1	1
LightMnfc	1	1	1	1	1	1	1	1	1	1
HeavyMnfc	1	1	1	1	1	1	1	1	1	1
Util&Constuct	1	1	1	1	1	1	1	1	1	1
OthServices	1	1	1	1	1	1	1	1	1	1

E2. Sensitivities tests

Table AE.12: Sensitivity Test for Cambodia

Sensitivity Test for Cambodia									
Elasticities	Labor&Capital			Domestic&Imported labors			Imported labors		
	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4
GDP	0.044%	-0.042%	-0.240%	0.000%	0.000%	0.001%	0.000%	0.000%	-0.002%
Consumption	0.037%	-0.034%	-0.192%	0.000%	0.000%	0.001%	0.000%	0.000%	-0.001%
Employment	0.003%	-0.003%	-0.016%	0.002%	-0.001%	-0.010%	0.001%	-0.001%	-0.009%

Table AE.13: Sensitivity test for Indonesia

Sensitivity test for Indonesia									
Elasticities	Labor&Capital			Domestic&Imported labors			Imported labors		
	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4
GDP	-0.1587%	0.1113%	0.5136%	0.0016%	-0.0014%	-0.0092%	0.0003%	-0.0003%	-0.0023%
Consumption	-0.1600%	0.1131%	0.5278%	0.0017%	-0.0014%	-0.0093%	0.0003%	-0.0003%	-0.0023%
Employment	0.0006%	-0.0006%	-0.0039%	0.0005%	-0.0005%	-0.0033%	0.0000%	0.0000%	-0.0001%

Table AE.14: Sensitivity test for Lao PDR

Sensitivity test for Lao PDR									
Elasticities	Labor&Capital			Domestic&Imported labors			Imported labors		
	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4
GDP	-0.1338%	0.0782%	0.2396%	0.0010%	-0.0009%	-0.0069%	0.0003%	-0.0003%	-0.0027%
Consumption	-0.1086%	0.0622%	0.1796%	0.0009%	-0.0008%	-0.0063%	0.0003%	-0.0003%	-0.0024%
Employment	0.0034%	-0.0030%	-0.0160%	0.0018%	-0.0016%	-0.0107%	0.0004%	-0.0004%	-0.0041%

Table AE.15: Sensitivity test for Malaysia

Sensitivity test for Malaysia									
Elasticities	Labor&Capital			Domestic&Imported labors			Imported labors		
	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4
GDP	-0.0633%	0.0455%	0.2016%	0.0081%	-0.0073%	-0.0502%	0.0012%	-0.0012%	-0.0080%
Consumption	-0.0588%	0.0429%	0.1928%	0.0090%	-0.0081%	-0.0559%	0.0014%	-0.0013%	-0.0088%
Employment	0.0272%	-0.0264%	-0.1976%	0.0181%	-0.0169%	-0.1287%	0.0026%	-0.0023%	-0.0161%

Table AE.16: Sensitivity test for Philippines

Sensitivity test for Philippines									
Elasticities	Labor&Capital			Domestic&Imported labors			Imported labors		
	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4
GDP	0.0667%	-0.0474%	-0.2213%	-0.0008%	0.0007%	0.0034%	-0.0001%	0.0001%	0.0009%
Consumption	0.0728%	-0.0509%	-0.2311%	-0.0009%	0.0007%	0.0036%	-0.0001%	0.0001%	0.0009%
Employment	0.0006%	-0.0006%	-0.0046%	0.0005%	-0.0005%	-0.0039%	0.0000%	0.0000%	-0.0001%

Table AE.17: Sensitivity test for Singapore

Sensitivity test for Singapore									
Elasticities	Labor&Capital			Domestic&Imported labors			Imported labors		
	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4
GDP	0.2965%	-0.2143%	-0.9313%	0.0764%	-0.0630%	-0.3226%	0.0088%	-0.0086%	-0.0583%
Consumption	0.3447%	-0.2483%	-1.0805%	0.0830%	-0.0684%	-0.3503%	0.0096%	-0.0093%	-0.0633%
Employment	0.3074%	-0.2539%	-1.1278%	0.2303%	-0.1895%	-0.9683%	0.0268%	-0.0259%	-0.1768%

