Impact of US-China Trade War on Thailand's electronic exports

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Arts in International Economics and Finance
Field of Study of International Economics
Faculty Of Economics
Chulalongkorn University
Academic Year 2023

ผลกระทบของสงครามการค้าระหว่างประเทศจีนและสหรัฐอเมริกาต่อการส่งออกสินค้าอิเล็กทรอนิกส์ของประเทศไทย

น.ส.ชนากานต์ เพิ่มทองชูชัย

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตรมหาบัณฑิต
สาขาวิชาเศรษฐศาสตร์และการเงินระหว่างประเทศ สาขาวิชาเศรษฐศาสตร์ระหว่างประเทศ
คณะเศรษฐศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2566

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Field of Study	International Economics and Finance
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ชนากานต์ เพิ่มทองชูชัย : ผลกระทบของสงครามการค้าระหว่างประเทศจีนและสหรัฐอเมริกาต่อการส่งออกสินค้าอิเล็กทรอนิกส์ของประเทศไทย. (Impact of US-China Trade War on Thailand's electronic exports) อ.ที่ปรึกษาหลัก : รศ. ดร.ดนุพล อริยสัจจากร

งานวิจัยฉบับนี้มีวัตถุประสงค์เพื่อศึกษาผลกระทบของสงครามการค้าระหว่างสหรัฐอเมริกาและจีนที่มีผลต่ออุตสาหกรรมการส่งออกสินค้าอิเล็กทรอนิกส์ไทยซึ่งถือว่าเป็นสินค้าหลักในการส่งออก โดยการวิจัยใช้การวิเคราะห์ตารางปัจจัยการผลิต (Input Output Table) เพื่อศึกษาความสัมพันธ์และการมีส่วนร่วมในห่วงโซ่มูลค่าโลก (Global Value Chain) ของอุตสาหกรรมอิเล็กทรอนิกส์ไทย ประกอบกับการวิเคราะห์ผลกระทบทางเศรษฐกิจผ่านแบบจำลองดุลยภาพทั่วไป (Computable General Equilibrium: CGE) โดยใช้แบบจำลอง GTAP ในการจำลองสถานการณ์จากการขึ้นภาษีสินค้าในสงครามการค้าระหว่างสหรัฐอเมริกาและจีน ผลจากการจำลองสถานการณ์แสดงให้เห็นว่า ภาพรวมของเศรษฐกิจไทยได้รับประโยชน์จากสงครามการค้าระหว่างสหรัฐอเมริกาและจีนจากการเบี่ยงเบนทางการค้า (Trade Diversion) โดยมีการขยายตัวของ GDP และสวัสดิการของประเทศ อย่างไรก็ตาม ในภาพรวมของอุตสาหกรรมอิเล็กทรอนิกส์ไทยที่เป็นอุตสาหกรรมเป้าหมายของการศึกษานี้ ได้รับความเสียหายจากการเกิดสงครามการค้าเนื่องจากห่วงโซ่มูลค่าของอุตสาหกรรมอิเล็กทรอนิกส์ไทยที่เป็นอุตสาหกรรมกลางน้ำถึงต้นน้ำ ยังคงต้องพึ่งพาตลาดสหรัฐอเมริกาและจีนเป็นอย่างมาก

สาขาวิชา	เศรษฐศาสตร์และการเงินระหว่างประเทศ	ลายมือชื่อนิสิต .....
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6284023929 : MAJOR INTERNATIONAL ECONOMICS AND FINANCE
KEYWORD: Trade diversion, Supply chain disruption, CGE model, GTAP, US-China Trade war

Chanakarn Permthongchoochai : Impact of US-China Trade War on Thailand's electronic exports. Advisor: Assoc. Prof. DANUPON ARIYASAJJAKORN, Ph.D.

This paper aims to examine how US-China trade war impacts on Thailand's electronics industry which is important to Thai economy in term of export. The study uses input-output table to show the connection of Thailand's electronics sector with other industry through its participation in global value chain. Moreover, the study uses a Computable General Equilibrium (CGE) model by using the reclassified General Trade Analysis Project (GTAP) database to simulate the results from the set-up scenarios. The results from the simulations show that, overall, Thai economy benefits from US-China trade war in term of both GDP and welfare of the country due to the trade diversion effects. However, the main focus sector of this study, which is electronics sector, will experience export reduction from trade war since Thailand electronics industry is in the midstream or upstream of global value chain which depends much on both US and China market.

Field of Study:	International Economics and Finance	Student's Signature .....
Academic Year:	2023	Advisor's Signature .....

ACKNOWLEDGEMENTS

This thesis could not be complete without the supportive, cheerful, and guidance from my important people.

First of all, I would like to express my gratitude and warmest thanks to my thesis advisor, Associate Professor Danupon Ariyasajjakorn, Ph.D. for his advice, patience, supportive and guidance. My thesis could not come this far if I don't have a guidance from him.

Secondly, I really want to thanks to my thesis committee, Associate Professor Chompoonuh Kosalakorn Permpoonwiwat, Ph,D. and Assistant Professor Sineenat Sermcheep, Ph.D., for the question and suggestion for edit my research. My research becomes much better from their comments.

I also thank to my colleagues from Master of Arts in International and Finance (MAIEF) who spend time together and give some feedback and suggestion for my research. And I would like to thanks to MAIEF staff, Ms. Lawan, who always helping me for the process of sending thesis.

Last but not least, I would like to give a special thanks to my family who always support me in every step and always cheer up me.

Chanakarn Permthongchoochai

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Chapter 1

Introduction

1.1 Background of bilateral US-China trade

The trade relation between United States and China had grown significantly after the end of World War II. Since Cold War in 1949, United States seems to have a limit relationship with China (People Republic of China) from the conflict of ideology among Communist and Democracy and maintain a relationship with Taiwan under Jiang Kai Shrek. The diplomatic and trade relation of China and United States still limit until 1971, which it started to have a good sign of their relation after United States sent delegate into China first time after World War II and China granted permanent seat in United Nation Security Council (UNSC). In 1978, China had an important economic reform during Deng Xiao Ping become a president of China which called open economic door policy and this policy makes China economic grows exponentially (Aslam, 2019). China and US trade relation has grown again when US gave China most favor nation (MFN) status that US and China trade each other with a low tariff. Since China granted Most Favor Nation from US in 1999, China became an important trading partner and a main country that export product to US and import product from US. The bilateral trade of these two countries grew even faster in 2001 that China became a member of World Trade Organization (WTO) which it is known as the biggest economic integration organization. After an accession to WTO, China and US became a good partner for each other and succeed from attending international economic system (Meltzer and Shenai, 2019). The growth of bilateral trade among these 2 countries increased extremely while the share of China economy among this period increased

correspondingly to 16 percent of global activities compared to a period before entering WTO which was about 3.4 percent (Wright and Rosen, 2018). Now China is becoming the second largest economy today after United States (Meltzer and Shenai, 2019).

1.2 The beginning of US-China Trade War

Since China became a main player in World economic, US started to see China as a threat rather than a partner of their country. A break point between them started from trade conflicts that China increasingly gained trade surplus from trading with US. From the trade statistic collected from World integrated trade solution show that comparing with China before went in WTO in 2001 that China gained around almost 30 billion dollars trade surplus from trading with US, in 2018 China gained more than 300 billion dollars trade surplus with US. According to figure 1, the graph shows that China gains more trade surplus continuously for trading with US.

Figure 1: China trade with United State since 2001 to 2019

Source: Data from World Integrated Trade Solution (WITS)

Until 2016 the trade tension between US and China was getting worst from the big circumstance that Donald Trump as a president of US had announced in his presidential election campaign to do his promise for sanction along with reduce trade deficit with China. President Trump claimed that China exploits benefit of trade liberalization where China gains unfair bilateral trade from applying unfair trade policy by using currency manipulation and domestic product subsidize to stimulate their exports (Kapustina et al., 2020). Moreover, Trump restates that the rising of China also comes from a technology stealing and intellectual property theft which it affirms that China could be a threat for US. This situation turns into what we called US-China trade war since China and US had retaliated each other for their trade dispute. In early of March 2018 president Trump of US started to apply tariff on China important products that have been send to US such as Steel, Aluminum, and Metal from China and imposed 25 percent tariff or 50 billion dollars of China's goods (Onyusheva et al., 2020) especially computer and machinery parts. In response, China imposed import duties on 128 commodities from US worth 50 billion dollars (Onyusheva et al., 2020) included agricultural, seafood, and automobile products. Imposing tariff on products of two countries makes some of the company design moving their production out from the trade dispute country. In 2018, Trump announced imposing 10 percent tariff on smartphone and laptop imports from China (Wu, 2018) and announced that American companies to look for an alternative destination beside China (Wu, 2019a). This situation hurts Apple company, which is a US region industry from losing their mainly profit from selling iPhone due to most of the Apple products and various parts are mainly assembled in China (Wu, 2018). Therefore, the trade war of US and China makes some of Apple suppliers design to relocate their production to other countries

such as South Asia or Southeast Asia to avoid an increasing tariff on China-made products that send to US (Wu, 2020). For instance, Foxconn company which is a main manufacturing partner of Apple company supported Apple needs by moving their production from China to India (Wu, 2019b) and they can increase its diversification from 25 percent in June to 30 percent in August 2019 (Wu, 2020). Thus, the relocation of Apple partner manufacturing unsteadied China product supply chain for a main production country of US products.

Moreover, imposing tariff is not only a way they do in this trade dispute, but products ban is also one way they do on this war. In 2019, Huawei company which is a leading company in information and communication technology infrastructure and devices in China was banned by US for a reason that Huawei is a threat for US national security. This announcement makes US companies or foreign technology companies that deal with US has to block an action with Huawei company such as Google company has no longer allow Huawei to use g-mail or google (Hosain, 2019), or Intel company stop supplying chips in Huawei (Hosain, 2019). In response, China also banned Apple products which it is a product company from US. After looking through the tit for tat action of those two superpowers who are technological expertise countries, most of analysis called this action would not be only simple trade war but tech war where both superpowers compete on being the largest high-technology country. The situation of US-China trade war continues since then and it doesn't seem to end soon even though they have once reconciled for this issue in G20 summit which held up in the middle of 2019.

The situation of US and China Trade war may cause a supply chain disruption of global economy. From the trade war that two superpowers impose tariff on their import

products will make the countries which their products rely on both exports and imports from US and China may suffer from this situation. Trade war will affect both production and consumption. Tariff imposition will slow down the capability of some production that needs input from the products effected by tariff imposing. Moreover, the purchasing power of consumer will reduce since the price of product is more expensive. Therefore, trade war will slowdown global economy from this supply chain disruption.

