

**The Estimation of Economic Effects Brought by
the US - China Trade War on ASEAN Nations
----- Using the GTAP Model -----**

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Abstract

This paper is to analyze the economic effects brought on ASEAN countries by the trade war between the U.S. and China with utilizing the GTAP model to quantify its economy-wide effects. In the era of globalization, international trade of goods and services is extremely indispensable for nations to develop its national economy. However, the trade could also be a cause for an international conflict. The U.S. and China: the two largest economies in the world, have conflicted over the trade; and the impact of the trade war is anticipated to affect the world economy since the international trade network is so complicated that many nations are intertwined under the global supply chain. ASEAN is one of the most important regions that is involved in the global supply chain, and responsible for future economic development of Asia. In order for ASEAN nations to remove anxiety by the trade war and prepare for possible economic effects, this paper conducts the quantitative research to explore the numerical economic effects such as EV, the change in GDP, the change in ToT, and the change in BOT on each ASEAN nations.

Keywords: The US – China trade war, ASEAN, the GTAP model.

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List of Abbreviations

ASEAN	Association of Southeast Asian Nations
BOT	Balance of Trade
CEO	Chief Executive Officer
CGE	Computable General Equilibrium
EU	European Union
EV	Equivalent Variation
FTA	Free Trade Area
GDP	Gross Domestic Product
GTAP	Global Trade Analysis Project
IMF	International Monetary Fund
NAFTA	North American Free Trade Agreement
OCBC	Oversea-Chinese Banking Corporation
OECD	Organization for Economic Co-operation and Development
PPP	Purchasing Power parity
ToT:	Terms-of-Trade

Chapter One

Introduction

1.1 Objective of Research

The purpose of this study is to analyze the economic effects of international trade war between the U.S. and China on third countries: ASEAN with utilizing the GTAP model, multi-regional CGE model, by quantifying its economy-wide effects.

1.2 Significance of Research

In the era of globalization, international trade has a significant economic influence on each nation in either a positive or negative way. Since the global trade network is so complex, international trade conflicts could easily give immense and unexpected impact on not only main actors but also third countries. The two largest economies in the current world: the U.S. and China have recently started a serious trade dispute, especially since the current US President Donald Trump aims at China as an unfavorable trading partner to burden an excessive amount of trade deficit on the U.S.. Consequently, the U.S. began to impose tariffs on Chinese products imported into the U.S. in March 2018, and China also started to retaliate against US aggression by imposing tariffs on imports coming from the U.S.. Asian times addresses that some analysts even consider the current trade war escalation as the signal of a new cold war (Abdollahpour, 2018). The world carefully observes the consequence of the trade dispute because the spillover effects on third countries could be either profitable opportunities or huge risks for national or regional economy.

ASEAN is now one of the crucial drivers of global economic growth by exploiting a strategic geological location and the amount of abundant cheap labor force in terms of global value chain. As a result, the region has been increasingly chosen to be a destination for investments. However, the trade dispute between the U.S. and China may be such a matter to change the current situation of ASEAN economy. It is undoubtedly essential for ASEAN

nations to comprehend if the effects of the trade war between the two world largest economies could be potential opportunities to exploit for further economic development or the danger to jeopardize the progressive status of future ASEAN economic growth.

This paper seeks to examine the effects on ASEAN nations caused by the trade war, using the GTAP model to pursue numerical economy-wide effects. It is certain that the US – China trade war will give impacts on ASEAN economies; however, even though many researchers have conducted to estimate the existence of possible economic effects on the U.S., China, and third nations, the researches to quantify the economy-wide effects, especially on each ASEAN nation, have not been conducted. Thus, the quantitative analysis of economy-wide effects such as equivalent variation, change in GDP, and change in term-of-trade, and change in balance of trade will be contributive as a new research agenda.

1.3 Thesis Layout

In this paper, the chapter two describes the literature review by investigating the US – China Trade war, ASEAN, and the GTAP model. The chapter three explains structure of the GTAP model and define the design of the model in this study. The chapter four shows the results of analysis based on economy-wide effects in each ASEAN nation. The final chapter summarize the contents of this paper, describes the criticism with the limitation of the research method, and illustrates the potential future research field as a conclusion of this paper.

Chapter Two

Literature Review

2.1 Introduction

In this chapter, the previous researches and background information about the US – China Trade war, ASEAN, and the GTAP model are reviewed to reach and demonstrate one hypothesis to estimate the economic effects of the trade war on the ASEAN countries.

2.2 US – China Trade War

2.2.1 The Significant Presence of the U.S. and China

The international trade war between the U.S. and China has recently gathered global attention. This fierce competition contended by the two world largest economies might exert immense effects on the globe due to vital economic and political status of both countries. The U.S. has been one of the most economically wealthiest countries as a world superpower especially from around World War II (WWII). China is an emerging economy that has achieved significant economic growth since 1980s; and the country is now the largest economy in terms of GDP based on PPP (IMF DataMapper, 2018). By combining two gigantic economies, the share of GDP based on PPP is about 34% of the entire GDP in the world in 2018 (15.17% for the U.S. and 18.72% for China). For both nations, each country is important trading partners in the era of globalization. According to the center for international development at Harvard University (Atlas of Economic Complexity, n.d.), the U.S. is the largest exporting country for China, which accounts for 18.68% of entire exports in 2016. For the U.S., China is the largest importing country, which accounts for 20.14% of its entire imports in 2016 as well.

Table 2.1: Top 5 Trading Partners of China in 2016

No.	Import	Share (%)	Export	Share (%)
1	Taiwan	9.48%	USA	18.68%
2	South Korea	9.21%	Hong Kong	11.72%
3	Japan	8.62%	Japan	6.01%
4	USA	8.17%	Germany	4.35%
5	Germany	5.80%	South Korea	3.48%

(Source: Atlas of Economic Complexity, n.d.)

Table 2.2: Top 5 Trading Partners of the U.S. in 2016

No.	Import	Share (%)	Export	Share (%)
1	China	20.14%	Canada	17.31%
2	Canada	13.51%	Mexico	15.91%
3	Mexico	13.41%	China	8.29%
4	Japan	6.06%	Japan	4.43%
5	Germany	5.54%	Germany	3.76%

(Source: Atlas of Economic Complexity, n.d.)

2.2.2 Why Is the Trade War Happened between the U.S. and China

One of the main reasons why the international trade war between the U.S. and China has been intensified is the huge trade deficit that the U.S. has been burdened with. The U.S. has suffered from tremendous trade imbalance, especially since 1970s due to three reasons. First of all, demand for a massive amount of imports causes trade imbalance. The U.S. is the world largest economy that its consumption accounts for 70% of the entire GDP (Japan: 60%, China: 40%) (Saito, 2017). Active domestic consumption per capita has led US economic growth in the long US history. In order to fulfill tremendous demand for the consumption, a massive volume of products is required to import into the U.S. from all over the world. As a result, the U.S. ends up with a large excess of imports over exports. Another reason for the trade deficit is high-valued US dollar. As the U.S. gained enormous economic capacity, especially after WWII, the value of US dollar started to dominate the role of key currency in the world financial order because of its high credibility (Beityuboeki, 2018). Nowadays, International trade and

financial flows have been commonly transacted in US dollar. In terms of exchange rate, since US dollar is more stable and expensive than other currencies in general, American products tend to be more expensive when they are exported to the international market comparing to products that are produced in a country whose currency is lower-valued than the US dollar. Therefore, this exchange rate condition makes the American products difficult to be exported overseas countries. In addition, higher production costs such as labor costs in the U.S. is also a cause of trade deficit. US export sectors have struggled with international competitiveness when the U.S. exports its products because they became more expensive than products produced in countries that require cheaper production cost (Beityuboeki, 2018). In order to recover from the long-term trade imbalance because of active domestic consumption, high-valued currency, and high production costs, the US President Donald Trump declared to impose tariffs on many products brought into the U.S. even though retaliation is expected to occur by trading nations.

Among many nations that the U.S. has a trade deficit with, the President Trump notably aimed at China to warn as an essential enemy to recover from the trade imbalance. For the U.S., China is a trading partner that causes the largest deficit (Saito, 2017). 47% of trade deficit arises from trade with China in 2016: prominently surpassing the second largest nations: Mexico and Japan that both of them account for 9%. Therefore, progress to reduce the trade deficit with China is a significant improvement for US economy. Moreover, the U.S. might take advantage of opportunities to impede the Chinese policy: Made in China 2025 from implementation by imposing tariffs and slow the progress in development of advanced technologies. Made in China 2025 is the master plan for China to transform the nation into a high-tech powerhouse by specializing industries such as robotics, advanced information technology, and new energy vehicles. For the U.S., the Chinese strategic plan could possibly be an unprecedented threat if China exceeds US capacity to maintain the current status as the most dominant economic and military power. Therefore, the U.S. is eager to impose high rate of tariffs to prevent China from

the further development in advanced manufacturing in order to sustain the current economic status.