Table AE.18: Sensitivity test for Thailand

Sensitivity test for Thailand									
Elasticities	Labor&Capital			Domestic&Imported labors			Imported labors		
	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4
GDP	0.1003%	-0.0746%	-0.3597%	0.0038%	-0.0035%	-0.0250%	0.0009%	-0.0009%	-0.0078%
Consumption	0.1081%	-0.0800%	-0.3825%	0.0041%	-0.0038%	-0.0268%	0.0010%	-0.0010%	-0.0084%
Employment	0.0289%	-0.0260%	-0.1527%	0.0185%	-0.0168%	-0.1116%	0.0040%	-0.0039%	-0.0326%

Table AE.19: Sensitivity test for Vietnam

Sensitivity test for Vietnam									
Elasticities	Labor&Capital			Domestic&Imported labors			Imported labors		
	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4
GDP	-0.3980%	0.2736%	1.2313%	0.0025%	-0.0022%	-0.0154%	0.0007%	-0.0007%	-0.0049%
Consumption	-0.2791%	0.1924%	0.8723%	0.0016%	-0.0015%	-0.0105%	0.0005%	-0.0005%	-0.0034%
Employment	0.0005%	-0.0005%	-0.0029%	0.0003%	-0.0003%	-0.0018%	0.0000%	0.0000%	-0.0001%

Table AE.20: Sensitivity test for ROASEAN

Sensitivity test for ROASEAN									
Elasticities	Labor&Capital			Domestic&Imported labors			Imported labors		
	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4
GDP	-0.4687%	0.3284%	1.4803%	0.0041%	-0.0036%	-0.0247%	0.0009%	-0.0009%	-0.0063%
Consumption	-0.4389%	0.3102%	1.4098%	0.0039%	-0.0035%	-0.0238%	0.0009%	-0.0008%	-0.0060%
Employment	0.0007%	-0.0004%	-0.0017%	0.0017%	-0.0015%	-0.0111%	0.0000%	0.0000%	-0.0002%

Table AE.21: Sensitivity test for ROW

Sensitivity test for ROW									
Elasticities	Labor&Capital			Domestic&Imported labors			Imported labors		
	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4	x 0.7	x 1.3	x 4
GDP	0.0056%	-0.0026%	-0.0083%	0.0006%	-0.0005%	-0.0057%	0.0004%	-0.0003%	-0.0024%
Consumption	-0.0362%	0.0214%	0.0787%	0.0006%	-0.0005%	-0.0055%	0.0003%	-0.0003%	-0.0024%
Employment	0.0009%	-0.0010%	-0.0123%	0.0006%	-0.0006%	-0.0080%	0.0006%	-0.0005%	-0.0039%

Appendix F

F1. Actual economic data[65]

Table AF.1: Actual GDP data, 2007-2012

GDP (Billion US dollar)						
Country	2007	2008	2009	2010	2011	2012
Cambodia	7,682.23	8,084.65	7,926.44	8,403.76	8,967.24	9,545.98
Indonesia	320,529.03	339,961.03	355,517.63	377,221.97	401,364.19	426,650.16
Lao PDR	3,189.53	3,429.77	3,690.09	3,982.64	4,311.68	4,673.30
Malaysia	155,180.78	162,381.97	159,725.41	171,216.05	180,119.28	189,305.36
Philippines	116,256.29	120,719.36	122,105.22	131,424.28	137,546.05	144,259.66
Singapore	144,214.78	145,872.06	144,748.84	165,695.44	174,477.30	181,979.83
Thailand	194,709.98	199,731.19	195,011.55	210,187.34	217,619.56	228,047.89
Vietnam	62,128.22	65,946.18	69,456.49	74,168.43	78,434.59	83,354.01
ROASEAN	26,865.02	33,154.33	38,878.22	43,789.55	50,016.10	61,830.19
ROW	46,663,560.00	47,603,308.04	46,550,123.69	48,360,218.56	49,672,726.04	51,095,034.34