1.3 Thailand electronics industry

Electronics industry plays an important role in the global economy since electronic products are a main component that they were used for other industries' production. At present, electronics sector has become one of the most rapidly expanding markets in the world, and it has a lot of room to grow (Gavlovskaya and Khakimov, 2020).

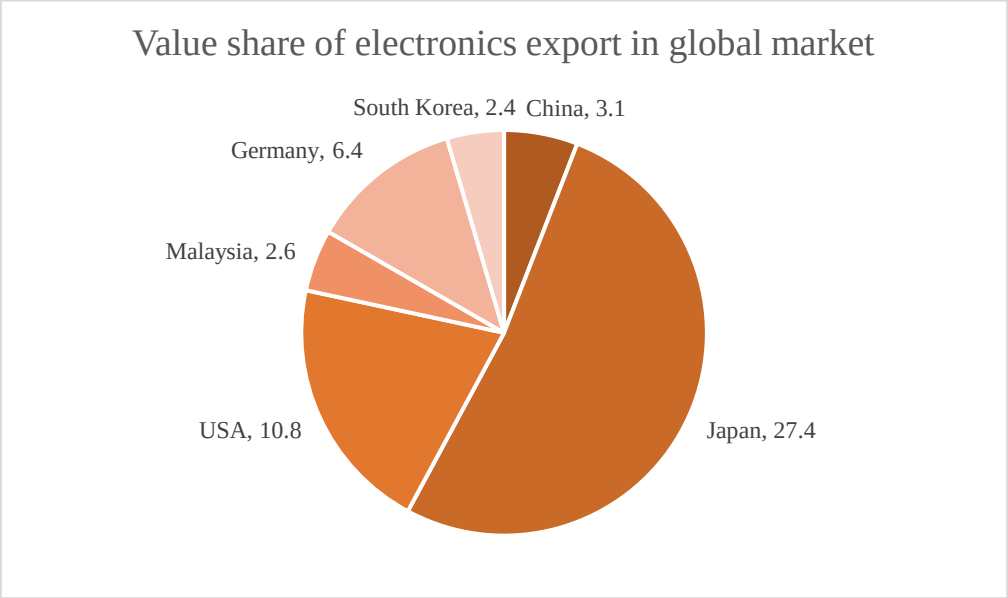
Electronics industry development started to become powerful around 1980s where radio electronics went on to significantly develop all around the world, but primarily in the USA, Germany, and Japan (Gavlovskaya and Khakimov, 2020). From the rise of electronic industry, East Asia, and Southeast Asia countries, including China, Singapore, Malaysia, and Thailand, became a main destination for leading firms from developed countries to expand their electronics industry production in order to benefit from lower labor and infrastructure costs (Abdul-Aziz and Zulkifli, 2016). Asian electrical and electronics (E&E) industry accounted for 55 percent of total E&E global sales in 2018 (Thailand Bord of Investment, 2015) and 27 percent of total products export in Asian countries (Korwatanasakul and Intarakumnerd, 2021).

In the 1970s, Thailand joined the electronics industry value chain, a decade after Singapore and concurrently with Malaysia (Intarakumnerd et al., 2016). Since this

period, Thailand government has supported the industry through various measures and policies in order to shift Thailand industry from import substitution to export orientation (UNCTAD, 2005). The policy implemented by Board of Investment (BOI) aimed to attract foreign investment (Thailand Bord of Investment, 2015) by providing the exemption on import duty on the input materials used in production or the non-tax of advance technology electrical and electronics products and the support services from BOI (Thailand Board of Investment, 2015). Moreover, due to Thailand has a low labor cost, Thailand successfully attracts foreign investors inflow, especially Japan, Taiwan, and US, in electronics industry for investing and set up their manufacturing in Thailand such as Seagate, Minebea group, Hana semiconductor etc. (Abdul-Aziz and Zulkifli, 2016). It was very successful as Thailand electronics exports of global exports share grew very fast in the past 2000 to 2006 (Rasiah, 2009).

Moreover, since Thailand exportation of manufacture products after electric and electronics had been promoting was increased from 5 percent in 1970 to 74 percent in 2001 of total exports (UNCTAD, 2005). Therefore, Thailand electrical and electronics industry in the present has been a main hub in Asian regions, and it is the 13th largest exporter for E&E production in 2017 (Thailand Bord of Investment, 2015). While Thailand's main electronics production are hard disk drives (HDDs) which has a share value at 29 percent of total electronic exports, other computer components at 21 percent, integrated circuit around 19 percent, and others in 2020 (see the figure 2). The main export countries of Thailand electronic products go to US, Hongkong, ASEAN, EU, China, and Japan.

Figure 2: value share of Thailand electronic exports



Source: Yongpisanphob (2021) in Krungsri research

However, Thailand electronics industry is still being in the midstream to downstream in electronics global value chain (Yongpisanphob, 2021). Electronics manufacturers in Thailand are mostly in the stage of assembly and packaging and re-exports to foreign markets (Intarakumnerd et al., 2016) and Thailand electronic industry still relies much on multinational corporations (MNCs) who settle their company in Thailand (Intarakumnerd et al., 2016). According to Krungsri research on Thailand electronics industry outlook 2021 to 2023 (Yongpisanphob, 2021), Thailand electronics are classified into 2 big groups where 31 percent of total electronics manufacturers are a large company or a joint-venture manufacturers that MNCs are full of high technology knowledge and design while the rest of 69 percent are small to medium manufacturers or SMEs which have a limited of technology (Yongpisanphob, 2021). Therefore, Thailand electronics industry still lack of capability to develop a high technology and design. With a role of midstream to downstream position, Thailand

electronics industry needs to import foreign intermediate input for its production. Korwatanasakul and Intarakumnerd (2021) explain the global value chain participation of Asian electronics industry through the share of foreign value-added and found that Thailand electronics industry depends on intermediate input and technologies import from foreign country and original MNCs. They show that Thailand electronic industry has a high value of foreign value-added share of total exports when compared with other industries. The important sources of Thailand intermediate input imported destination are China, Japan, and ASEAN countries (Table 1).

Table 1: The foreign value-added and domestic value-added share by countries

FVA				**DVX**			
	1990	2019	Annual Growth		1990	2019	Annual Growth
China	3.1	24.7	15.8	China	0.8	9.8	18.9
Japan	27.4	11.2	4.5	Germany	8.8	9.6	9.5
USA	10.8	7	6.2	Singapore	7.6	8.7	9.7
Malaysia	2.6	5.5	10.5	Netherlands	7.1	7.7	9.5
Germany	6.4	5.3	7.1	Malaysia	4.3	7.3	11.1
South Korea	2.4	4.4	10.1	Japan	10.3	6.4	7.4
Indonesia	1.8	3.3	10.1	South Korea	2.8	3.7	39.4
India	1.3	2.5	10.3	Belgium	4.9	3.5	8
Australia	3.5	2.3	6.2	Canada	2	3.3	11
France	3.1	2.1	6.4	UK	3.9	3.1	8.3
Other	37.8	31.7		Other	47.3	37	

Source: Korwatanasakul and Intarakumnerd (2021)

Because US and China are two world's largest economies, this trade dispute which they impose their tariff on the products and product sanction could slow down purchasing power of all over the country in the World from an effect of international trade. Moreover, due to the situation of the competition on technology among US and China, Thailand industry that principally affected is an electronics industry which it accounted as the third export products of the country. The trade war situation could

make an impact on electronics supply chain as China also a main country for electrical and electronics industry and Thailand has a very close to China industry since Thailand industry relies on China import product as an intermediate input for Thailand production. Therefore, Thailand would be one country that we should keep an eye on since Thailand is an export driven country and her first and second trade partner are US and China.

1.4 Objectives of the study

This study aims to evaluate the impact of US-China trade war on Thailand electronics supply chain which it is main export of Thailand. Since electronics in Thailand is one of the main export sectors of the country, the findings of this study could benefit for Thai government to design policy respond on electronic industry which affected by this trade war. Therefore, the objective of the study is focusing on the effect of how US-China trade war impact on Thailand's electronic exports.

1.5 Scope of the study

This study focuses on the impact of the economy and Thailand's electronics exportation effected by the imposing tariff of the two superpowers. Electronic products in this study will looking at computer parts and electronic accessories which we identified from the HS code (focus on the HS code 85). As US and China start a trade dispute in 2018 by imposing product tariff, this study will focus mainly on 2 points of periods which US firstly impose tariff on China steel and aluminum and secondly will focus on the tariff imposition from both US and China.

Chapter 2

Review of Literatures

The study of the impact of US-China trade dispute or as we known as US-China trade war get a lot of attention from various researchers. As many of the literatures use Computational General Equilibrium (CGE) model to compute the impact of a change in tariff on the global economy. This study has review various literatures and analyze the effect of US-China trade dispute to both US and China and other trading partners. We found out that most of literatures give a view that other countries gain benefit from the trade diversion, and some get hurts from US-China trade war due to an impact of global value chains (Aslam (2019); Bouët and Laborde (2018); Mao and Görg (2020); Tu et al. (2020)).

2.1 Trade diversion effects

Previous literatures, which study on the impact of US-China trade war on both US and China economy and the impact of trade dispute on their trading partners, found out that trade dispute between US and China creates trade diversion effects in global economy. US and China will suffer from trade diversion effects due to both countries implement policy of imposing tariff on import products. It makes the price of import products from US and China become more expensive. Moreover, it hurts term of trade which lead to the decline in their products demand, welfare and the GDP of US and China. In contrast, the previous empirical study also mentions that other countries who are not involved in trade dispute have benefit from the reverse of trade diversion. Most

of literatures show that other countries gain a greater number of exports, improve term of trade, increase in welfare, and more output production.

Aslam (2019) studies on the impact of US-China trade dispute on ASEAN countries through the spillover effects. He found that ASEAN will benefit from US impose tariff on China export products from trade diversion in which US is looking for other import sources rather than China and ASEAN would be one of the regions that US focus on (Aslam, 2019).