2.2.3 Timeline of the US – China Trade War

During the 45th presidential election campaign, the current US President Donald Trump blamed China for stealing jobs from America, devaluing its currency yuan, and creating unfavorable trade imbalance with US trade. In March 2018, the Trump administration finally determined to impose tariffs on steel and aluminum that China was directly affected by the announcement. Responding to the US aggression, China struck back at the U.S. by imposing tariffs on US imports on April 2nd. After the first tit-for that exchanges between the U.S. and China, both countries continue to retaliate against each other in July, August, and September with implementation of additional tariffs on different products. The following timeline shows how two nations retaliate against each other.

Table 2.3: Timeline of the US - China Trade War

Date	Nations	Action
March 23rd 2018	USA	The Trump administration proposed to impose additional tariffs on steel (25%) and aluminum (10%) for the sake of national security.
April 2nd 2018	China	The Chinese government responded to the US's action by increasing tariffs (ranging from 15% to 25%) on 128 products valued at around US\$3 billion on various imports including pork products, aluminum waste and scrap, and selected fruits and nuts.
July 6th 2018	USA	Imposing tariffs (25%) on US\$34 billions of Chinese imports composed of 818 tariff lines
	China	Imposing tariffs (25%) on US\$34 billions of US imports composed of 545 tariff lines as retaliation
August 23rd 2018	USA	Imposing tariffs (25%) on US\$16 billions of Chinese imports composed of 279 tariff lines
	China	Imposing tariffs (25%) on US\$16 billions of US imports composed of 333 tariff lines as retaliation
September 24th 2018	USA	Imposing tariffs (10%) on US\$200 billions of Chinese imports composed of 5,745 tariff lines (The tariff rate will be raised to 25% from 2019)
	China	Imposing tariffs (ranging from 5 to 10%) on US\$60 billions of US imports composed of 5,207 tariff lines

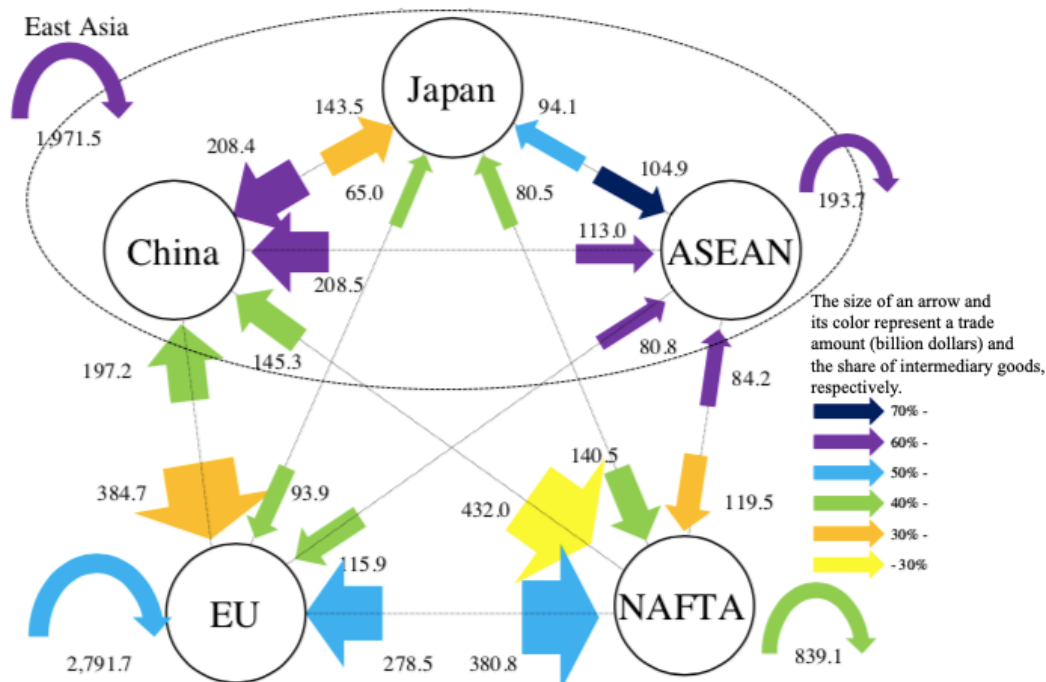
(Source: Brew, Hadfield, Toubia, Goetz, Waltermann, and Condori, 2018)

2.2.4 The Effects on Third Countries: ASEAN

The trade dispute between these two giants to increase and guarantee national welfare and security for each country has been escalated into a global issue; and the effects of the trade war should inevitably hit the existing condition of the international economy even though the

main parties of the trade war are the U.S. and China. As the chart 2.1 depicts the flow of international trade among the major regions, the trade is intricately interrelated in the world as the global supply chain.

Chart 2.1: Flow of Trade between Major Regions Worldwide in 2010



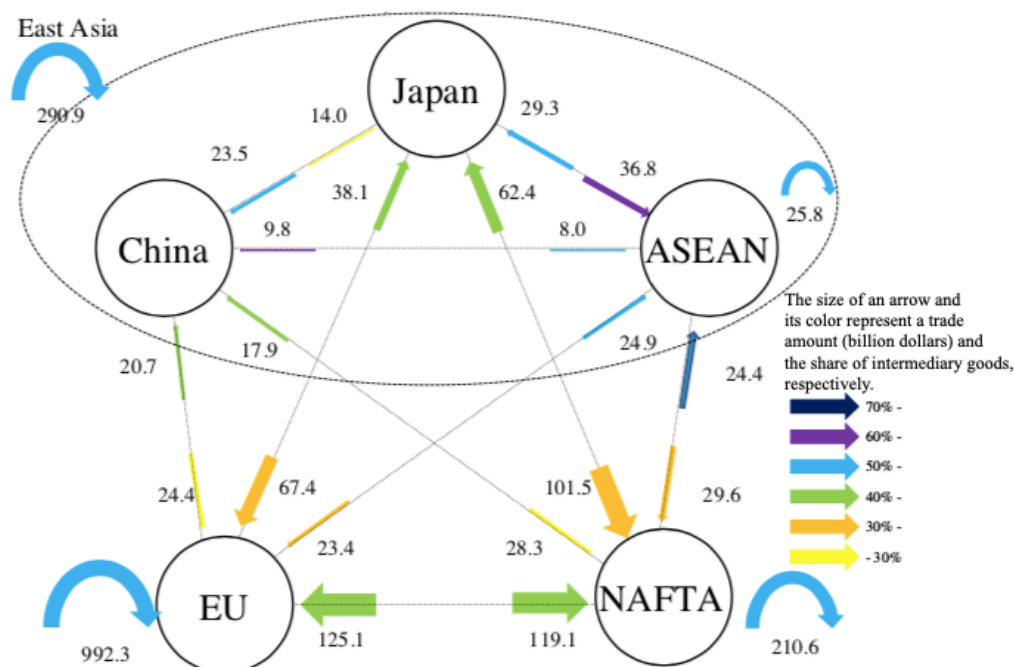
(Source: The Ministry of Economy, Trade and Industry of Japan, 2012)

Therefore, the recession in one of the regions could easily affect on the economic condition of other regions. According to the IMF, US GDP will be expected to drop by about 0.2% after the implementation of additional tariffs on imports from China, and Chinese GDP will also drop by 1.6% over the first two years (Trump tariffs will hurt global growth, 2018). The economic downturn of the two economic giants would give either positive or negative impacts on the world economy. The OCBC Bank reports that the trade war could lower global economic growth by 1 – 1.5% in the medium term according to OECD (Trade tariffs & its impact on ASEAN, 2018). Depending on the degree of economic integration with both the U.S. and China, the effects of the trade war may significantly differ.

In addition to that, as a tendency of trade structure, China tends to import intermediate goods and export final goods to overseas while the U.S. tends to import final goods (The Ministry of Economy, Trade and Industry of Japan, 2012). This tendency could be crucial to consider the effects of the trade war on third countries because the demand of intermediate goods will decline when the tariff is imposed on Chinese final goods embedding the intermediate goods from third countries.

Among the major actors in the world economy, ASEAN is one of the regions that economic integration has been advanced in recent decades. Comparing the Chart 2.2 below, which describes the flow of international trade among the major regions in 1990, to the Chart 2.1 above, the trade amount of ASEAN including both import to and export with other regions such as the U.S. and China has leaped. This could be considered as the progress of economic integration for the ASEAN region.