Table AF.2: Actual consumption data, 2007-2012

Consumption (Billion US dollar)						
Country	2007	2008	2009	2010	2011	2012
Cambodia	6,224.85	7,000.22	6,676.11	7,234.27	7,606.06	-
Indonesia	205,046.02	210,790.03	216,507.75	228,761.86	237,794.74	253,475.65
Lao PDR	2,267.11	2,435.01	2,526.90	2,757.59	3,027.14	3,237.65
Malaysia	74,675.91	81,187.44	81,636.86	87,239.26	93,177.01	100,847.21
Philippines	84,260.75	87,361.44	89,399.72	92,395.07	97,618.75	104,025.63
Singapore	53,803.80	57,586.83	55,110.87	57,251.33	59,433.63	60,786.89
Thailand	106,845.67	110,159.25	109,131.21	114,186.51	115,475.48	125,763.94
Vietnam	44,239.27	47,697.82	48,632.17	50,531.34	53,398.77	52,933.51

[65] Source: World Bank Database

Table AF.3: Actual government spending data, 2007-2012

Government spending (Billion US dollar)						
Country	2007	2008	2009	2010	2011	2012
Cambodia	443.49	465.66	566.67	637.50	687.10	-
Indonesia	26,399.94	29,153.00	33,722.72	33,831.97	34,921.32	35,367.49
Lao PDR	270.38	324.99	397.88	381.14	425.93	539.37
Malaysia	18,523.02	19,796.02	20,774.33	21,489.39	24,883.26	26,206.95
Philippines	11,017.22	11,049.02	12,254.27	12,743.98	13,009.74	14,595.86
Singapore	14,368.15	15,218.42	15,853.04	17,555.03	17,358.24	17,347.76
Thailand	23,528.44	24,283.56	26,092.69	27,753.62	28,066.26	30,169.30
Vietnam	3,721.70	4,001.60	4,305.61	4,834.44	5,168.71	5,551.05

Table AF.4: Actual investment data, 2007-2012

Investment (Billion US dollar)						
Country	2007	2008	2009	2010	2011	2012
Cambodia	1,527.21	1,770.40	1,841.57	1,660.35	1,839.12	-
Indonesia	75,800.58	84,810.33	87,603.49	95,033.38	102,960.64	112,936.06
Lao PDR	1,089.85	1,107.65	1,122.33	978.25	1,149.55	1,498.04
Malaysia	37,542.46	38,426.25	37,385.61	41,824.87	44,435.03	53,014.62
Philippines	22,749.87	23,466.61	23,056.32	27,450.94	26,912.10	29,722.70
Singapore	37,326.45	41,418.30	42,945.93	46,307.04	48,290.12	52,575.07
Thailand	53,738.23	54,368.84	49,345.07	53,958.97	55,713.65	63,066.04
Vietnam	24,594.04	25,538.15	27,766.45	30,791.38	28,385.60	28,917.19

Table AF.5: Actual export data, 2007-2012

Export (Billion US dollar)						
Country	2007	2008	2009	2010	2011	2012
Cambodia	5,294.31	6,123.15	5,519.06	6,653.84	7,910.39	-
Indonesia	115,649.77	126,675.19	114,400.19	131,864.89	149,862.20	152,865.39
Lao PDR	1,102.96	1,103.67	1,144.42	1,429.46	1,615.47	1,703.73
Malaysia	179,399.41	182,221.60	162,398.65	180,451.13	188,742.91	185,053.04
Philippines	57,154.75	55,625.53	51,268.91	62,020.37	60,285.80	65,629.19
Singapore	347,915.31	363,839.23	336,577.81	395,156.40	413,178.98	419,308.23
Thailand	152,678.17	160,452.85	140,397.77	161,023.84	176,310.97	181,734.17
Vietnam	45,926.84	52,218.80	49,563.44	53,751.55	59,548.38	68,902.88

F2. Model accuracy test

Figure AF.1: Consumption of ASEAN countries, 2007-2012 *(Actual data vs CGE model)*