Bouët and Laborde (2018) also study the impact of the US-China trade war and Mexico as their main trading partner. The study uses multicounty, multisector Armington trade model (MIRAGRODEP model simulations) to examine the impact of trade war (Bouët and Laborde, 2018). They focus on the impact of trade war in the major macro-economic effects such as term of trade, trade impact, macroeconomic outcomes and value added. They show the result in 3 situations. They study on the situation that US impose tariff on China and Mexico individually and US impose tariff on both countries. The results show that US impose tariff on China and Mexico which are US's main trading partner, causes Mexico and China face deteriorate in term of trade since US reduce their import from China and Mexico. Moreover, it also impacts both welfare and GDP loss in China and Mexico. Moreover, they also mention about the impact of other countries from US-China-Mexico trade war. They show that other countries gain more opportunity to export their product to US, China, and Mexico due to the trade diversion that US finding new sources for imports such as Southeast Asia, Japan, The Republic of Korea, and others (Bouët and Laborde, 2018).

Tu et al. (2020) study the impact of US and China trade war on the global trade by using the SMART model which simulate the trade effect from the tariff changes.

The study shows effects at product level from trade creation and trade diversion, welfare. The result shows the impact against US, China, and other countries. Tu et al. (2020) show the result that China and US will suffer from the welfare loss and the loss of investment. Moreover, Tu et al. (2020) also shows the positive result to other countries through trade diversion effect. He concludes that US and China will source the products from other exporting markets. Main alternative markets for the US are Mexico, Japan, Germany, Canada, and Taiwan while China are Brazil, Germany, Japan, Argentina, and United Kingdom (Tu et al., 2020).

Li et al. (2020) use GTAPinGAMS model, which is a CGE model, to explain the impact of US and China trade dispute on the trade weight tariff, welfare, sectoral effect, and pattern of trade. The study creates 3 scenarios in different tariff situation to compare the outcomes. The result shows that tariff imposition and the retaliation between US and China makes weight tariff of both US and China increase. The result from the percentage change of welfare shows that the increasing tariff will impact to the term of trade of both US and China which will affect to welfare of both countries. Moreover, when compare the results from 3 scenarios, it shows that the more tax applied to relatively lower elasticity products the lower the welfare loss (Li et al., 2020). However, manufactured exporters of all other countries will gain more welfare from the trade diversion. They found out that Malaysia, Mexico, Taiwan, Thailand, and other Southeast Asian will benefit from this trade dispute. Moreover, they show the effect of pattern of trade in which US and China reduce their exports to each other while trade diversion effect enhances trading partner exports to both US and China. They also show that Asian countries including Japan, South Korea, and Southeast Asia gain from the trade diversion effect in which they increase their export to both US and China.

Itakura (2020) evaluates the impact of US and China trade war through CGE model. He conducts 3 scenarios to find the impact of trade war when there are import tariffs, investment, and productivity. He found that tariff imposition leads to an increasing in prices of capital and labor (Itakura, 2020). It reduces number of outputs and imports in both countries. Moreover, he also shows that the output of other countries, including EU, Canada, Mexico, Chile, Peru and Asia and Pacific countries, benefit from trade diversion. However, He mentioned that global value chain will be a factor that hurt the world economies. It makes China and US face a reduction on import and output while it also lowers the output of other countries.

Kumagai et al. (2021) use IDE-GSM which is a CGE model to find the impact from both US and China impose 25 additional tariffs on their each other products (Kumagai et al., 2021). They study through the impact on both production and consumption side. They found out that GDP of both US and China decline. They also show that the sectors that have a largest loss is electrical and electronic sectors and automotive sectors. Due to the impact of other countries, they show the result that there is a reverse trade diversion effects that benefit other countries production, they imply that there is news report that firms will look for other opportunity to exports their product to China and US (Kumagai et al., 2021).

Taufikurahman and Firdaus (2019) use GTAP model as a model to simulate the results of trade war which impact Indonesia's and other Asian developing countries' investment and exports. They create a scenario by find the maximum tariff for a shock of US and China trade war. The result from study shows that US and China production decline from the tariff imposition and the GDP of both countries decline. On the other hand, other countries production increases from the higher demand from US and China

which he found out that US and China import amount from Asian countries are increasing. They show that sectors that benefit from this situation are electronics and equipment, electric components in Thailand and Taiwan while Vietnam textile, apparel and footwear exports are increase.

Cui et al. (2019) use GTAP model which is a multi-regional CGE model to find the impact of trade disruption from US and China tariff imposition and retaliation. They create 6 scenarios to measure the impact on real GDP, Inflation, Term of trade, Social Welfare, Trade Balance, Import and Export change, trade diversion effect. In the simulation, they study on the impact of trade war that impact on China, US, and other countries such as India, Japan, South Korea, Russia, UK. ASEAN, EU, other East Asia, and rest of the world. They conclude that US and China suffer from the GDP loss. Their country face deflation from the loss of export demand. The term of trade of China and US reduce but in China will hurt more than US since China exports to US more than imports. US and China welfare loss when there is a retaliation from each other. Trade balance of US and China is increase from trade sanction. Finally, import and export of US and China also decline. However, they also show impact of trade war on other countries from 6 scenarios. They show the result from trade diversion effect which cause US and China to create indirect trade with other countries. The trade diversion effect makes other countries export and import increase due to US and China exports their product through third countries while US and China also import more products from third countries as well. This effect leads to the trade deficit, but they gain more GDP, term of trade, and more welfare.

Carvalho et al. (2019) study on the impact of US and China trade war on emerging countries. They use GTAP which is a computable general equilibrium model

to determine the impact of trade war. They conduct 3 scenarios to examine the impact of trade war by focusing on US impose tariff on steel product, on aluminum product, and on China's products. They study the impact of trade war on production, trade balance, welfare, and sensitivity analysis. According to the simulation results, they show the impact on production of US, China, and other emerging countries that US increase the production of iron and steel, electronic equipment, and aluminum which is the main target of US tariff imposition. While China increases their production on soybeans but there is a reduction in production of high-technological sectors including manufacturing, electronic equipment, transportation equipment. For other emerging countries including Canada, Mexico, Argentina and Brazil benefit from the increase in iron and steel, aluminum products. The impact of trade war will improve both US trade balance which they reduce their import from each other while other regions face a reduction of trade balance. The welfare of US and China has a large reduction, from the loss of term of trade while other countries gain more welfare as they have more demand for the products from US.

Nugroho et al. (2021) use CGE model to investigate the poverty and income distribution impact from trade war by focusing impact on Indonesia and compare it with the impact on Thailand, and Vietnam. He found that US and China face GDP contraction while export and import of both US and China also decline. However, they show the impact from trade war on Indonesia, Thailand, and Vietnam that these countries will benefit from trade diversion. Due to a tariff imposition US and China will have excess supply that the third country import commodities from US and China from the price reduction and excess demand US and China find an alternative input from other countries. Moreover, the study also compares the trade competition between

Indonesia, Thailand, and Vietnam. They found out that Thailand and Vietnam produce substitute products so that their trade performance with US and China is better than Indonesia especially in textile, machinery, electronics, and metal products (Nugroho et al., 2021).

Rosyadi and Widodo (2018) estimate the impact of trade war on global economy. They use GTAP model to simulate the effect of tariff imposition through GDP, term of trade, welfare, output quantity, domestic price, and trade diversion. From simulation results, China and US face a negative impact on GDP which China hurt more than US while trade balance of US seems to be improved but China trade balance is decline. The output quantity of both US and China is decline in the sector that affected by tariff imposition. Moreover, US and China both suffer a welfare loss. However, they show that there are some countries that benefit from this situation through trade diversion. They show that trade diversion leads to a decline in bilateral trade in both US and China, but it increases their trade with other trading partner in both exports and imports. Moreover, other countries gain more benefit in increasing of GDP, welfare, and term of trade.

2.2 Global value chain effects

There are some empirical studies that show the impact of US-China trade war through GVC. Most of the literatures who examine the impact of US-China trade war shows that some industries in other countries beside US and China hurt from the global value chain disruption because of it highly dependent on US and China products

From Mao and Görg (2020) review, the study uses cumulative tariff, which is a method developed by Rouzet and Miroudot (2013), to find the indirect tariff apply to

production process from global value chain, which it might cause an impact on third countries (Mao and Görg, 2020). This study shows the result of cumulative tariffs at the country level and explain the impact through the industry level (Mao and Görg, 2020). They compare the impact of cumulative tariff adds up on other countries products between US applying tariffs on China products and China applying tariffs on US products. The results show that the impact of other countries on cumulative tariffs added from US increase tariffs on China product is huge than China impose tariff on US. It can imply that, due to global value chain, China products are likely to be imported as an intermediate input in other countries' production rather than US products. Moreover, countries that extremely hurt from US impose tariff on China trade war are Canada, Mexico which are US main trading partner which sectors that hit hardest from the add on cumulative tariff are chemical, electrical, electronics and vehicle manufacturing sectors (Mao and Görg, 2020) since they are a major sector that depend on intermediate input for their production.

Aslam (2019) concluded that there is a possibility that ASEAN may hurt from this trade situation. He shows the negative impact from value chain disruption as China plays a main role in global value chain in the manufacturing products (Aslam, 2019). Therefore, US imposing tariff on China products will affect to a fall of China exports and it will have an indirect effect on ASEAN as ASEAN is a major supplier for intermediate input and final products to China. He states that the main sectors that have a large impact from this trade war are electrical, electronic, machinery, and its component sector.

Tu et al. (2020) show that the tariff imposition on intermediate input will hurt both US and China production and exporting companies through global supply chain

that the cost of production is increasing. The result also shows the impact of high intermediate cost will spillover to third countries manufacturing firm along the supply chain (Tu et al., 2020).

Itakura (2020) mentions that the world GDP fall which he implies that effect on global value chain of intermediate input will make countries that related to intermediate input trade with US and China face a negative impact which cause a reduction of GDP and welfare and it reduce their exports to US and China.

Kumagai et al. (2021) also show the negative effect through terms of global value chains. They show the negative result in medium Asian economies such as Taiwan, Malaysia, Korea and, Thailand which their production and exports are dependent on US and China market.

To sum up, most of these studies use CGE model to create the scenarios to measure the impact of US and China trade war. Most of the studies show that US and China seem to be suffer from imposing tariff on each other products. Most of literatures show that US and China loss their GDP, welfare, term of trade and their production. While these studies also explain the impact of trade war on other trading partners. They show 2 main points for the trading partner effect. Most of studies show that there are some trading partners benefit from trade diversion effect when both US and China reduce their bilateral trade and looking for other import and export destination. Moreover, some literatures show that trading partner may also suffer from global value chain disruption. Since US and China impose tariff on the imported products, countries that are more dependent on US and China market will suffer from this trade dispute.

2.3 Hypothesis of the study

According to the review of literature, this study tries to capture the impact of US-China trade war on Thai electronics sector and Thai economy with the following hypothesis

Hypothesis 1: Thailand overall industry will gain more GDP from trade diversion.