Chart 2.2: Flow of Trade between Major Regions Worldwide in 1990



(Source: The Ministry of Economy, Trade and Industry of Japan, 2012)

Table 2.4: Trade Amount of ASEAN with NAFTA/China in 1990 and 2010

	NAFTA		China	
	Import	Export	Import	Export
1990	24.4	29.6	8.0	9.8
2010	84.2	119.5	113.0	208.5

in billion US dollar

(Source: The Ministry of Economy, Trade and Industry of Japan, 2012)

On the other hand, it also implies that the region could be affected by the trade war more than ever before because the region has been more dependent on the condition of the world economy. Moreover, ASEAN is the region that exports relatively lots of intermediate goods to China based on the Chart 2.1. This trade structure might also induce economic effects on ASEAN. ASEAN nations could be the region that should be aware of how the US – China trade war will give impacts on its region. Therefore, this paper focuses on the economic effects brought by the trade war on ASEAN countries.

2.3 ASEAN

2.3.1 Basic Information of ASEAN

The Association of Southeast Asian Nations, ASEAN, was established on 8 August 1967 in Thailand by 5 countries Indonesia, Malaysia, Philippines, Singapore, and Thailand. Brunei Darussalam, Vietnam, Lao PDR(Laos), Myanmar, and Cambodia joined one after the other making up what is ASEAN today. For the sake of economic, social, political, security, and cultural prosperity in Southeast Asian region, ASEAN aims to pursue and promote close cooperation by active collaboration and mutual assistance through joint endeavors of member states (Establishment, n.d.). Since its formation of ASEAN, member states have achieved significant economic growth over the decades. If ASEAN were one economy, it would have combined nominal GDP of about \$2.6 trillion which makes it collectively the third largest economy in Asia and the seventh largest in the world (MedemiruASEAN, 2018).

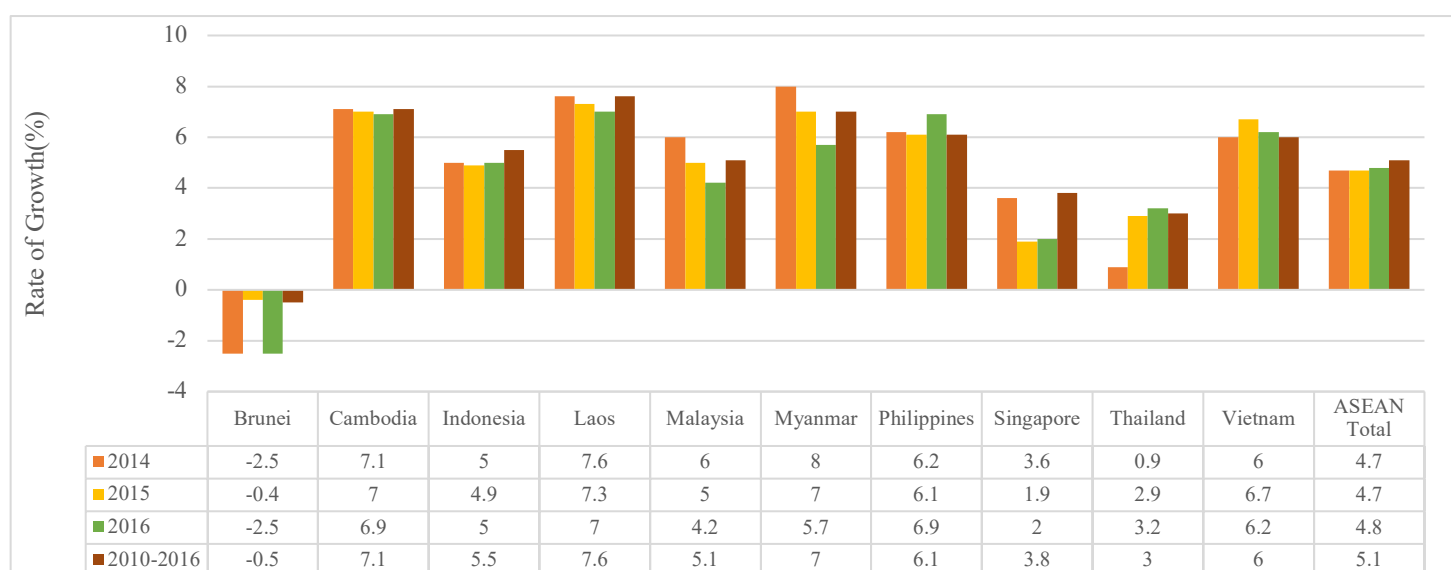
One of the most notable features of ASEAN is the diversity of the economic status within the region. In ASEAN nations, the status of economic development remarkably differs. As a leading economy of ASEAN, Singapore is one of the wealthiest countries whose GDP per capita has risen to US \$61,000 which is the seventh highest in the world according to IMF. Malaysia and Thailand have suffered from a long-term stagnant economic status, which the phenomenon is called the middle-income trap, in the last several decades. In order for ASEAN to advance its economic presence, Malaysia and Thailand need to overcome the middle-income trap by achieving further economic breakthrough. Emerging nations such as Cambodia, Myanmar, and Vietnam have recently accomplished miraculous economic growth from one of the poorest in the world; the average GDP growth rates in recent years for each country are about 6 to 7% per a year. Those emerging nations certainly contributes to economic development of entire ASEAN. Brunei mostly relies on export of crude oil and natural gas accounting over half of GDP share; therefore, the GDP fluctuates depending on the oil price (ASEAN Statistical Yearbook 2016/2017, 2017).

Table 2.5: GDP at Current Price in US\$ Millions, 2014 – 2016

	2014	2015	2016
Brunei	17,103	12,943	11,206
Cambodia	16,689	18,091	19,194
Indonesia	889,385	855,411	931,216
Laos	13,274	14,420	15,903
Malaysia	337,461	294,457	299,632
Myanmar	65,574	64,001	68,636
Philippines	285,158	289,985	311,453
Singapore	306,343	296,839	296,977
Thailand	406,491	399,646	407,048
Vietnam	186,224	193,407	198,196
ASEAN Total	2,523,701	2,439,200	2,559,463

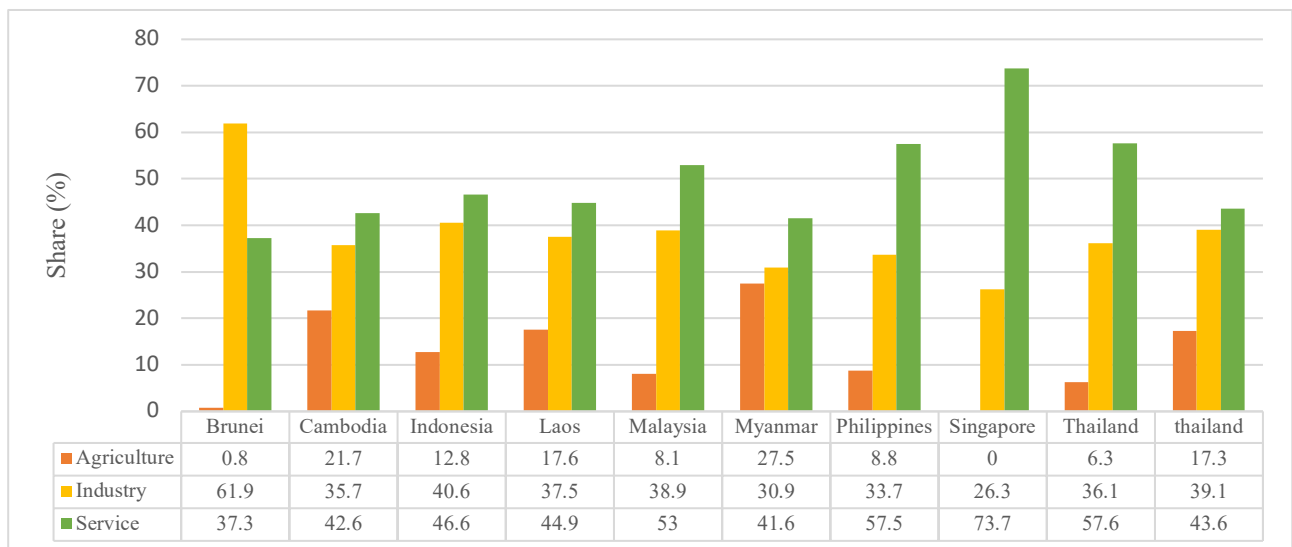
(Source: ASEAN Statistical Yearbook 2016/2017, 2017)

Chart 2.3: Rate of Real GDP Growth, 2014 – 2016 and Average



(Source: ASEAN Statistical Yearbook 2016/2017, 2017)

Chart 2.4: GDP Share of Major Group of Economic Sectors, 2016



(Source: ASEAN Statistical Yearbook 2016/2017, 2017)

2.3.2 Trade Structure of ASEAN Nations

As the status of economic development is different in each country in ASEAN, the trade structure of each nation including the trade relation with the U.S. and China is also diversified. The Table 2.6 shows the top 3 trading partners of each ASEAN nation. The countries trading with the U.S. and China more may be affected more by the trade between them. In addition to that, the Table 2.7 shows the contents of exporting products in each ASEAN country to China. The countries that exports more intermediate goods to China may be negatively influenced by the trade war. In the table 2.7, the intermediate goods is shaded by grey color.