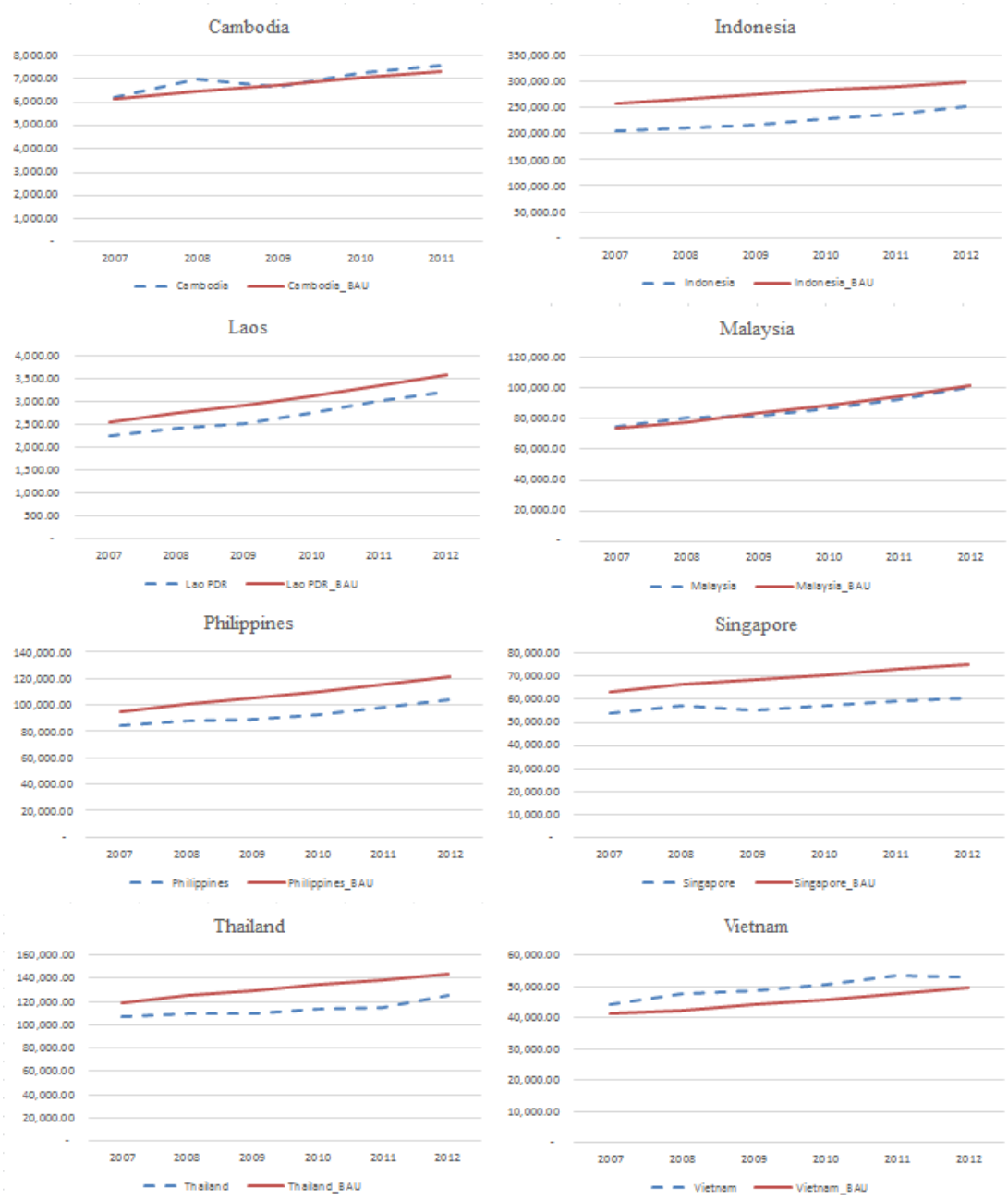

Figure AF.2: Government spending of ASEAN countries, 2007-2012 (Actual data vs CGE model)