Hypothesis 2: Thailand overall industry will gain more welfare from trade diversion.

Hypothesis 3: Trade balance of Thailand electronic industry is decrease.

Hypothesis 4: Thailand electronic industry will suffer from the global value chain effect which electronic industry depend much on the intermediate input from China.

Hypothesis 5: Thailand electronic industry faces an increase in import products.

Chapter 3

Conceptual Framework

The conceptual framework this study used to explain how bilateral trade between US and China happen and how it impacts to other countries in the World from trade dispute is based on trade diversion and trade creation concepts. Moreover, this study will use the concept of global value chains (GVCs) as it is one of the concepts that explain the relation of international trade.

3.1 Trade diversion and Trade creation effects

Since globalization, the concept of trade liberalization was adopted by most nations, this leads to the growing of international trade and it lower or remove the trade barriers among countries. Since the growth of trade liberalization, bilateral trade, regional trade and economic integration also arises under an idea of preferential trade agreement that members in the same economic group trade with lower trade barriers from government restrictions or interventions (Fouda, 2012). Preferential Trade Agreement (PTAs) is a first stage of many types of economic integration such as free trade areas (FTAs), custom unions (CUs), common markets and Economic or Monetary Union. It is a treaty that participating countries apply its agreements by reducing tariff on member's country products for a purpose of increasing their market access (Limão, 2016) increasing their trade of goods and services and improving the productivity in the production process (Darma and Hastiadi, 2017).

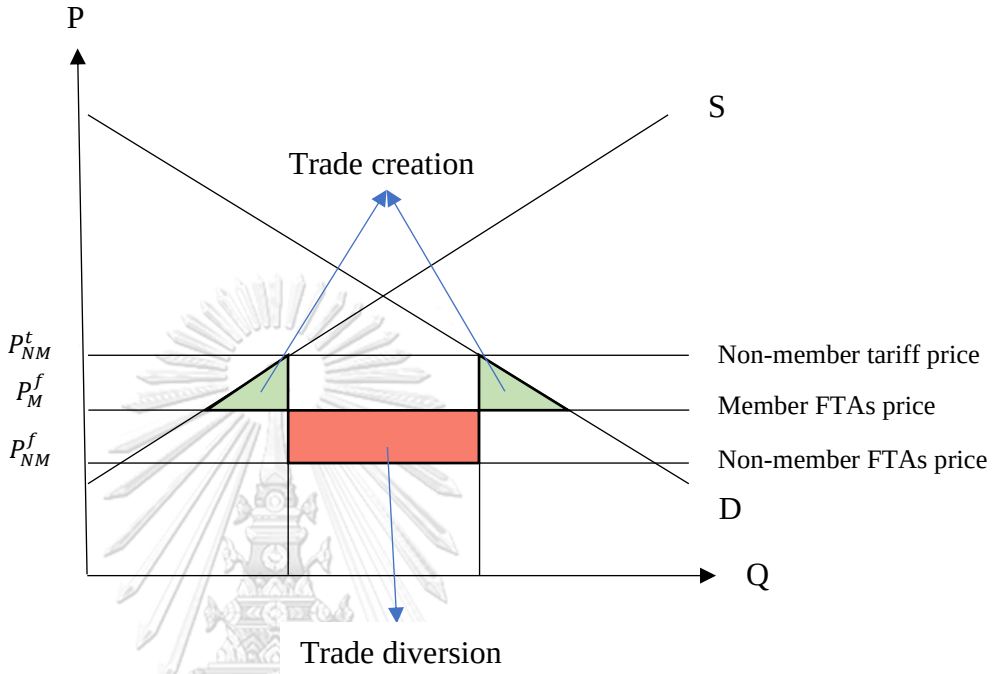
However, those members still have trade restrictions with other non-member countries. In general, preferential trade agreement doesn't only increase national

member's welfare, it is possible that preferential trade agreement makes national welfare decrease. Therefore, to know that how much is net change in national welfare, we should consider trade creation and trade diversion effects.

Trade creation happens when countries reduce or eliminate trade barriers which results on a lower of products price. So, it makes the member countries gain from buying product from low-cost producers. This will increase an economic welfare from an increase in producer surplus by having an opportunity for member countries to replaced lower cost imports products from their member group. According to figure 3. which demonstrates impacts on country C welfare from trade creation and trade diversion due to trading with member and non-member in economic integration. Green areas in the figure show areas that country C welfare gain from trade creation.

Trade diversion is a cost that come from a lower comparative advantage of member countries that they import high-cost products from their trade agreement member rather than a chance to import lower cost products from non-member. It lowers economic welfare as it diverts resources out of comparative advantage. To understand it clearly, red area in figure 3. shows areas that country C loss their welfare from trade diversion.

Figure 3: Trade creation and trade diversion due to trading with member and nonmember in economic integration.



Most of literatures use trade diversion effect to explain about the impact of US-China trade war and how other countries effected by this situation. In this thesis we can imply that imposing tariff of both US and China is affected by trade diversion where both importers seek for products from elsewhere that can be substituted to each country's products (Nicita, 2019). Therefore, trade diversion from US-China trade conflict make benefit to third countries from gaining more trade with US and China (Bekkers and Schroeter, 2020)

3.2 Global value chain (GVCs)

OECD (2013) defines a value chain as “a value chain is the full range of activities that firms engage in to bring a product to market, from conception to final use”. The activities that firms can put the value added in their products are design, production, marketing, logistics and distribution to support the final customer (OECD, 2013). However, some value chain activities are not only be performed by a single firm but by different firms (Fernandez-Stark, 2011). The concept of value chain is dominantly and has been carried out to global network since the world enter globalization, that the global economy turns into trade liberalization era where a flow of capital and labor are increasing, and the trade barrier or product’s tariff has been reduced. Therefore, the value chains are called global value chains where the growth of them make global economy becomes more interconnected, complex and linkage (Kowalski et al., 2015). Moreover, GVCs not only make global economy becomes interconnected but it also drive the growth of productivity, job creation and an intermediate trade flow around the world (OECD, 2013).

Due to the reduction of the trade cost, every country produces their specialize products and export to other countries as an intermediate input of other products through GVCs. It makes more developing countries or emerging countries have an ability to participate in global value chain (Kowalski et al., 2015). Also, the production countries who are participated in GVCs also benefit from an efficiency and lower cost of input that they import from specialize countries. It can present the activities of countries whom are participated in GVCs that they can either import intermediate inputs from partner for exports production or grant inputs for their trade partner’s export production (OECD, 2013). These two types of activities are called backward linkage

where the country import other countries input for their production and forward linkage where country export product as an input for other country's production. It shows that the products that export to various sources are all linked. The GVCs, therefore, improve trade and production of global economy and increase the global market competition and productivity (OECD, 2013).

With global value chains, we can trace how the global trade looks like, how the products are dispersed and how the products between countries are linked (Fernandez-Stark, 2011). US-China trade war could lead to a disruption in global value chains where the other who are in the same chain of their products will be affected from the trade dispute. However, these impacts to other countries depend on the position of their production in GVCs.

Chapter 4

Research Methodology and Scenarios

4.1 Methodology

4.1.1 Computable General Equilibrium (CGE)

Computable General Equilibrium (CGE) model is a basic tool that is developed for analyzing the economy-wide impact of a policy examination (Rosyadi and Widodo, 2018). As the CGE approach is mostly used for international economy issue, the model includes institutional details, market structure, factor endowment, and interaction among region (Partridge and Rickman, 2007). Therefore, this approach is being used for economic studies of various regional dimension such as an inter-regional trade, a shock which occur from the trade (taxation or tariff), immigration, technology, labor markets, natural resources, financial crises and etc. (Dixon and Jorgenson, 2013). As mentioned in the review of literatures, CGE model is also a model that US-China trade dispute studies mostly use to find the effect of US-China trade dispute on global economy. As a change of their policy by imposing tariff could be a shock that shift the old equilibrium to a new one, other regionals are impacted because of US and China are significant actors in global economy.

In this study, we use GTAP model which developed from concept of CGE model to study on the impact of electronics exports which effected by US-China trade war. GTAP model is appropriate to seek for a result as the program has its own database which cover wide range of countries and economic sectors (Ariyasajjakorn et al., 2009). GTAP base data is normally in the equilibrium state when there is no change of trade condition. Nonetheless, when the system has disturbed or it has a shock on trade

policies, the system will be adjusted to new equilibrium state (Ariyasajjakorn et al., 2009). Moreover, the GTAP database is in the form of Input-Output (IO) table which it includes the data identified economic linkage among countries such as intermediate import and export of each country for each sector, factor endowment and protection among country (Hertel, 1997).

4.1.2 Basic Structure of Input Output Table

To evaluate value chain of Thailand electronic parts which impacted by US-China trade war, this study creates IO table from both OECD database by integrate data into small groups that related to the scope of our study. IO analysis was developed by Wassily Leontief which it first appeared to be an economic framework that explain United State economy. IO table is in the Matrix form which show the relationship of whole economy's industries regarding the products that being used in domestic or sent to other countries and the product imported from abroad (United Nations, 1999). The table includes intermediate inputs, final demand, primary inputs (value added) and total output (see table 2.).

Table 2: A simplified input output table

Intermediate inputs (II_{ij})	Final demand (F)	Total output (X)
Primary inputs (V)		
Total output (X)		

Where the general table of input output matrix are in the form which shown in table 3.

Table 3: *Input Output table in general term*

	Industry A	Industry B	Industry C	Final Demand	Output
Industry A	a_{11}	a_{12}	a_{13}	f_1	y_1
Industry B	a_{21}	a_{22}	a_{23}	f_2	y_2
Industry C	a_{31}	a_{32}	a_{33}	f_3	y_3
Value Added	v_1	v_2	v_3		
Output	y_1	y_2	y_3		

The coefficient matrix can be calculated by

$$a_{ij} = \frac{II_{ij}}{y_j}$$

Where II_{ij} denotes as flows of the intermediate input which represent in table 1. So, a group of coefficient matrix from every sector of the economy (n) are called matrix A.

$$[a_{ij}]_{nxn} = A$$

Furthermore, the basic equation of input output analysis represents as

$$y = Ay + f \qquad (1)$$

Where A represents the coefficient matrix of intermediate input, f represents a vector of final demand and y represents a vector of output. In equation 1, A shows the direct impact of the economy. This equation only shows how input from each industry requires for producing one unit of output product for another industry (Nations, 1999). However, the production process has more complicated chain of interaction in producing one product due to equipment that being used as input need to be produced and it requires inputs to produce it (United Nations, 1999). In general, the chain of

production includes abundant cycle of input where some output product could be used as an input requirement for other inputs.