Table 2.6: The Top 3 Trading Partners of ASEAN Nations in 2016

	No.	Import	Share (%)	Export	Share (%)
Brunei	1	Singapore	23.72%	Japan	36.45%
	2	USA	19.06%	South Korea	14.84%
	3	Malaysia	15.88%	Thailand	13.05%
Cambodia	1	Thailand	27.09%	USA	16.83%
	2	China	25.03%	Germany	9.29%
	3	Vietnam	13.56%	UK	7.59%
Indonesia	1	China	21.53%	China	11.87%
	2	Singapore	17.96%	USA	11.48%
	3	Japan	8.19%	Japan	10.59%
Laos	1	Thailand	66.01%	Thailand	44.37%
	2	China	16.51%	China	30.00%
	3	Vietnam	7.66%	Vietnam	8.16%
Malaysia	1	China	19.78%	China	18.74%
	2	Singapore	19.51%	USA	14.20%
	3	Japan	6.98%	Singapore	11.85%
Myanmar	1	China	37.20%	China	33.19%
	2	Thailand	18.83%	Thailand	18.68%
	3	Singapore	10.22%	India	8.64%
Philippines	1	China	28.21%	China	21.93%
	2	Japan	9.49%	Japan	15.46%
	3	Taiwan	8.18%	USA	12.69%
Singapore	1	China	14.95%	China	13.04%
	2	Malaysia	10.49%	Hong Kong	11.39%
	3	USA	9.63%	Malaysia	10.64%
Thailand	1	China	20.25%	China	15.62%
	2	Japan	14.83%	USA	11.47%
	3	Singapore	6.84%	Japan	8.47%
Vietnam	1	China	28.04%	USA	19.23%
	2	South Korea	15.99%	China	17.09%
	3	Japan	6.77%	Japan	7.14%

(Source: Atlas of Economic Complexity, n.d.)

Table 2.7: The Top 3 Exporting Products to China from ASEAN Nations in 2016

	No.	Products	Share (%)
Brunei	1	Petroleum oils	56.53%
	2	Chemicals & Plastics	25.77%
	3	Petroleum gases	14.19%
Cambodia	1	Tanned fur skin	17.39%
	2	Liquid Crystal Device	12.76%
	3	Rice	8.70%
Indonesia	1	Coal	10.58%
	2	Lignite	9.93%
	3	Palm oil	8.49%
Laos	1	Copper ore	24.20%
	2	Unspecified	17.65%
	3	Bananas	11.17%
Malaysia	1	Electronic integrated circuit	50.23%
	2	Semiconductor devices	5.69%
	3	Computers	3.39%
Myanmar	1	Petroleum gas	40.17%
	2	Sugar cane	16.24%
	3	Tin ore	8.45%
Philippines	1	Electronic integrated circuit	35.04%
	2	Computers	13.76%
	3	Parts of machines	6.26%
Singapore	1	Electronic integrated circuit	33.18%
	2	Petroleum	6.31%
	3	Polymers of ethylene	4.58%
Thailand	1	Computers	11.35%
	2	Electronic integrated circuit	9.03%
	3	Precious stones	5.87%
Vietnam	1	Unspecified	26.36%
	2	Electronic integrated circuit	12.81%
	3	Telephones	5.95%

(Source: Atlas of Economic Complexity, n.d.)

2.4 Hypothesis

Based on the information so far, one hypothesis can be generated to estimate the economic effects of the trade war on ASEAN nations. First of all, the degree of economic integration between each country and both the U.S. and China is important due to the

interrelation of global network in the world economy. Second, the countries exporting intermediate goods to China may be negatively influenced by the trade war because of the trade structure of China: importing intermediate goods from ASEAN and exporting final goods to overseas. Based on the hypothesis, it could be expected that Malaysia, Philippines, and Singapore may be the countries that indicate the negative effect by the trade war. In order to testify the hypothesis, the statistical evidence of economy-wide effects brought by the trade war on each ASEAN nation will be necessary; however, the researches to quantify the economy-wide effects by the trade war on each ASEAN nation have not been conducted yet even though the researches to estimate the effects on the U.S., China, and other third nation exist.

2.5 The GTAP Model Assessments: Previous Researches

As a previous research to investigate the numerical economic effects of the US – China trade war on third nations, Janine Dixon examined the effects on Australia of the 45% US tariffs imposed on Chinese manufacturing imports and Chinese retaliation against the US tariffs by utilizing the GTAP model, multi-regional CGE model (Dixon, 2017). Both the U.S. and China are the two largest trading partners for Australia in terms of both imports and exports; therefore, the trade war between them is a huge concern for Australia to possibly confront unanticipated economic recession. In order for Australia to prepare for unexpected economic damage, it is vital to calculate possible quantitative shocks to analyze for a breakthrough against the issue. The GTAP model provides the numerical macroeconomy-wide effects such as change in GDP and terms-of-trade effects. The result of the research shows that both the US and Chinese economy decline about 0.6% and 2% for each in GDP due to the tariffs imposed on each other, and Australia rather expand its GDP by 0.04%. By utilizing the GTAP model, the hypothesis above could be verified with statistical evidences.

Chapter Three

Research Methodology and Data Collection

3.1 Introduction

In this chapter three, the GTAP model, which is utilized to examine the hypothesis in this paper, will be explained. After the explanation for the overview of the structure of the GTAP model, the data settings in this research and the explanation for the economy-wide variables in the simulation will be described as well.

3.2 The GTAP Model

This analysis utilizes the GTAP model, which is a static multi-regional Computable General Equilibrium (CGE) model. CGE models are commonly utilized to investigate the influence of economic policies with an objective to quantify its policy impact. Some of CGE models are multi-regional analysis that examine the effect of global economic policies while other CGE models focus on economic effect of policies in a single country. Among numerical analysis methods, CGE models are widely employed by various national and international organizations such as EU Commission, IMF, World Bank, and OECD for economic policy analysis at the sector-level as well as the economy-wide level (Böhringer, Rutherford, and Wiegard, n.d.).

The Global Trade Analysis Project (GTAP), coordinated by the Center for Global Trade Analysis in Purdue University's Department of Agricultural Economics, is a global network of researchers and policy makers conducting quantitative analysis of international policy issues. 定量分析

(Global Trade Analysis Project, n.d.). GTAP provides a variety of products including a model, database, and a software for multi-regional general equilibrium analysis. + 均衡分析

The GTAP model is a standard CGE model, which depicts the behavior of households, governments, and global sectors across each economy in the world. As a multi-regional model, each economy is interlinked through international trade in the model. Prices and quantities are

simultaneously determined in factor markets and commodity markets by the equilibrium conditions specified by the economic agents and the structure of international trade (Tawan, 2005). The database, which the latest version is 9A, contains information on 140 regions and 57 economic sectors corresponding to the global economy for a specific point of time in three benchmark years: 2004, 2007, and 2011. The model calculates quantitative data of state economy after changing the value of shock variables and its impact on the economy-wide variables based on the database. 関連性 経済全体

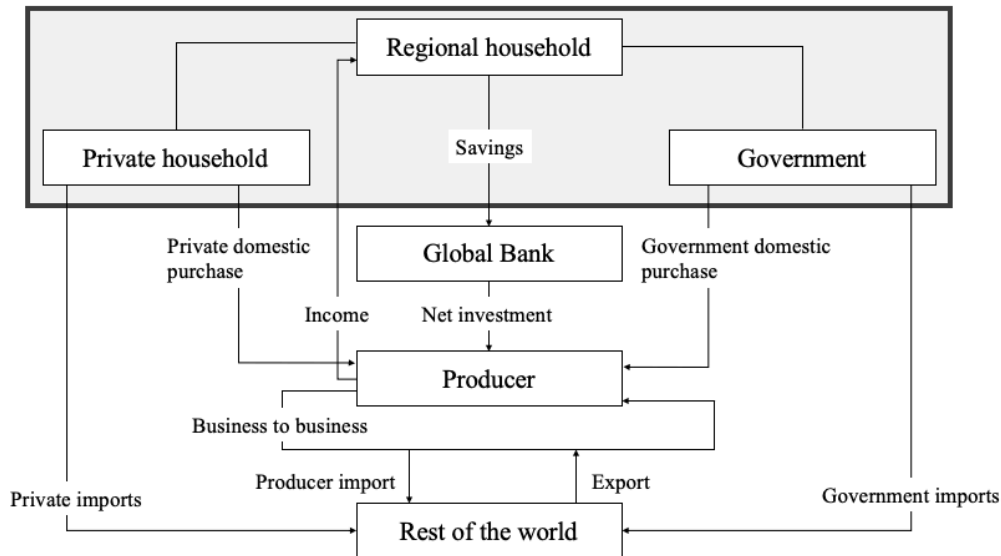
The standard version of the GTAP model includes several key assumptions. First, the market structure is presumed to be perfect competition; therefore, constant return to scale is assumed. 仮定 Second, imperfect substitution in products between the home economy and those abroad among different origins of economies are assumed by the Armington parameters. Third, the amount total labor – one factor endowment is fixed. This means that the model assumes full employment and no unemployment. The amount of total capital is also fixed in the standard GTAP model (Hertel, 1997).