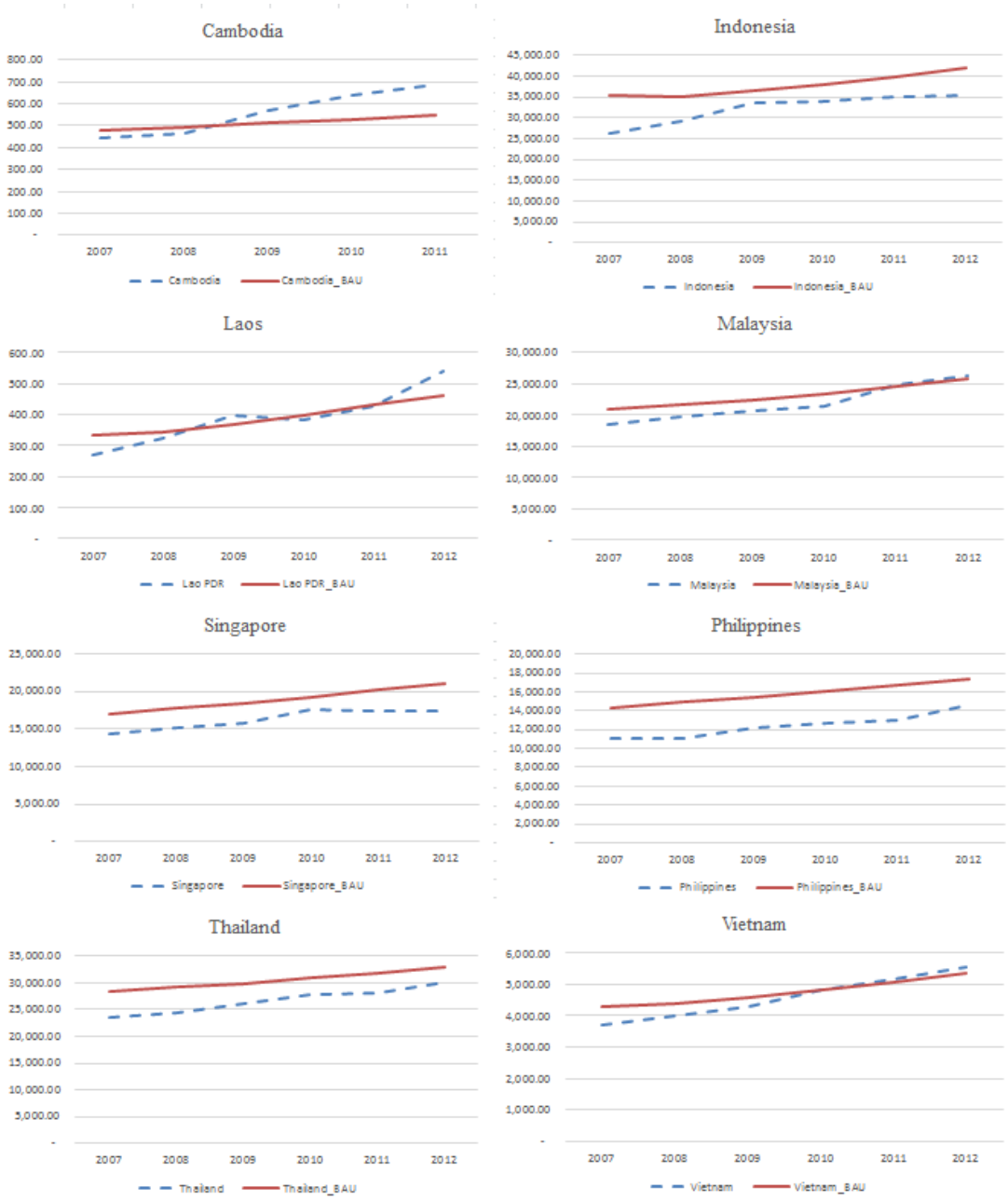

Figure AF.3: Investment of ASEAN countries, 2007-2012 *(Actual data vs CGE model)*

Figure AF.4: Export of ASEAN countries, 2007-2012 (Actual data vs CGE model)

Appendix G

G1. Walras' Law

An implication of Walras' Law is that equilibrium in the last market follows from the supply-demand balance in all other markets (Burfisher, 2011). In other words, if there are N market and N-1 markets are in equilibrium, the last market is also in equilibrium. Therefore, one equation must be dropped from general equilibrium model because it is redundant. However, in order to balance the number of equation and variable once again, one price in the model has to serve as a numeraire. Then, all other prices are expressed as relative prices in terms of the numeraire. We do not solve the absolute prices but only relative prices as in other CGE and general equilibrium models with zero homogeneity in prices (Hosoe, Gasawa, & Hashimoto, 2010).