Thus, the vector of output can be represented in the other form of

$$y = (I - A)^{-1} f \qquad (2)$$

Where I is an identity matrix which the diagonal line are equal to 1 and the others are 0. From the Input Output analysis $(I - A)^{-1}$is called Loentief coefficient. In equation (2), $(I - A)^{-1}$ demonstrates the result of total economic impact which it represents both direct and indirect impact. Moreover, it shows the position of industry in the value chains which it can represent that the industry is upstream or downstream industry.

The coefficient in both direct and indirect impact of matrix or what we called Leontief inverse matrix shows the global value chain participation and position of the country which use to measure the value-added in the production. It represents the output multiplier in which it explains the linkage between economic industries (Handayani and Rosy, 2022) in which an intermediate input of some sector can be used as an input of other sector in the other hand the output of some sector can be used as an input for other sector (Lee and Hlee, 2021). The linkages are divided into 2 types, firstly, forward multiplier which represents the effect of the production of all industries that their output is being used as an intermediate input or raw material for produce the final product of other industry (Cristóbal and Biezmab, 2006). Therefore, the more forward multiplier for one sector means that the more that sector is in the upstream in which their output is mainly used as an intermediate input for other industry production. Secondly, backward multiplier demonstrates the effect of the production of one sector that needs the output of other related sectors as an intermediate input for their production

(Cristóbal and Biezmab, 2006). Thus, the more backward multiplier for one sector means that the more that sector is in downstream in which their production is depends on the output products from other industries. According to the paper of Lee and Hlee (2021), they categorized the industry based on the level of forward and backward multiplier which the classifications of them are shown in the table 4:

Table 4: Classification of the level of forward and backward multiplier

		Forward Linkage	
		Low	High
Backward linkage	Low	Independent as a final primary production (midstream industry)	Dependent on interindustry demand as an intermediate primary production (upstream industry)
	High	Dependent on inter-industry supply as a final manufacture (downstream industry)	Dependent as an intermediate manufacture (key industry)

Source: Lee and Hlee (2021) and Handayani and Rosy (2022)

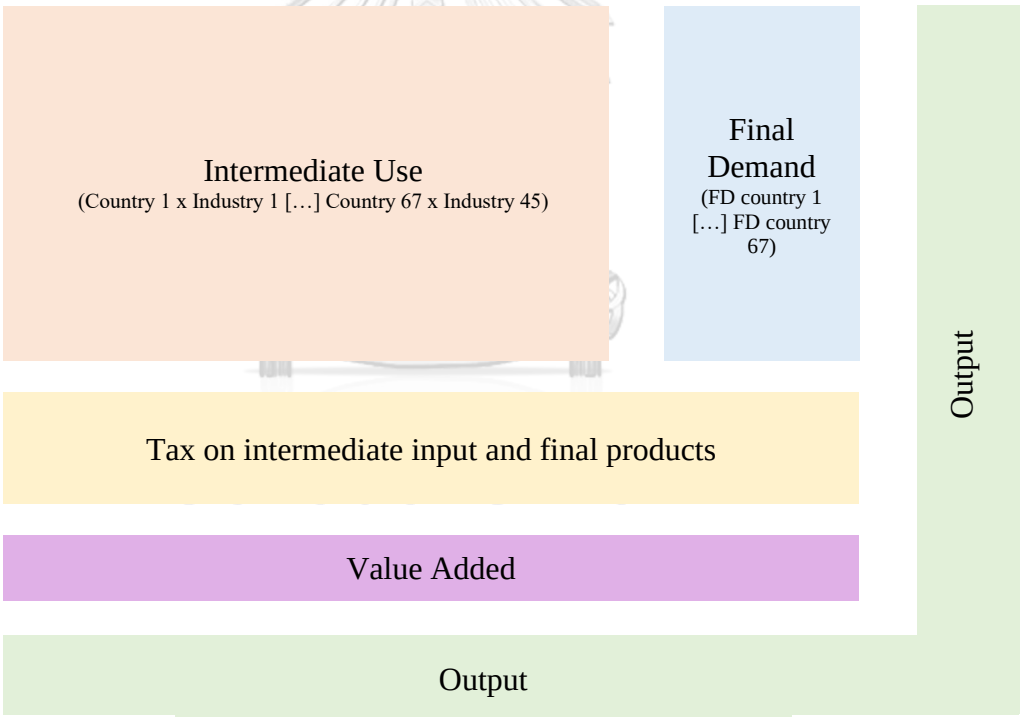
Therefore, this study will calculate both direct and indirect economic impact from the Input Output table which created from OECD inter country input output table (ICIO table). Moreover, we will examine through GTAP database on how the chain of Input Output changes from the situation that there is an exogenous shock caused by increasing tariff on products.

4.2 OECD Inter Country Input Output Table (ICIO)

To understand the relationship of the world's trade and how the global supply chain has been disrupted from trade war situation, this research will start explaining by using OECD Inter Country Input Output Table (ICIO) from 2015 to 2018 database. The

OECD had collected the trade statistic and represent how each OECD and non-OECD country and sectors are participating in the global value chains (GVCs) (Belotti et al., 2020). The raw data of OECD ICIO database consists of 67 economic countries and 45 unique industries which was set as an intermediate use in the table, and the structure of ICIO table is in the form of matrix which include intermediate use, taxes less subsidy of intermediate and final products, value added, total final demand, and output. The structure of ICIO table is shown in figure 4.

Figure 4: The structure of OECD Inter Country Input Output table.



Source: OECD (2021)

To make the data becomes clearer and more appropriate for explaining the relationship of intra and inter trade of the product and country that focused on this thesis, this study will choose matrix of intermediate input part in ICIO table for explaining the relationship. We aggregate some of industry and country which are the intermediate input into a group of data and abbreviate into the main focused industries and countries that most fitted to clarify their trade relation. We have aggregated the data to 4 important regions which are Thailand, US, China, and the rest of the world. For 6 group of industries including agriculture, food, steel and aluminum, manufacture, electronics, and other industry. (See in Table 15 and Table 16 in Appendix)

As mentioned in the basic structure of input output table in 4.1.2, we will explain the relationship among these countries and industries through 2 groups of intermediate input matrix. Firstly, we will explain through intermediate input matrix (Matrix A) which the data will show the direct impact where the coefficient represents how much each intermediate input will be used to produce one of product in other industry. Secondly, we will explain through the inverse of intermediate input matrix or Leontief inverse matrix (Matrix $(I - A)^{-1}$) which the data shows both direct and indirect impact or whole economy impact where the coefficient represents the multiplier of how important of one input being use or how much it depends in other industry or what we call forward and backward linkage effects. The results of ICIO table will be explained more in further section.

4.3 The GTAP model

4.3.1 Data Source

The data used in this thesis comes from the Global Trade Analysis Project (GTAP) database. This GTAP database is in version 10 which represent the world economy of 141 regions, 65 economic sectors and 8 endowment factors in 2014. The data is in the form of Input Output table that show a bilateral trade of each country's goods and services and extend to each sector level (Aguiar et al., 2016). Moreover, the database also includes the government taxes. The GTAP database is being used in many economic research especially for the research which looking at the relation of international trade. Therefore, the data from the GTAP database is appropriate to find out the impact of Thailand electronics exportation from China imposing tariff on US products.

To examine the impact of Thailand electronics exports due to US-China trade dispute, this research re-classifies the data from the base GTAP database to make the data suitable to observe the result. We aggregate the data by HS code group. We group up region from old 141 regions to 8 economic groups which are Thailand, United States, China, ASEAN, East Asia, EU, Oceania and Rest of the World. The sectors are aggregated from 65 sectors to 11 new sectors including Agricultural, Livestock, Mining and Extraction, Food, Textiles, Manufacturing, Steel and Aluminum, Electronics, Utilities and Construction, Transportation and Communication and the rest of sectors. The factor endowment is grouped into 5 endowment factors which are Land, Unskilled labor, Skilled labor, Capital, and Natural resources. (See in Table 17 in Appendix)

4.3.2 Updated tariff for the base scenario

Since the latest version of GTAP database that we use is in 2014 which it is too old for compare the scenario data after there is a trade war situation in 2018, our research updates the database from the original GTAP database in 2014 into 2016. We use tariff database and total export between US and China in 2016 which is collected from World Integrated Trade Solution (WITS) to calculated tariff weight average. The database is classified by HS code number. So, we group and classify the sector data by HS code into 11 sectors which equal to the aggregated GTAP database that we mention in 4.3.1. After grouping the data and finding tariff weight average, we update the data by shock the tariff weight average that we have calculated in the GTAP model. So, the result after shock weight average tariff will be the base scenario or the scenario before there is a trade war happens which will be continue using in the GTAP model to find and compare the result of the trade among each country after there is a trade war.

4.3.3 Scenarios

This study simulates results from shocks that happen from US-China trade dispute from the concept of the CGE model. Our main concern is the impact on Thailand electronics exports from US-China trade war, the scenarios are set under a concept that there is a trade protection among US and China. Hence, 3 scenarios which we use to compare results are:

Scenario 1: Steel and Aluminum in 2018 situation: US impose tariffs on the steel and aluminum in 2018 which import from China. This situation is like the very first start of US-China Trade War.

Scenario 2: Trade war situation in 2018: This tariff situation includes Steel and Aluminum situation (Situation 1) and the additional tariff increase between US and China in 2018. Including, China imposes tariff on US products in 3 billion round, 50 billion round, 1st wave of 60 billion and US impose tariff on China products in 50 billion round and 200 billion rounds.

Scenario 3: Trade war situation in 2019: This tariff situation includes Steel and Aluminum situation (Situation 1), Trade War situation in 2018 (Situation 2) and the additional tariff increase between US and China in 2019. Including, China imposes tariff on US products in 2nd wave of 60 billion and 75 billion round and US imposes tariff on China products in 300 billion rounds.

4.3.4 Tariff calculation for the scenario

Due to the calculation of the GTAP program, we use tariff as a shock that disrupt the equilibrium stage of the base scenario in the GTAP model as tariff is main reason of US and China trade war. We use the tariff from Li (2018) database which he collected the data of US-China impose tariff among the trade war period. The tariff is distinguished by US and China announced to increase tariff on each other's situation. See the appendix 2 for the impose tariff situation. The tariff data from Li (2018) is classified by HS code of the US and China products. We aggregate the tariff data as same as we aggregate the industries in the GTAP database, and we find the weight average of each tariff for use in the GTAP simulation.