3.3 Structure of the GTAP Model

3.3.1 Overview of the GTAP Model

Under the GTAP model framework, the domestic structure consists of one regional household specified over private consumption, government consumption, and saving activities; production behavior in the region; and global sectors through which all the regions of the world are linked with each other through international trade and investment flow. The structure of the GTAP model is as follows (Fujikawa and Watanabe, 2007).

Chart 3.1: Structure of GTAP Model (Multi Region Open Economy)



(Source: Fujikawa and Watanabe, 2007)

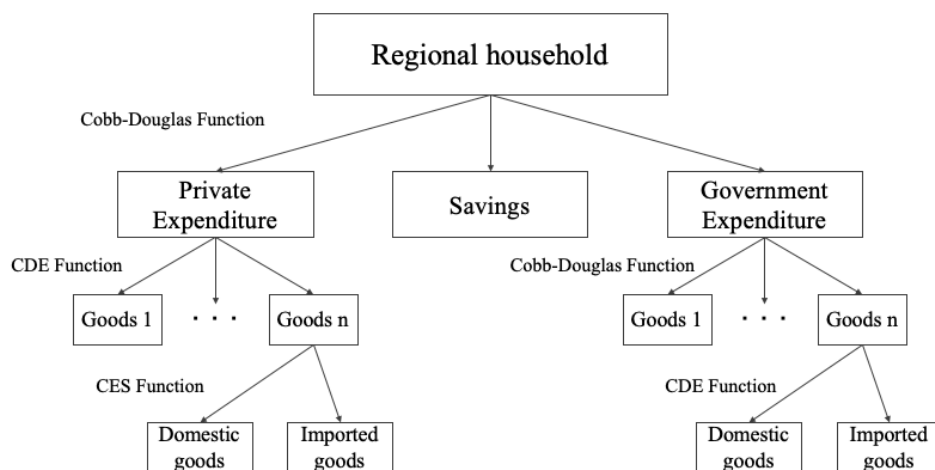
3.3.2 Household Behavior

The regional household is divided into two ^{TPH} ~~entities~~: private household and government. The consumption expenditure is classified into two categories based on entities: private household consumption expenditure and governmental consumption expenditure. In exchange for labor, capital, or land as factors for output, the private household earns income. The government collects taxes that derived from the private household, producer, and international trade. The total income of private household and government is income of regional household. In addition, the amount of income remained after the consumption expenses of the regional household is defined as savings. On the other hand, producer provides goods and services based on production factors, and make investments that corresponds to the regional household consumption expenditure and exports. Finally, in order to equalize regional savings and investments on international level, hypothetical entity called global bank is introduced in the model. Once the savings of a region are sent to the global bank, they are turned to into net regional investment (gross investment – depreciation). The allocation of investment in each country by the global bank differs in line with the rate of

return on investment. The following is the behavior of entities that are the fundamental elements in the economic structure of regions.

The behavior of a regional household is governed basing on the objective to allocate the income to maximize the aggregated utility per capita. Government expenditure is derived from Cobb-Douglas function for demand by products and from a Constant Elasticity of Substitution (CES) production function for demand by domestic and imported products. Also, private household expenditure is determined by a Constant Difference of Elasticity (CDE) expenditure function for expenditure in each category of products, and demand for domestic and imported products (Aroa, Singh, and Mathur, 2015).

Chart 4.2: Structure of Consumer Behavior



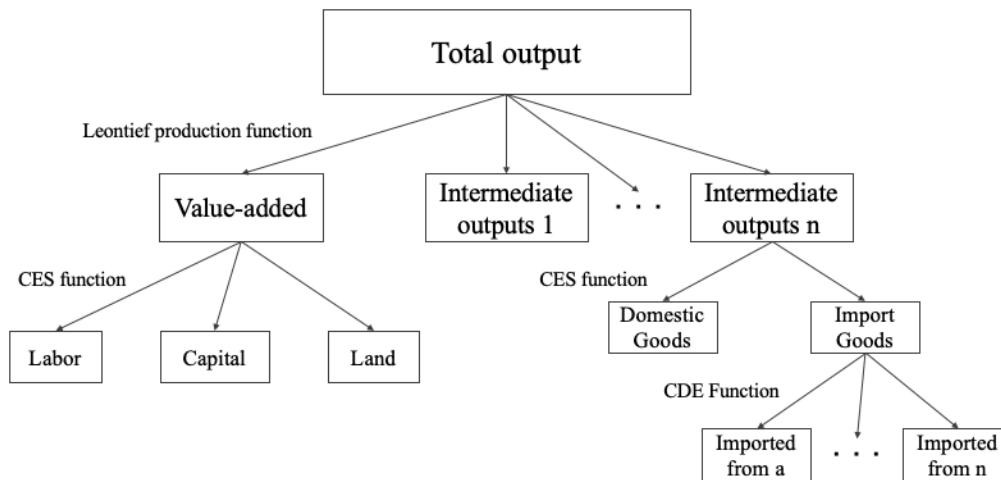
(Source: Hertel, 1997)

3.3.3 Producer Behavior

According to the Leontief production function, intermediate demands and factor demands for total output are derived. Land, capital, and labor are envisioned as factor demands corresponding to the derived total output, and each demand is determined according to the CES production function. The intermediate demands can be divided into domestic

demands and imports by countries. The difference between total output and domestic consumption is exports which is to satisfy the import demands of other regions (Aroa, Singh, and Mathur, 2015).

Chart 4.3: Structure of Producer Behavior



(Hertel, 1997)

3.3.4 Global Bank

In multi-regional CGE model, two global sectors exist; one is the external sector, and the other is Global bank. The external sector accounts for the international trade and transport activities between the regions. The demand for domestic product coming from the external sector generates additional revenue for the domestic producer and it also provides the additional source of intermediate goods from the outside by paying import taxes. The other sector is Global bank, which intermediates between global savings and investments of all regions at same prices. This entity satisfies demand of regional household for savings by selling shares from the regional investment. In the GTAP model, the implication of this entity is that if all the sectors in a multi-region model are in equilibrium, the global investments must be equal to global savings (Aroa, Singh, and Mathur, 2015).

3.4 Economy-wide Effects Measurement

This research measures the economy-wide effects on ASEAN nations by the trade war with four economic variables: equivalent variation (EV), change in GDP, change in terms of trade (ToT), and Balance of Trade (BOT).

3.4.1 Equivalent Variation

EV is typically utilized to evaluate the change in monetary welfare for households after economic shocks. It describes the difference between the expenditure required to obtain the new level of utility at the initial prices and the initial expenditure. The utility level of regional household depends on the per capita household consumption, per capita government expenditure, and per capita savings in the GTAP model. This recognizes that economic welfare of regional households is derived from their present household consumption expenditure and savings which is to maximize a top-level Cobb-Douglas utility function (Hertel, 1997) (Tawan, 2005).

3.4.2 Real Gross Domestic Product

GDP is defined as monetary measure of the total value of all the final goods and services produced in a specific period of time within a country; therefore, GDP represents an overall national economic activity including all private and public consumption, investments, and foreign trade.

3.4.3 Terms-of-Trade

Terms-of-Trade (ToT) is defined as the amount of imported goods which an economy can purchase per unit of export goods. Countries can benefit from the improvement of ToT since the improvement can be interpreted as more imports for any given level of exports that the countries can purchase. One of the factors that ToT can be influenced is changes in price of both import and export goods.

3.4.4 Balance of Trade

Balance of Trade (BOT) is the calculation of exports of a country minus its imports over the certain period of time to describe national economy. As one of the measurements, it represents the relative strength of national economy comparing to other nations.

3.5 Experimental Design and the Research Scenarios

The following tables describe the experimental design in terms of regional, industrial, and scenario's settings.