In practice, modelers usually omit the macroeconomic market-clearing equation that defines aggregate savings to be equal to aggregate investment. As an alternative, some modelers fix a numeraire but keep the redundant equation and add an additional variable to check that all markets are in equilibrium (additional variable will equal 0) in the base data and model solutions.

This study uses agricultural market to be the number N market to check no excess supply in this market and GDP deflator of ROW to be the numeraire.

G2. Numeraire

A CGE model describes only relative prices. To express all prices in relative terms, the modeler chooses one price variable in the CGE model to remain fixed at its initial level. This price serves as the model's numeraire, a benchmark of value against which the changes in all other prices can be measured (Burfisher, 2011).

G3. Closure Rule

Modeler decides which variables are exogenous and which are endogenous. These decisions are called model closure (Burfisher, 2011). CGE model requires a set of control variables that determined by modeler in order to analyze some interested

factors or policies. These control variables are exogenous and called as the closure rule because these variables make the number of equations equals the number of endogenous variables to find the solution of the model.

The closure rule will determine how economy return to its equilibrium after shock appeared in the economy. In general equilibrium, there are three main control variables that modeler can select to be the closure rule. Firstly, government balance defines government revenue must equal government spending at the same year. Secondly, savings and investment balance defines all agents savings (household, government, and ROW) must equal to total investment at the same year. Thirdly, rest of the world balance defines current account must equals to ROW savings.

G4. Choices of complier for CGE Model

The CGE model uses actual economic data to estimate how the whole economy in single country and global might react to changes in policy, technology or other external factors (Brockmeier, 1996). There are three popular complier programs for CGE model, namely, Global Trade Analysis Project (GTAP), General Equilibrium Modelling PACKage (GEMPACK) (Harrison, Horridge, Jerie, & Pearson, 2011) and General Algebraic Modeling System (GAMS). These programs are suitable for applied general equilibrium models because it can handle a wide range of economic behavior.

GTAP is a specific type of GCE model which is able to evaluate a broad spectrum of economic activity across a number of countries and different economic sectors. There are two equations which form the basis of the model; the first is used to quantify the interactions between economic agents in terms of their accounts, ensuring that all aspects are balanced. The second equation type reflects microeconomic theory, and these are used to model the behaviors of each particular agent within the economy or economic system (Brockmeier, 1996). However, modeler cannot alter details of database in GTAP but it can be done in GEMPACK and GAMS. The difference between GEMPACK and GAMS is the calculation speed. GEMPACK works faster than GAMS to find the solution when the model contains non-linear equations because GEMPACK transforms non-linear equations to linear one and then calculate the solution but GAMS directly calculates the solution of model with non-linear equations.

Appendix H: Migration Factors

H1. Background

This chapter examines the determinants of internal migration in Thailand by regression-based models. The purpose of a migration model is to explain the direction of population movement or to predict future movement. The common aspects of the labor market study are the analysis of the interrelationship between macroeconomic conditions and the labor movement (Borjas, 1994). Kulkolkarn (2007) used a geographic approach to study the impact of immigration on unemployment rates and native wages. She found that if there is a 1% increase in immigration in 2001, natives' unemployment rate will increase about 0.5% in a province in Thailand in 2005. In addition, she claimed that unskilled labors are most affected by the immigration. However, she did not find the effect of immigration on wages.

In contrast with Borjas (1994), he did not find the negative impact of migrants on unemployment in the United States and European but he found a small negative impact on minimum native wages. This is because unskilled migrants may fill jobs not wanted by domestic labors (Yarbrough & Yarbrough, 2006). The difference result between Thailand and Western countries is the number of unskilled labors employed in tradable sectors. In Thailand, tradable sectors, especially agriculture and fisheries, mainly employ unskilled labors. Since tradable sectors are highly competitive in the world market, firms are unable to raise price to respond higher wages but instead firms tend to hire the migration labors, which abundant, from neighboring countries to maintain the minimum wages. Therefore, between Thailand and Western cases is different in both qualitative and quantitative (Kulkolkarn, 2007).