Chapter 5

Simulation Results

In this section, we would like to present the result of ICIO table which explains the participation of countries in the world and sector in global value chain (GVCs). Moreover, we would like to analyze the impact of US-China trade war from increase tariff by simulating the GTAP model that we have aggregated the data. We will compare and analyze 5 factors which are welfare, trade balance, and quantity output, gross domestic production, and market price of import sectors.

5.1 Result from ICIO table to explain the Global Value Chain (GVCs)

5.1.1 Direct Impact

Matrix A of ICIO table shows the relationship of global trade. The coefficient from matrix A can be explained the result in 2 forms. Firstly, when we look at the vertical line, the coefficients show as the ratio of how much products from other industry being used as an intermediate input to produces one unit of product in one industry. Secondly, when we look at horizontal line it also shows how much the product of one industry is distributed or dispersed to use as an intermediate input to produce one industry's output.

From table 5, we can explain the value chain of steel and aluminum, and electronics, which are the main impact sectors in US-China trade war. For global value chain of US, total production of steel and aluminum sector in US is from domestic's steel and aluminum 19.443 percent and import intermediate input from Thailand and China as 0.0396 and 0.8969 percent respectively. For the US electronics sector, US uses

steel and aluminum from domestic as intermediate input to produce electronics product about 1.8185 percent and import from Thailand and China 0.0043 and 0.0947 percent respectively. And US also uses domestic electronics parts around 5.2895 percent and import electronics part from Thailand and China around 0.0061 and 2.3491 percent of total production value of US electronics sector respectively.

In the case of China, China steel and aluminum sector use domestic steel and aluminum 32.8771 percent of total production value and they import steel and aluminum from Thailand and US only 0.0050 and 0.1566 percent respectively. For China electronics sector, they use domestic steel and aluminum and electronics part as an intermediate input equal to 4.2228 and 30.5342 percent of total electronics sector's production respectively. When looking at the imported intermediate input from US and Thailand, China import steel and aluminum as a part of electronics production at 0.0011 percent from Thailand and 0.0388 percent from US. Furthermore, the import value of electronics parts of China from US and Thailand as an intermediate input for China electronics production is around 0.6989 and 0.5548 percent correspondingly. Therefore, this matrix shows that China mainly uses domestic input for their production.

When looking at direct impact of Thailand electronics sectors, we can see that from increasing one production for Thailand's electronics sector, we need to import steel and aluminum from US and China about 0.197 and 0.746 percent accordingly and uses domestic steel and aluminum about 0.879 as an intermediate input. Moreover, they use electronics products as an intermediate input for electronics sectors about 1.159 and 9.493 percent from US and China respectively and uses domestic products at 14.961 percent. When look at Thailand steel and aluminum sectors, we can see that Thailand

uses steel and aluminum from domestic about 12.363 percent and import from US and China about 1.132 and 7.372 percent of total production value. However, the amount of steel and aluminum, and electronics produced in Thailand is very low for being used as an intermediate input in US and China's steel and aluminum and electronics sectors. From table 3 shows that Thailand produces steel and aluminum, and it was sent as an intermediate input in US and China steel and aluminum sector for 0.0396 and 0.005 percent of their total production. However, the value of intermediate input that both Thailand steel and aluminum, and electronics production required from China is in the high ratio.

Table 5: The matrix of coefficients of ICIO table which represent a direct impact (%)

	THA_agri	*THA_food*	*THA_steelalu*	*THA_manu*	*THA_elec*	*THA_others*	*US_agri*	*US_food*	*US_steelalu*
THA_agri	0.148950	0.335345	0.000043	0.007808	0.000000	0.009148	0.000084	0.000137	0.000000
THA_food	0.073352	0.139998	0.000000	0.003409	0.000000	0.020308	0.000260	0.000417	0.000001
THA_steelalu	0.000881	0.002651	0.123629	0.027439	0.008785	0.004941	0.000023	0.000036	0.000396
THA_manu	0.024319	0.021422	0.068522	0.193978	0.050614	0.061320	0.000130	0.000168	0.000171
THA_elec	0.000104	0.000153	0.001428	0.007119	0.149613	0.004337	0.000002	0.000009	0.000126
THA_others	0.107281	0.151623	0.161789	0.194257	0.121985	0.293423	0.000126	0.000188	0.000121
US_agri	0.001103	0.002424	0.000000	0.000059	0.000000	0.000058	0.135225	0.216697	0.000291
US_food	0.001096	0.001705	0.000039	0.000197	0.000031	0.000247	0.066411	0.107484	0.000958
US_steelalu	0.000099	0.000285	0.011328	0.003307	0.001973	0.000357	0.006668	0.010275	0.194436
US_manu	0.001167	0.000405	0.002826	0.007910	0.002535	0.001368	0.051170	0.033176	0.089832
US_elec	0.000020	0.000020	0.000324	0.000682	0.011591	0.000381	0.000758	0.001087	0.010563
US_others	0.001735	0.002490	0.003341	0.004442	0.005181	0.004706	0.261558	0.303669	0.247473
CHN_agri	0.001518	0.003343	0.000000	0.000081	0.000000	0.000080	0.000548	0.000903	0.000000
CHN_food	0.001664	0.002603	0.000000	0.000077	0.000000	0.000335	0.000654	0.001001	0.000001
CHN_steelalu	0.000544	0.001487	0.073718	0.017811	0.007458	0.002759	0.000533	0.000728	0.008970
CHN_manu	0.004295	0.002392	0.013049	0.035937	0.027084	0.007576	0.003508	0.001996	0.005818
CHN_elec	0.000100	0.000125	0.001185	0.004990	0.094934	0.003050	0.000077	0.000184	0.002528
CHN_others	0.000962	0.001395	0.005068	0.006387	0.009496	0.004768	0.000834	0.001120	0.001627
ROW_agri	0.006837	0.015089	0.000017	0.000385	0.000012	0.000403	0.011178	0.018790	0.000013
ROW_food	0.008033	0.012712	0.000164	0.000640	0.000126	0.001703	0.004859	0.007795	0.000155
ROW_steelalu	0.000661	0.002142	0.187825	0.045969	0.024172	0.004700	0.001000	0.001492	0.052870
ROW_manu	0.010945	0.004572	0.022105	0.077343	0.029592	0.013593	0.013168	0.004823	0.013367
ROW_elec	0.000180	0.000217	0.002810	0.006727	0.116065	0.003882	0.000198	0.000215	0.002429
ROW_others	0.009843	0.013738	0.055515	0.056670	0.028587	0.072260	0.012325	0.013529	0.019589

	US_manu	*US_elec*	*US_others*	*CHN_agri*	*CHN_food*	*CHN_steelalu*	*CHN_manu*	*CHN_elec*	*CHN_others*
THA_agri	0.000001	0.000000	0.000001	0.000358	0.000667	0.000000	0.000015	0.000000	0.000019
THA_food	0.000007	0.000000	0.000025	0.000212	0.000276	0.000001	0.000012	0.000000	0.000021
THA_steelalu	0.000128	0.000043	0.000018	0.000001	0.000002	0.000050	0.000022	0.000011	0.000006
THA_manu	0.000478	0.000062	0.000079	0.000197	0.000074	0.000215	0.000876	0.000313	0.000208
THA_elec	0.000271	0.001236	0.000104	0.000007	0.000004	0.000027	0.000249	0.005549	0.000108
THA_others	0.000185	0.000240	0.000094	0.000194	0.000214	0.000120	0.000344	0.001022	0.000306
US_agri	0.001787	0.000006	0.001254	0.002065	0.003555	0.000018	0.000097	0.000002	0.000159
US_food	0.003873	0.000414	0.006489	0.000363	0.000659	0.000015	0.000073	0.000019	0.000094
US_steelalu	0.051622	0.018185	0.006063	0.000015	0.000026	0.001567	0.000640	0.000388	0.000084
US_manu	0.151291	0.019978	0.027823	0.000496	0.000132	0.000703	0.003737	0.001091	0.000710
US_elec	0.012526	0.052896	0.004685	0.000014	0.000009	0.000070	0.000363	0.006990	0.000147
US_others	0.244010	0.107714	0.314443	0.001412	0.001997	0.002049	0.002363	0.003193	0.002295
CHN_agri	0.000006	0.000000	0.000003	0.213294	0.385070	0.001463	0.009556	0.000228	0.015156
CHN_food	0.000018	0.000000	0.000050	0.084881	0.139557	0.000331	0.005270	0.000315	0.015390
CHN_steelalu	0.002923	0.000947	0.000414	0.003018	0.004248	0.328771	0.105618	0.042229	0.028673
CHN_manu	0.011721	0.003489	0.002044	0.055022	0.027904	0.118787	0.318593	0.127711	0.099510
CHN_elec	0.005308	0.023492	0.002006	0.000564	0.000370	0.002589	0.016462	0.305342	0.006696
CHN_others	0.003891	0.002215	0.001415	0.106073	0.120676	0.270586	0.215051	0.136384	0.321214
ROW_agri	0.000141	0.000003	0.000077	0.006576	0.010454	0.000112	0.000346	0.000012	0.000678
ROW_food	0.000380	0.000059	0.000543	0.003362	0.004686	0.000072	0.000273	0.000078	0.000436
ROW_steelalu	0.011840	0.004965	0.001006	0.000095	0.000157	0.014712	0.005118	0.002773	0.000958
ROW_manu	0.038987	0.004966	0.005039	0.004304	0.001160	0.005342	0.022342	0.011127	0.005020
ROW_elec	0.004861	0.019496	0.001754	0.000177	0.000106	0.000729	0.005809	0.123635	0.002497
ROW_others	0.024673	0.006396	0.015535	0.004912	0.005247	0.044166	0.018400	0.017626	0.020006