3.5.1 Region

Table 3.1: Regional Setting GTAP Model

No.	Region Description	Countries in GTAP database
1	USA	USA
2	China	China
3	Brunei Darussalam	Brunei Darussalam
4	Cambodia	Cambodia
5	Indonesia	Indonesia
6	Laos	Lao People's Democratic Republic
7	Malaysia	Malaysia
8	Philippines	Philippines
9	Singapore	Singapore
10	Thailand	Thailand
11	Vietnam	Vietnam
12	Rest of World	Australia, New Zealand, Rest of Oceania, Hong Kong, Japan, Korea, Mongolia, Taiwan, Rest of East Asia, Rest of Southeast Asia, Bangladesh, India, Nepal, Pakistan, Sri Lanka, Rest of South Asia, Canada, Mexico, Rest of North America, Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela, Rest of South America, Costa Rica, Guatemala, Honduras, Nicaragua, Panama, El Salvador, Rest of Central America, Dominican Republic, Jamaica, Puerto Rico, Trinidad and Tobago, Caribbean, Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherland, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom, Switzerland, Norway, Rest of EFTA, Albania, Bulgaria, Belarus, Croatia, Romania, Russian Federation, Ukraine, Rest of Eastern Europe, Rest of Europe, Kazakhstan, Kyrgyzstan, Rest of Former Soviet Union, Armenia, Azerbaijan, Georgia, Bahrain, Islamic, Republic of Iran, Israel, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, Turkey, United Arab Emirates, Rest of Western Asia, Egypt, Morocco, Tunisia, Rest of North Africa, Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Ghana, Guinea, Nigeria, Senegal, Togo, Rest of Western Africa, Central Africa, South Central Africa, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Tanzania, Uganda, Zambia, Zimbabwe, Rest of Eastern Africa, Botswana, Namibia, South Africa, Rest of South African Custom, Rest of the World

3.5.2 Sectors

Table 3.2: Sector Setting GTAP Model

No.	Sector Description	Sector Description
1	Grains and Crops	Paddy rice, Wheat, Cereal grains nec, Vegetable, Fruit, Nuts Oil Seeds, Sugar Cane, Sugar beet, Plant-based fibers, Crops nec, Processed rice
2	Livestock and Meat Products	Cattle, Sheep, Goat, Horses, Animal products nec, Raw milk, Wool, Silk-worm cocoons, Meat: cattle, sheep, goats, horse, Meat products nec
3	Forestry	Forestry
4	Fishing	Fishing
5	Mining and Extraction	Coal, Oil, Gas, Minerals nec
6	Petroleum and coal products	Petroleum, Coal products
7	Processed Food	Vegetable oils, and fats, Dairy products, Sugar, Food products nec, Beverages and tobacco products
8	Textiles and Clothing	Textile, Wearing apparel, Leather products
9	Light Manufacturing	Wood products, Paper products,
10	Chemical, Rubber, Plastic products	Chemical, Rubber, Plastic products
11	Steel Products	Mineral products nec, Ferrous metals, Metals nec, Metal products
12	Auto	Motor vehicles and parts
13	Electronic equipment	Electronic equipment
14	Heavy Manufacturing	Transport equipment nec, Machinery and equipment nec, Manufactures nec
15	Utilities and Construction	Electricity, Gas manufacture, Distribution, Water, Construction
16	Transport and Communication	Trade, Transport nec, Sea transport, Air transport, Communication
17	Other Services	Financial services nec, Insurance, Business services nec, Recreation and other services, Public Admin/ Defense/Health/Education, Dwellings

3.5.3 The Research Scenarios

By utilizing the GTAP model mentioned above, the simulations are conducted to examine 4 following scenarios, which have been happened in 2018 for real.

Table 3.3: Scenarios Setting GTAP Model

Scenarios	Nation	Date	Action
Scenario 1	US	March 23rd 2018	Additional tariffs by 25% on [Steel Product]
	China	April 2nd 2018	Additional tariffs by 15% on [Grains Crops, Processed Food] Additional tariffs by 25% on [Meat Livestock, Steel Product]
Scenario 2	US	July 6th 2018	Additional tariffs by 25% on [Auto, Electronics, Heavy Manufacturing, Trans Communication]
	China	July 6th 2018	Additional tariffs by 15% on [Chemicals]
Scenario 3	US	August 23rd 2018	Additional tariffs by 25% on [Extraction, Petroleum, Chemicals]
	China	August 23rd 2018	Additional tariffs by 25% on [Extraction, Petroleum, Light Manufacturing, Chemicals, Auto, Heavy Manufacturing, Utility Construction]
Scenario 4	US	September 24th 2018	Additional tariffs by 10% on [Grains Crops, Meat Livestock, Fishing, Processed Food, Text Wapp, Light Manufacturing, Utility Construction]
	China	September 24th 2018	Additional tariffs by 5% on [Electronics] Additional tariffs by 10% on [Text Wapp] Additional tariffs by 20% on [Grains Crops] Additional tariffs by 25% on [Grains Crops] Additional tariffs by 30% on [Auto] Additional tariffs by 35% on [Meat Livestock, Extraction, Light Manufacturing, Chemicals, Steel Product, Heavy Manufacturing]

Chapter Four

Empirical Results and Major Findings

4.1 Introduction

In this chapter four, the empirical results will be analyzed based on the quantitative simulation conducted by the GTAP model for each scenarios of the economy-wide effects.

4.2 EV

As a result of the simulations, it is obvious that most of ASEAN nations benefit from the trade war in terms of EV, except for Brunei and Cambodia. Among the ASEAN nations, Malaysia and Thailand exploit from the opportunities the most; this may disconfirm the hypothesis in terms of EV that Malaysia and Singapore are expected to receive negative effects by the trade war. China is damaged the most by the trade war even though the U.S. obtains positive effects in the scenario 2 and 3.

Table 4.1: EV in Nations by Scenarios

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
US	-5129.24	17500.84	656.22	-13350.74
China	-5298.29	-70733.64	-78382.46	-78323.82
Brunei	-2.47	-20.24	-3.70	4.20
Cambodia	-0.50	-4.66	-14.83	-45.74
Indonesia	66.38	114.94	518.83	753.52
LaoPDR	1.75	4.35	9.16	11.36
Malaysia	75.21	1381.79	1557.14	1766.57
Philippines	41.84	585.48	607.21	652.68
Singapore	-20.81	631.33	862.16	1023.80
Thailand	124.40	1408.73	1610.84	1800.18
Vietnam	99.42	790.79	820.94	835.48
RestofWorld	8394.58	44682.54	63678.11	75177.77

4.3 The Change in GDP

As well as EV, most of the ASEAN nations also benefit in terms of the change in GDP; the hypothesis is disproved. Cambodia, however, does not apparently gain the positive effects in the scenario 3 and 4; especially the negative effect is larger in the scenario 4. Both the U.S. and China decrease its GDP; this may show that a conflict of trade war hinders the economic development of major actors conflicting in a trade war. This fact might show that the progress of Chinese policy: Made in China 2025 could possibly be forced to delay as the U.S. aims.

Table 4.2: % Change in GDP in Nations by Scenarios

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
US	-0.0062	-0.0188	-0.0315	-0.0367
China	-0.0436	-0.2327	-0.3217	-0.3552
Brunei	0.0014	0.0045	0.0088	0.0117
Cambodia	0.0013	0.0105	-0.0004	-0.0438
Indonesia	0.0008	0.0001	0.0041	0.0067
LaoPDR	0.0059	0.0490	0.0569	0.0608
Malaysia	0.0053	0.0452	0.0489	0.0559
Philippines	0.0003	0.0070	0.0097	0.0129
Singapore	-0.0004	0.0080	0.0098	0.0108
Thailand	0.0045	0.0915	0.1025	0.1091
Vietnam	0.0120	0.1401	0.1453	0.1374
RestofWorld	0.0053	0.0336	0.0421	0.0456

4.4 The Change in ToT

The simulation results for ToT mostly coincide with the results of EV and change in GDP. Cambodia is the only country among the ASEAN nations that ToT deteriorates through the all scenarios. Malaysia and Philippines improve the value relatively larger than other countries. China, on the other hand, worsens its ToT through the all scenarios as well as Cambodia. Comparing to China, the U.S. obtains both positive and negative value in the scenarios.

Table 4.3: % Change in ToT in Nations by Scenarios

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
US	-0.1722	0.5831	0.0349	-0.4743
China	-0.1454	-2.9514	-3.0963	-3.0181
Brunei	-0.0378	-0.0801	0.0940	0.1578
Cambodia	-0.0052	-0.0738	-0.1624	-0.4118
Indonesia	0.0248	0.2244	0.3598	0.4244
LaoPDR	0.0181	-0.0091	0.1039	0.1502
Malaysia	0.0244	0.5913	0.6467	0.7162
Philippines	0.0477	0.6584	0.6805	0.7274
Singapore	-0.0091	0.3112	0.3574	0.3881
Thailand	0.0425	0.4753	0.5309	0.5889
Vietnam	0.0705	0.4846	0.5038	0.5284
RestofWorld	0.0386	0.2582	0.3422	0.3945

4.5 The Change in BOT

Through the all scenarios, it could be assumed that BOT of ASEAN nations tend to become negative as the trade war between the U.S. and China escalates. Comparing the scenario 1 and 4, the US and Chinese BOT improve in the scenario 4 while the trade deficits of ASEAN nations tend to rise in the scenario 4 as well. Therefore, as the U.S. originally desires, the US trade deficit improves somewhat. Instead of that, the rest of the world including ASEAN nations seems to incur the burden. Moreover, in terms of the electronics industry, China always receive huge negative effects while ASEAN nations such as Malaysia

and Singapore that export electronic intermediate goods gain huge positive effects. This result is completely against the hypothesis.