Kulkolkarn and Potipiti (2009) analyzed the impact of immigration on labor markets in a destination country. They claimed that immigrants are substitute or complement to native labors in the job markets depending on the number of immigrants. When there are small numbers of immigrants, they will harm native labors by depressing wages in the unskilled labor segment. This leads to the movement of native labors to other sectors. These sectors may require native language which is a barrier to enter for immigrants. However, if there is further immigration, immigrants will become

complement to native labors through the efficiency gain from the division of labor between native and immigrants. This is because labor markets eventually become completely segmented. Nevertheless, too many immigrants will harm native labors because they start to enter and compete for jobs in other sectors.

In addition, González and Ortega (2011) claimed that the inflow of unskilled migrant labor does not have the effect on wage and employment rate of unskilled labor market in the receiving country because the increase in the inflow of unskilled migrant labor is absorbed through the increase in total employment which driven by the change in skill intensities at the industry level. The receiving regions that received a large inflow of unskilled migrants would adapt to use more unskilled labors or increase the intensity of unskilled labor uses. González and Ortega (2011) concluded that the industries those respond for this absorption were retail, construction, hotels and restaurants and domestic services. All these industries produce non-traded goods.

H2. Methodology

The purpose of this chapter is to examine the factors that are believed to be responsible for immigrants in Thailand. A variety of analysis of migration flows with generally promising results have ranged from gravity models to complex and cumbersome systems of equations with excessive demands data and computation (Ramin, 1988). A popular technique for the interpretation of migratory movements has been the application of regression-based models because researchers feeling that these techniques give rise to some promises in the estimation of factors influencing migration (Willis, 1975). In addition, regression analysis provides a method of testing the hypothesis of which factors are associated with migration.

H2.1. Independent variables

Ramin (1988) and Kumpikait and Zickute (2013) claimed that income motives are the primary determinant of migration flows and it can be used as an index of opportunities. Regions characterized by higher average income usually show greater opportunities for a higher standard of living than regions with lower income levels (Ramin, 1988; Kumpikait & Zickute, 2013). Moreover, migration theory suggests that

interregional migration is influenced by economic development because developed areas tend to have more job opportunity and higher wages (Ramin, 1988). Thus, gross provincial product (GPP) represents the level of economic development.

One of the most important reasons to explain differentials is that the living costs may differ between regions. A majority of migrants are supposed to come from the low cost of living (agricultural regions) to the high cost of living (industrial regions). Thus, in order to attract labors to manufacturing facilities in the cities, wages higher than the average encountered in agriculture must be offered costs (Ramin, 1988; Kumpikait & Zickute, 2013). Due to the lack of reliable cost of living data at the region level for the period under investigation, the study used the minimum wage to represent living.

Education has been used in population studies as an explanatory variable influencing migration (Ramin, 1988). That is highly educated people are more mobile that the less well-educated. Ramin (1988) indicated a positive relationship between education and migration. World system theory suggests that global cities in destination countries concentrate wealth and a highly educated workforce and create strong demands for unskilled labors from overseas (Kim & Cohen, 2010).

Ramin (1988) claimed that labor force participation is causally connected to internal migration, if economic motives are of prime importance. When an individual enters the labor force, a decision has to be made as to whether to pursue an occupation in his origin or elsewhere. It is possible that a person who originated in a rural area may decide that the opportunities for employment are greater in urban area (Ramin, 1988). According to Todaro's model, the movement of labor from rural to urban sectors is primarily function of the differential in the expected income between these two sectors (Todaro, 1969). The probability of obtaining job in urban sector is seen as an important determinant of an individual's expected income and of his decision to migrate. Thus, number of unemployment represents the probability of obtaining job.

H2.2. Analysis method

Since participation in the labor force is seen as an economically motivating force helping to generate internal movements, the hypotheses for this study is the number of migrants depending on minimum wage, GPP, employment, and education level. Pooled ordinary least square (OLS) regression analysis is used to illustrate the

important factors influencing the number of migrant. The study contains time-series data from 2009 to 2011 on the flows of international migrants recorded by 77 provinces in Thailand. These data concern only legal migration reported by Office of Foreign Workers Administration. The equation for the immigration in Thailand is as following.

$$\log(\text{Total\_Migration}) = \log c + a_1\log(\text{Min\_Wage}_i) + a_2\log(\text{GPP}) + a_3\log(\text{Unemployment}) + a_4\log(\text{Less than Primary School}) + u$$

where:

- Total_Migration represents the number of migrants in 77 provinces (unit = persons)
- c is constant
- Min_Wage represents minimum wage in 77 provinces (unit = baht)
- GPP represents gross provincial product in 77 provinces (unit = million baht)
- Unemployment represents unemployment in 77 provinces (unit = persons)
- Less than Primary School represents labors who graduated primary school and less than primary school in 77 provinces (unit = persons)
- *u* is the error term

All independent variables are specified in logarithms. A logarithmic relationship is used because it is realistic to assume that the amount of push migration will not rise linearly with increasing values of the independent variables.

H3. Results

The data are from 77 provinces in Thailand from 2009 to 2011. The result has shown as following:

Table AH.1: Regression Result by Pooled Ordinary Least Square

		c	Log(Min_Wage)	Log(GPP)	Log(Unem)	Log(Less than Primary School)
Model 1: R-squared = 0.6581	**Log(Total_Migration)**	-43.98	8.1366	0.6784	-0.2860	0.5536
	t-statistic	*-7.45*	*6.55*	*6.48*	*-4.50*	*5.29*
		c	**Total_Migration**			
Model 2: R-squared = 0.6983	**GPP**	1262.80	5.9710			
	t-statistic	*0.11*	*22.87*			
Model 3: R-squared = 0.4155	**Min_Wage**	158.55	0.0002			
	t-statistic	*189.09*	*12.67*			
Model 4: R-squared = 0.1309	**Unemployment**	6515.68	0.0837			
	t-statistic	*10.05*	*5.83*			

Source: Author's regression model

According to Table 3.1, it shows the coefficients of each variable, R-squared of 4 models, and standard error of each variable. All variables in 4 models are significant at 95% confidence. We can write the model 1 as following:

Log(Total_Migration) = -43.98 + 8.14*Log(Min_Wage) + 0.68*Log(GPP) – 0.29*Log(Unemployment) + 0.55*Log(Less_than_Primary_School)

From the equation, number of migration is dependent variable and minimum wage, gross provincial product, unemployment, and lower than primary school education persons are independent variables. It shows that when the minimum wage increases by 1%, it will attract migrants by 8.14%. In addition, when 1% increases in the number of native who graduated primary school and lower, it will attract migrants by 0.55%.

Model 2 indicates the positive relationship between migrants and economic growth. It shows that when there is 1 more migrant, GPP will increase by 5.9 million baht. This result supports Klein and Ventura (2009) work which claimed that output will increase if there is no barrier and labor movement freely between countries.

Model 3 indicates the very small positive relationship between migrants and minimum wage. It shows that when there are 10,000 migrants more in a province, minimum wage will increase by 2 Baht. This result contrasts to Borjas (1994) in direction of effect but similar in small magnitude because Borjas (1994) found a small negative impact on minimum native wages. However, the magnitude is very small. In

addition, Kulkolkarn (2007) found no effect of immigration on wages. This is because unskilled migrants may fill jobs not wanted by domestic labors (Yarbrough & Yarbrough, 2006).

Model 4 indicates the positive relationship between migrants and unemployment. It shows that when there are 100 migrants more in a province, there will be people unemployed more for 9 positions. This result supports Kulkolkarn (2007) who found that if there is a 1% increase in immigration in 2001, natives' unemployment rate will increase about 0.5% in a province in Thailand in 2005.

H4. Conclusion

Willis (1975) claimed that migration movement is complex and cannot explain by a single equation model. The interaction between cause and effect suggests that it is necessary to specify a model of migration which takes into account the interactions between the various independent factors involved in the process. There are two main weaknesses when we want to study the effective of migration policy for Thailand. Firstly, there are short of migrant movement across and within countries data. We can only obtain the public data from 2009 to 2011. This is very short time series, thus it limits our choices in choosing alternative models. Secondly, since we have a short time series data of migration movement, there is hard to find migration policy effectiveness by econometric models. CGE model requires only 1 year data (input-output table) and constructs the whole country system, thus it seems suitable for analyzing policy effectiveness and be able to examine cause and effect relationships between economic variables. Therefore, the main model of dissertation will base on CGE model.

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