	ROW_agri	*ROW_food*	*ROW_steelalu*	*ROW_manu*	*ROW_elec*	*ROW_others*
THA_agri	0.000052	0.000181	0.000000	0.000002	0.000000	0.000002
THA_food	0.000360	0.000749	0.000001	0.000019	0.000001	0.000049
THA_steelalu	0.000022	0.000039	0.000663	0.000211	0.000232	0.000048
THA_manu	0.000314	0.000211	0.000297	0.001165	0.000857	0.000229
THA_elec	0.000002	0.000002	0.000011	0.000072	0.002733	0.000036
THA_others	0.000438	0.000392	0.000271	0.000478	0.000915	0.000374
US_agri	0.000962	0.003393	0.000005	0.000038	0.000001	0.000044
US_food	0.000904	0.002100	0.000044	0.000167	0.000049	0.000143
US_steelalu	0.000087	0.000285	0.006314	0.001970	0.001434	0.000291
US_manu	0.001723	0.000861	0.002406	0.009212	0.003644	0.001235
US_elec	0.000020	0.000021	0.000168	0.000366	0.009077	0.000165
US_others	0.003477	0.005163	0.006322	0.007477	0.014160	0.006709
CHN_agri	0.000396	0.001336	0.000001	0.000016	0.000001	0.000020
CHN_food	0.000729	0.001769	0.000003	0.000047	0.000002	0.000116
CHN_steelalu	0.000240	0.000413	0.013514	0.003403	0.002327	0.000800
CHN_manu	0.002524	0.001460	0.003996	0.011101	0.013139	0.002498
CHN_elec	0.000065	0.000066	0.000374	0.001969	0.055780	0.001025
CHN_others	0.001007	0.001083	0.001688	0.003209	0.005992	0.002698
ROW_agri	0.150506	0.261687	0.000785	0.003513	0.000205	0.005639
ROW_food	0.064875	0.154532	0.001188	0.004853	0.000842	0.010368
ROW_steelalu	0.003155	0.007876	0.261871	0.060882	0.035119	0.011672
ROW_manu	0.052466	0.040637	0.118645	0.258620	0.099704	0.051750
ROW_elec	0.000462	0.000860	0.003288	0.007701	0.202139	0.003492
ROW_others	0.153189	0.234051	0.272878	0.256137	0.196509	0.339053

Source: Author calculation from OECD (2021) database

5.1.2 Direct and indirect impact of Global Value Chains (GVCs)

Table 6 represents a Leontief inverse matrix table which an author has calculated from the OECD database. The results of multipliers of matrix show the linkage of products in steel and aluminum, manufacturing, electronics, and other sectors which is the main focus of the study. Author has calculated and aggregate the multipliers of the Leontief inverse matrix and explain the forward and backward linkages of global economy through intra-regional sectors and inter-regional sectors.

Table 7 and figure 5 show the calculation of intra-regional forward and backward multipliers results of US, China, Thailand, and Rest of the world industries. From the forward and backward multipliers of Thailand domestic industries, food and manufacturing industries have a high volume of domestic backward multiplier which they have a strong demand for the output supply from other local industries for their production. While agricultural industry has a strong domestically forward multiplier in which it shows that it's in the upstream industry that their product output distributes to other domestically industry production. Steel and aluminum and electronics industries has a low level of domestically forward and backward multiplier on which this is show that these industries have a weak interconnect with other domestic industries.

Levels of US forward and backward intra-regional multiplier from table 7 also state that manufacturing and agricultural industries have a high forward multiplier which it can state that these industries have a high interconnection with other domestic industries for using their product as an input for the production. While food and steel and aluminum have a high level of domestically backward multipliers that they have a strong demand for the domestic output from the local industry. For the US electronics industry, it has a low level of domestically forward and backward multiplier which

show that US electronic industry has a weak interconnect with other domestic industries in terms of a product supplied to other industries and other product input's demand.

For the levels of China forward and backward intra-regional multipliers, its represent that steel and aluminum and manufacturing sectors are categorized as key industry of China which they have high level of forward multiplier and also a high level of backward multiplier which these industries have a strong interconnection with other domestic industry for both being a high product supply for other industries and have a high demand of other industry outputs to use as an intermediate input for their production. While electronics industry seems to be a downstream industry since it has low forward multiplier and relatively high backward multiplier when compared with other domestic industries. This defines that China's domestically electronic industry has a high demand and rely on other domestic industries output.

From figure 5, which represent the forward and backward of intra-regional multiplier of the world global value chain, it shows that, when compare the multiplier levels of US, China, and Thailand. China has a high level of both domestic forward and backward multipliers. This can be concluded that China has a strong domestically industry value chain while US is lower and Thailand is the least when compared to China.

Table 8 represents the calculation of inter-regional forward and backward multiplier results of US, China, Thailand, and Rest of the world for all industry.

For Thailand, inter-regional multiplier, it shows that steel and aluminum, manufacturing and electronics sectors have a highest level of backward multiplier which it can imply that these Thailand industries have a very strong linkage as their production is highly rely on the intermediate input from international suppliers. While

the forward multiplier of Thai industries is significantly low level when compared to other regions which it means that Thai industries has a very low of output distribution to other countries in terms of inter-regional value chain.

US inter-regional forward and backward multiplier show the position of US industries in the global sectors in which the backward multiplier of US steel and aluminum and manufacturing industries is relatively high when compared to other regional backward multiplier level which mean that US steel and aluminum, and manufacturing industries are relying on the intermediate inputs that need to be imported from other regional suppliers. While the forward multiplier of US industries is in the moderate level when compared to other regional industries which mean that the output production of US industries is moderately significant for the output distribution when compared to global value chain.

China inter-regional forward and backward multipliers show the position of each industry in the global economy. China industries mostly have a high level of forward multiplier when compared with the forward multiplier of other regions. China's manufacturing, steel and aluminum and electronic industry are having a strong forward multiplier which means that these China industries play a significant role as a strong output distribution to other inter-regional customer that buy China products as intermediate input for their industry production. However, China backward multipliers is also high when compared to every inter-regional backward multiplier. China steel and aluminum, and electronic industries also have a high level of backward linkage in which it determines that these China industries also rely on their inter-regional suppliers for intermediate inputs.

Figure 6 shows the relationship of the backward and forward multiplier of US, China, Thailand, and the rest of the world. The graph shows that Thailand industries mostly have a high level of backward multiplier when compared to every industry from other region. US industries multiplier also shows as a high level of backward multiplier when compared to China. This means that the US also depend on the intermediate input from other countries for their production. While China sectors seem to have a high level of forward multiplier and low backward multiplier effect. Therefore, most of China industries seem to be an upstream industry of the global value chain.

Due to US-China trade war, the intra and inter regional forward and backward multiplier shows that China steel and aluminum play a significant role to other inter-regional customer. While US and Thailand steel and aluminum industries are having a high level of backward multiplier which shows that its production is rely on the input from other countries. When looking at the electronics industry, it shows that China electronics industry also play a significant role as a strong output distribution to other inter-regional customer. While the backward multiplier also high which it determines that China electronic industries also rely on the inter-regional intermediates for its production. Thailand electronics industry has a strong level of backward multiplier and a low level of forward multiplier which means that Thailand electronics production still significantly relies on the inter-regional suppliers.

Therefore, Thailand electronics industry participate in the midstream to downstream in global value chain as they have a low value of forward multiplier and relatively high of backward multiplier. Figure 7 and figure 8 show that Thailand electronic sector relies on China in both import intermediate input for its production and export as intermediate inputs to China.

Table 6: Matrix of ICIO which represent both direct and indirect impact

	THA_agri	*THA_food*	*THA_steelalu*	*THA_manu*	*THA_elec*	*THA_others*	*US_agri*	*US_food*	*US_steelalu*
THA_agri	1.221247	0.482396	0.007675	0.021864	0.005992	0.031686	0.000348	0.000548	0.000051
THA_food	0.109771	1.212713	0.008272	0.015685	0.006509	0.037766	0.000495	0.000776	0.000068
THA_steelalu	0.004690	0.008584	1.146981	0.042372	0.016327	0.012155	0.000120	0.000153	0.000744
THA_manu	0.057643	0.075024	0.121730	1.274887	0.094629	0.115197	0.000552	0.000682	0.000813
THA_elec	0.001867	0.002813	0.004686	0.012922	1.179954	0.008620	0.000169	0.000202	0.000463
THA_others	0.226358	0.356751	0.300424	0.369633	0.236708	1.464392	0.000819	0.001113	0.001041
US_agri	0.002578	0.005229	0.000427	0.000618	0.000387	0.000579	1.180559	0.288767	0.003051
US_food	0.002167	0.003713	0.000669	0.000936	0.000603	0.000836	0.092251	1.147250	0.006069
US_steelalu	0.001299	0.002034	0.021290	0.009280	0.006699	0.002488	0.021474	0.028047	1.256673
US_manu	0.004214	0.004873	0.012453	0.018375	0.010943	0.005971	0.095484	0.087837	0.152279
US_elec	0.000421	0.000601	0.001669	0.002302	0.018524	0.001290	0.005308	0.006417	0.018863
US_others	0.011330	0.017590	0.030917	0.029751	0.031779	0.018882	0.535524	0.662620	0.518147
CHN_agri	0.005363	0.010188	0.005116	0.004837	0.006140	0.002544	0.002190	0.003161	0.001411
CHN_food	0.003821	0.006475	0.003263	0.003074	0.003915	0.001946	0.001623	0.002323	0.000908
CHN_steelalu	0.009088	0.013864	0.157166	0.065795	0.058933	0.020076	0.005759	0.006366	0.026815
CHN_manu	0.020457	0.025350	0.084039	0.106530	0.126947	0.037028	0.014777	0.014154	0.028314
CHN_elec	0.003202	0.004598	0.010991	0.019409	0.185691	0.011537	0.003752	0.004349	0.010220
CHN_others	0.017128	0.024741	0.107991	0.083151	0.125740	0.036000	0.012305	0.013690	0.028331
ROW_agri	0.017957	0.035803	0.006177	0.006752	0.004672	0.005926	0.021718	0.035206	0.002496
ROW_food	0.016546	0.028416	0.007377	0.007821	0.005598	0.007619	0.010878	0.016720	0.003059
ROW_steelalu	0.013428	0.020682	0.325016	0.118032	0.078560	0.030766	0.010852	0.012168	0.102161
ROW_manu	0.041173	0.048209	0.138175	0.191747	0.129538	0.065648	0.040832	0.034834	0.063110
ROW_elec	0.003811	0.005496	0.014497	0.022619	0.207100	0.013467	0.003820	0.004275	0.009948
ROW_others	0.085697	0.129350	0.354525	0.300758	0.251757	0.223429	0.072536	0.084108	0.130723