[Scenario 1]

Table 4.4: Change in Balance of Trade in Nations by Sectors (Scenario 1)

	US	China	Brunei	Cambodia	Indonesia	LaoPDR
Grains Crops	-468.965	-200.945	-9.039	22.386	-805.705	16.918
Meat Livestock	-325.852	551.125	-4.812	2.539	-59.056	-13.025
Forestry	195.601	-798.917	-0.136	3.324	11.808	26.227
Fishing	-165.664	6.840	-1.702	2.656	72.858	-0.050
Extraction	-32166.160	-34348.734	797.786	-1.549	5203.970	49.371
Petroleum	3893.755	-302.500	-17.481	-141.537	-2678.120	-17.776
Processed Food	-2802.968	263.606	-28.958	-91.036	1760.488	-35.357
Text Wapp	-13164.697	29586.701	-15.035	381.989	1039.570	7.410
Light Manufacturing	-2484.836	4179.387	-19.083	-19.745	705.719	22.578
Chemicals	2863.272	-2194.888	-13.231	-56.763	157.840	-32.426
Steel Product	-4810.499	-19029.260	-40.753	-80.727	-211.701	17.703
Auto	-9628.973	-2708.272	-27.687	-32.547	-514.089	-51.602
Electronics	-18277.065	28505.178	-10.914	-24.607	-342.845	-13.703
Heavy Manufacturing	-3244.335	26576.305	-125.562	-146.019	-2832.705	-94.462
Utility Construction	367.196	485.974	-1.258	-18.939	-5.206	12.636
Trans Communication	2529.882	4162.716	0.469	63.053	-237.786	15.734
Other Services	9806.816	45.036	-40.855	39.602	-811.198	3.431

Table 4.5: Change in Balance of Trade in Nations by Sectors (Scenario 1) (Continued)

	Malaysia	Philippines	Singapore	Thailand	Vietnam	RestofWorld
Grains Crops	-633.255	-9.097	-160.116	659.051	400.343	-3645.113
Meat Livestock	-45.412	-60.989	-130.657	177.449	-112.095	-642.674
Forestry	88.159	-0.679	-1.931	-6.158	-31.407	278.863
Fishing	3.908	18.342	-25.578	5.241	-9.002	-226.673
Extraction	678.559	-830.645	-3911.937	-3862.873	772.487	50810.051
Petroleum	-718.149	-404.959	2121.921	556.251	-1094.531	-5846.561
Processed Food	1729.368	-211.472	-167.646	1246.882	-67.612	-6656.672
Text Wapp	-176.538	-129.397	-274.535	618.205	1184.052	-23838.522
Light Manufacturing	352.024	-85.669	-103.187	102.858	213.934	-7386.463
Chemicals	508.100	-763.342	2280.623	1377.293	-1204.951	-13919.370
Steel Product	-514.179	-191.351	-743.231	-2334.607	-1092.882	23532.068
Auto	-393.471	-230.075	-218.825	965.612	-307.992	9186.203
Electronics	2182.863	800.358	3054.558	1047.884	29.331	-19187.691
Heavy Manufacturing	-1121.290	-502.050	-403.910	-427.396	-1172.126	-26502.629
Utility Construction	107.557	8.372	-166.718	-103.781	-19.175	-666.657
Trans Communication	1127.431	398.423	3880.469	1161.048	36.585	61428.840
Other Services	-256.859	183.789	1298.284	-614.991	-125.087	-9527.962

[Scenario 2]

Table 4.6: Change in Balance of Trade in Nations by Sectors (Scenario 2)

	US	China	Brunei	Cambodia	Indonesia	LaoPDR
Grains Crops	-896.668	1682.294	-9.200	23.767	-774.525	15.820
Meat Livestock	-526.202	1785.184	-4.906	3.198	-51.635	-12.951
Forestry	180.827	-601.048	-0.110	3.389	11.067	24.908
Fishing	-183.628	79.564	-1.843	2.700	72.113	-0.053
Extraction	-31851.949	-28591.834	796.349	-1.655	4980.346	47.805
Petroleum	4144.817	848.186	-17.690	-147.482	-2722.968	-18.379
Processed Food	-3561.408	5057.387	-29.868	-89.672	1690.735	-35.626
Text Wapp	-17802.754	68750.172	-15.614	335.054	93.961	-1.819
Light Manufacturing	-4441.456	15755.688	-19.768	-19.257	518.991	19.970
Chemicals	-13227.751	36949.738	-14.422	-54.312	-102.904	-33.778
Steel Product	-10181.466	17790.881	-41.903	-82.177	-499.089	17.783
Auto	-7920.462	-2633.649	-28.743	-31.164	-527.607	-53.750
Electronics	26305.943	-57134.766	-11.108	-24.058	319.949	-13.128
Heavy Manufacturing	40272.242	-26744.744	-131.479	-136.484	-2701.603	-91.791
Utility Construction	368.169	1861.106	-0.607	-18.590	-4.658	16.249
Trans Communication	3926.685	8555.566	2.358	80.178	-226.004	18.024
Other Services	8107.910	8656.860	-38.311	50.563	-844.807	5.038

Table 4.7: Change in Balance of Trade in Nations by Sectors (Scenario 2) (Continued)

	Malaysia	Philippines	Singapore	Thailand	Vietnam	RestofWorld
Grains Crops	-574.098	-63.963	-156.474	675.059	361.421	-5063.221
Meat Livestock	-49.426	-77.346	-137.426	178.411	-122.923	-1654.929
Forestry	81.169	-1.181	-1.715	-5.566	-27.395	121.374
Fishing	0.846	16.764	-27.041	6.741	-11.702	-285.794
Extraction	586.700	-848.852	-3766.312	-3751.911	718.494	45263.563
Petroleum	-714.328	-431.307	2186.422	499.909	-1136.509	-7200.229
Processed Food	1434.232	-304.208	-198.202	1117.414	-176.145	-10125.853
Text Wapp	-398.197	-308.130	-322.159	-314.510	704.258	-56887.473
Light Manufacturing	69.381	-138.174	-162.340	-89.501	72.575	-16731.574
Chemicals	-484.937	-865.848	1472.256	542.400	-1198.242	-33843.840
Steel Product	-1196.962	-430.995	-920.329	-3131.116	-1305.005	-6914.362
Auto	-548.315	-273.480	-246.099	895.824	-357.605	8046.042
Electronics	5372.541	981.495	5638.844	3465.788	129.471	13776.580
Heavy Manufacturing	-2316.840	-601.213	-703.156	-799.928	-1011.085	-11565.498
Utility Construction	30.222	5.085	-188.643	-145.468	-32.626	-1890.238
Trans Communication	858.076	328.432	3484.160	811.166	5.341	54994.477
Other Services	-624.086	100.120	776.265	-870.178	-202.071	-15117.320

[Scenario 3]

Table 4.8: Change in Balance of Trade in Nations by Sectors (Scenario 3)

	US	China	Brunei	Cambodia	Indonesia	LaoPDR
Grains Crops	-4115.521	6574.157	-0.415	1.380	-13.686	-1.782
Meat Livestock	-922.277	2538.584	-0.237	2.141	3.443	-1.068
Forestry	72.669	231.067	0.013	0.085	-2.228	-3.914
Fishing	-10.016	90.695	-0.184	0.154	-0.994	-0.007
Extraction	-475.207	12816.441	21.414	-0.112	-164.125	0.563
Petroleum	575.680	1253.902	-0.791	-10.859	-145.702	-1.528
Processed Food	1288.210	5394.478	-1.664	1.663	-116.685	-2.923
Text Wapp	-1386.460	42684.875	-1.272	-56.324	-1204.683	-12.338
Light Manufacturing	-7425.417	16964.850	-0.766	3.233	-8.575	3.924
Chemicals	-2167.986	11218.584	-0.209	7.086	24.185	-1.623
Steel Product	1995.055	13187.491	-1.898	-2.551	-282.883	0.068
Auto	7176.438	1502.556	-2.372	1.218	-63.213	-4.068
Electronics	51644.016	-79992.836	-0.751	0.384	475.030	0.288
Heavy Manufacturing	25593.801	-22355.647	-11.046	9.129	-225.643	-0.836
Utility Construction	413.339	1686.288	0.365	0.339	-6.738	3.628
Trans Communication	5953.471	5402.860	-3.029	21.702	-56.511	1.359
Other Services	10723.344	9808.012	-1.678	13.370	-115.990	0.519

Table 4.9: Change in Balance of trade in Nations by Sectors (Scenario 3) (Continued)

	Malaysia	Philippines	Singapore	Thailand	Vietnam	RestofWorld
Grains Crops	31.511	-49.559	0.698	113.115	-12.584	-1823.745
Meat Livestock	-5.964	-20.474	-8.847	-13.995	-16.045	-1462.989
Forestry	-6.479	-0.754	0.100	-1.737	2.116	-275.038
Fishing	-3.329	-1.460	-1.988	1.010	-3.291	-90.602
Extraction	-114.082	-63.583	-50.075	-113.283	-46.182	-8892.977
Petroleum	-29.195	-39.542	151.377	-40.903	-80.080	-1757.410
Processed Food	-262.965	-129.950	-32.152	-178.326	-141.886	-6051.050
Text Wapp	-250.491	-213.151	-56.622	-1052.518	-608.027	-39330.785
Light Manufacturing	-276.270	-48.304	-52.136	-72.098	-134.959	-9278.914
Chemicals	-668.467	-86.036	-229.995	-419.548	32.425	-5539.402
Steel Product	-502.774	-174.086	-169.118	-726.192	-154.558	-12440.981
Auto	-189.513	-54.726	-29.649	-86.291	-65.397	-7949.569
Electronics	2791.470	69.595	2353.070	2206.052	48.980	21400.373
Heavy Manufacturing	-1332.922	-134.948	-31.761	-592.503	96.012	2688.760
Utility Construction	-72.485	-3.088	-27.101	-52.544	-15.644	-1926.358
Trans Communication	-351.363	-90.263	-786.179	-492.557	-55.035	-18913.523
Other Services	-438.342	-102.881	-572.458	-354.732	-110.834	-18848.332

[Scenario 4]

Table 4.10: Change in Balance of Trade in Nations by Sectors (Scenario 4)

	US	China	Brunei	Cambodia	Indonesia	LaoPDR
Grains Crops	-5172.264	8026.053	-0.563	3.327	-39.572	-1.990
Meat Livestock	-1370.749	2905.089	-0.311	3.928	2.909	-1.511
Forestry	92.833	430.503	0.005	0.061	-3.777	-5.670
Fishing	1.341	84.031	-0.218	0.369	-0.634	-0.009
Extraction	-343.863	12142.430	33.386	0.027	-83.870	2.876
Petroleum	1598.117	1097.635	-1.198	-13.191	-195.602	-2.151
Processed Food	2487.981	4129.833	-2.087	7.096	-51.413	-3.912
Text Wapp	-1183.494	46070.969	-1.741	-89.976	-1469.347	-14.173
Light Manufacturing	-2700.087	7609.052	-0.874	7.000	191.748	7.911
Chemicals	-5290.026	15130.534	0.561	16.541	47.736	-1.765
Steel Product	1096.266	15512.353	-2.976	-0.908	-339.879	-0.132
Auto	10087.739	1814.438	-3.070	2.168	-86.437	-5.025
Electronics	54239.320	-81296.930	-1.042	1.564	431.389	0.024
Heavy Manufacturing	23860.611	-16391.588	-13.699	15.373	-394.955	-3.128
Utility Construction	844.699	1513.752	0.147	1.606	-10.578	3.598
Trans Communication	8789.581	5277.784	-5.307	33.430	-92.099	0.882
Other Services	18019.434	9776.448	-4.209	20.610	-159.165	-0.120

Table 4.11: Change in Balance of Trade in Nations by Sectors (Scenario 4) (Continued)

	Malaysia	Philippines	Singapore	Thailand	Vietnam	RestofWorld
Grains Crops	1.908	-52.021	-1.681	150.714	9.701	-1987.643
Meat Livestock	-9.467	-23.399	-10.181	-23.266	-16.779	-1288.145
Forestry	-12.325	-1.111	0.029	-3.274	-12.120	-455.634
Fishing	-3.671	-1.328	-2.353	0.434	-3.596	-98.930
Extraction	-119.116	-79.028	-112.077	-222.277	-28.605	-7752.372
Petroleum	-51.785	-47.114	180.827	-41.969	-98.485	-2621.494
Processed Food	-178.313	-134.013	-29.289	-165.699	-134.002	-6095.865
Text Wapp	-290.359	-267.776	-64.785	-1153.172	-860.833	-42225.227
Light Manufacturing	-178.208	-30.427	-32.940	13.464	76.572	-4244.525
Chemicals	-558.081	-88.641	-113.135	-138.873	54.314	-6757.686
Steel Product	-478.520	-171.434	-183.959	-774.930	-184.155	-13583.465
Auto	-218.047	-64.091	-31.934	-113.021	-70.488	-11081.635
Electronics	2758.856	94.053	2427.483	2172.754	52.232	20168.815
Heavy Manufacturing	-1527.125	-192.095	99.804	-747.940	67.745	-770.837
Utility Construction	-77.020	-3.367	-31.311	-60.134	-14.989	-2166.403
Trans Communication	-419.545	-109.538	-930.323	-587.580	-63.864	-23713.678
Other Services	-513.147	-124.994	-663.208	-423.646	-122.420	-25805.584

4.6 Major Findings

Based on the quantitative analysis conducted by the GTAP model in this paper, four economy-wide effect variables are derived: equivalent variation, change in GDP, change in terms-of-trade, and change in balance of trade; and the hypothesis that the countries such as Malaysia, Philippines, and Singapore will receive negative effects due to the decline of demand for intermediate goods exported to China was disconfirmed. As one of the major findings, it is notable that the ASEAN nations mostly gain positive effects in EV; especially, Malaysia and Thailand benefit the most. In terms of GDP and ToT, ASEAN nations gain positive effects from the economic shock. On the other hand, only Cambodia records negative effects across all economy-wide variables through all the four scenarios. However, in terms of BOT, as the trade conflict escalates to impose tariffs and retaliate each other, BOT worsens for third countries including ASEAN while the main actors: the U.S. and China improve the trade deficit.

Chapter Five

Conclusion

5.1 Summary

In this paper, the analysis to investigate the numerical economic effects on third countries: ASEAN, by the trade war between the U.S. and China with the GTAP model has been conducted. In the era of globalization, an international trade war could give immense impacts on not only the main states competing but also the rest of the world. The U.S. and China is now the two largest economies in the world; therefore, the influence generated by the trade conflict between the two giants is expected to be massive. ASEAN composed by ten Southeast Asian countries is also one of the possible regions that will be affected by the US – China trade war.

Based on the literature review, one hypothesis was established; the countries that have a strong trade relation with the U.S. and China will be affected more by the trade war, especially the countries exporting intermediate goods to China. For example, Malaysia, Philippines, and Singapore were expected to record negative effects. However, the hypothesis was disproved because the result of quantitative research by the GTAP model demonstrates the positive influence in four economy-wide effects: EV, the change in GDP, the change in ToT, and the change in BOT in ASEAN nations. Moreover, most of the ASEAN nations gain positive results by the trade war based on the research conducted with the GTAP model. On the other hand, as the conflict is accelerated, the BOT may worsen, and trade deficits increase in many ASEAN nations.

5.2 Limitation

In this paper, however, several limitations exist in the process of this research. First of all, the GTAP model that is utilized in this model is a static general equilibrium model, the simulation result cannot reflect dynamic change in a long term. Second, the data of the GTAP

9A is from in 2011; it cannot be desirable to conduct a quantitative research. In addition to that, this simulation excludes Myanmar because the data of GTAP 9A does not include Myanmar even though Myanmar is one of the ASEAN countries. Moreover, the categorization of the economic industries is too rough. For example, in the scenario 4, the U.S. imposed tariffs on 5,745 products imported from China, and China retaliated to impose tariffs on 5,207 products imported from the U.S.. Since the number of sector categorization is limited, all the products must be categorized into the most suitable sector even though the product is not perfectly fit into one of the categories. Therefore, the improvement can be considered to further develop this research. Finally, the limitation exists about the hypothesis as well. It is not possible to clarify if all the intermediate goods importing into China from ASEAN nations would be utilized for final goods combined in China and exported to the U.S. based on all the information in this paper. As the result of the numerical simulation shows, the hypothesis can be also reformed for improvement. These limitations noted are the area of improvement to upgrade this research.

5.3 Future Research Area

In order to develop this study, two suggestions are mentioned in this chapter. First, analysis of economic structure of each ASEAN nation should be more deepened to examine how economic events, such as the international trade war, gives influence on each nation more precisely. With more researches on ASEAN nations to investigate the economic structure of each nation, this study will be more useful because the connection between the economic structure of the nations and the expected economic shock generated by the trade war will be much clearer. After that, the numerical results derived in this research should be utilized to evaluate economic policies implemented in each ASEAN nations if the policies are genuinely effective based on the numerical researches. Another future research area is to analyze dynamic change of ASEAN nations by the trade war. As mentioned in the limitation

part, the GTAP model that is utilized in this model is static general equilibrium model that cannot analyze dynamic change such as a long-term transformation by economic shocks. The GTAP model to analyze the dynamics change exists: the Dynamic GTAP model. By utilizing the Dynamic model, the area of research will be much broader.

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