	US_manu	*US_elec*	*US_others*	*CHN_agri*	*CHN_food*	*CHN_steelalu*	*CHN_manu*	*CHN_elec*	*CHN_others*
THA_agri	0.000064	0.000037	0.000042	0.000914	0.001564	0.000131	0.000196	0.000216	0.000168
THA_food	0.000082	0.000044	0.000073	0.000517	0.000761	0.000112	0.000156	0.000217	0.000131
THA_steelalu	0.000336	0.000146	0.000078	0.000065	0.000073	0.000230	0.000223	0.000399	0.000097
THA_manu	0.001189	0.000485	0.000316	0.000845	0.000850	0.001426	0.002520	0.002815	0.001018
THA_elec	0.000663	0.001975	0.000283	0.000196	0.000216	0.000507	0.001020	0.010677	0.000510
THA_others	0.001157	0.001095	0.000467	0.001250	0.001588	0.001605	0.002377	0.005880	0.001450
US_agri	0.005556	0.000931	0.005177	0.004234	0.007209	0.000558	0.000742	0.000472	0.000760
US_food	0.009219	0.002163	0.011499	0.001149	0.001935	0.000420	0.000535	0.000490	0.000433
US_steelalu	0.082015	0.027930	0.015088	0.000755	0.000887	0.004617	0.003318	0.003527	0.001204
US_manu	1.205039	0.034994	0.051871	0.002982	0.003183	0.005937	0.010347	0.008305	0.003848
US_elec	0.019520	1.058259	0.008376	0.000371	0.000423	0.000974	0.001673	0.013902	0.000812
US_others	0.470886	0.192070	1.492002	0.009551	0.013316	0.016448	0.017760	0.025776	0.011057
CHN_agri	0.001584	0.001101	0.000548	1.347656	0.612194	0.032684	0.045913	0.022161	0.052370
CHN_food	0.001022	0.000710	0.000413	0.139622	1.230743	0.020214	0.026397	0.014219	0.035935
CHN_steelalu	0.015901	0.009693	0.004044	0.048091	0.055078	1.589424	0.289394	0.178736	0.114221
CHN_manu	0.035463	0.021148	0.009637	0.170968	0.169702	0.400799	1.630442	0.391501	0.268593
CHN_elec	0.014332	0.040620	0.005997	0.009010	0.009848	0.024606	0.048775	1.476133	0.023853
CHN_others	0.030175	0.023820	0.009906	0.311027	0.392716	0.775563	0.654948	0.501690	1.623931
ROW_agri	0.002753	0.000894	0.001549	0.015572	0.024749	0.004237	0.004368	0.004166	0.003936
ROW_food	0.003228	0.001095	0.002022	0.008351	0.012385	0.003938	0.003789	0.004396	0.002961
ROW_steelalu	0.036494	0.014832	0.006992	0.006016	0.006679	0.044138	0.028433	0.035905	0.011208
ROW_manu	0.086294	0.022663	0.019602	0.022772	0.022656	0.052443	0.075694	0.092861	0.031101
ROW_elec	0.013309	0.033892	0.005381	0.004545	0.004983	0.012341	0.023551	0.237338	0.011755
ROW_others	0.116863	0.045843	0.052128	0.048690	0.058952	0.187610	0.138320	0.204128	0.088462

	ROW_agri	*ROW_food*	*ROW_steelalu*	*ROW_manu*	*ROW_elec*	*ROW_others*
THA_agri	0.000401	0.000877	0.000094	0.000132	0.000151	0.000099
THA_food	0.000698	0.001399	0.000127	0.000172	0.000177	0.000165
THA_steelalu	0.000150	0.000219	0.001233	0.000590	0.000662	0.000187
THA_manu	0.000992	0.001153	0.001469	0.002648	0.002730	0.000827
THA_elec	0.000083	0.000114	0.000195	0.000327	0.004955	0.000160
THA_others	0.001652	0.002197	0.001937	0.002421	0.004192	0.001348
US_agri	0.002278	0.006361	0.000365	0.000494	0.000387	0.000381
US_food	0.001863	0.004090	0.000610	0.000811	0.000674	0.000556
US_steelalu	0.001346	0.002098	0.012970	0.006371	0.005377	0.001710
US_manu	0.005503	0.006319	0.010798	0.018957	0.012013	0.004850
US_elec	0.000383	0.000542	0.001111	0.001442	0.013778	0.000649
US_others	0.016525	0.026506	0.032626	0.033620	0.044949	0.020684
CHN_agri	0.002010	0.004583	0.001650	0.001753	0.003378	0.000898
CHN_food	0.001756	0.003736	0.001102	0.001186	0.002181	0.000720
CHN_steelalu	0.004555	0.006192	0.036990	0.018666	0.028922	0.006311
CHN_manu	0.011492	0.013468	0.028520	0.036901	0.067662	0.012703
CHN_elec	0.001909	0.002647	0.005050	0.008188	0.107834	0.004089
CHN_others	0.010689	0.014502	0.033162	0.031261	0.070594	0.014869
ROW_agri	1.210628	0.380834	0.011213	0.015601	0.008048	0.017854
ROW_food	0.098333	1.220374	0.013091	0.017325	0.009912	0.021705
ROW_steelalu	0.023011	0.036942	1.392118	0.130135	0.090951	0.036571
ROW_manu	0.122676	0.143736	0.277594	1.421254	0.230025	0.121851
ROW_elec	0.004262	0.006402	0.012887	0.019000	1.276994	0.009241
ROW_others	0.375767	0.596172	0.699853	0.625656	0.523393	1.592208

Source: Author calculation from OECD (2021) database

Table 7: Intra Regional Forward and Backward multiplier results

Intra industry sector	***Forward multiplier***	***Backward multiplier***
	Thai Sector	
Agricultural sectors	1.7709	1.6216
Food sectors	1.3907	2.1383
Steel and Aluminum sectors	1.2311	1.5898
Manufacturing sectors	1.7391	1.7374
Electronics sectors	1.2109	1.5401
Other sectors	2.9543	1.6698
	US Sector	
Agricultural sectors	1.4840	1.9306
Food sectors	1.2685	2.2209
Steel and Aluminum sectors	1.4312	1.9551
Manufacturing sectors	1.6275	1.7922
Electronics sectors	1.1167	1.3163
Other sectors	3.8712	1.5840
	China Sector	
Agricultural sectors	2.1130	2.0264
Food sectors	1.4671	2.4703
Steel and Aluminum sectors	2.2749	2.8433
Manufacturing sectors	3.0320	2.6959
Electronics sectors	1.5922	2.5844
Other sectors	4.2599	2.1189
	Rest of the world Sector	
Agricultural sectors	1.6442	1.8347
Food sectors	1.3807	2.3845
Steel and Aluminum sectors	1.7097	2.4068
Manufacturing sectors	2.3171	2.2290
Electronics sectors	1.3288	2.1393
Other sectors	4.4130	1.7994

Source: Author calculation

Figure 5: The graph shows the relationships forward and backward multipliers of intra-regional sector.

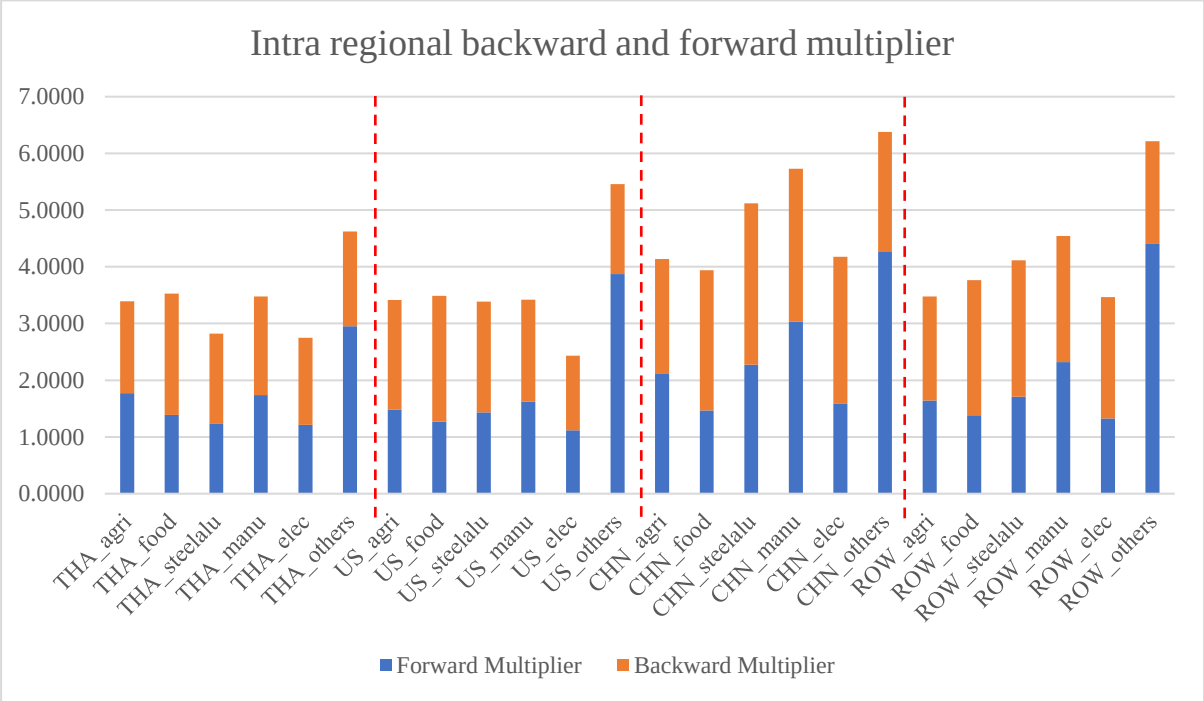


Table 8: Inter Regional Forward and Backward multipliers result.

Inter-industry sector	***Forward multiplier***	***Backward multiplier***
	Thai Sector	
Agricultural sectors	0.00603	0.25968
Food sectors	0.00617	0.38721
Steel and Aluminum sectors	0.00570	1.28176
Manufacturing sectors	0.02333	0.99179
Electronics sectors	0.02271	1.25352
Other sectors	0.03359	0.48603
	US Sector	
Agricultural sectors	0.03406	0.20354
Food sectors	0.02249	0.23483
Steel and Aluminum sectors	0.08727	0.41068
Manufacturing sectors	0.14987	0.36091
Electronics sectors	0.06086	0.22009
Other sectors	0.40907	0.11948
	China Sector	
Agricultural sectors	0.08265	0.12878
Food sectors	0.05567	0.16241
Steel and Aluminum sectors	0.75148	0.33767
Manufacturing sectors	0.97145	0.31502
Electronics sectors	0.60058	0.65147
Other sectors	0.96458	0.17091
	Rest of the world sector	
Agricultural sectors	0.19893	0.06429
Food sectors	0.14620	0.09700
Steel and Aluminum sectors	0.90236	0.17001
Manufacturing sectors	1.17935	0.16594
Electronics sectors	0.63213	0.37062
Other sectors	2.57388	0.07121

Source: Author calculation

Figure 6: The graph shows the relationships forward and backward multiplier of inter-regional sector.

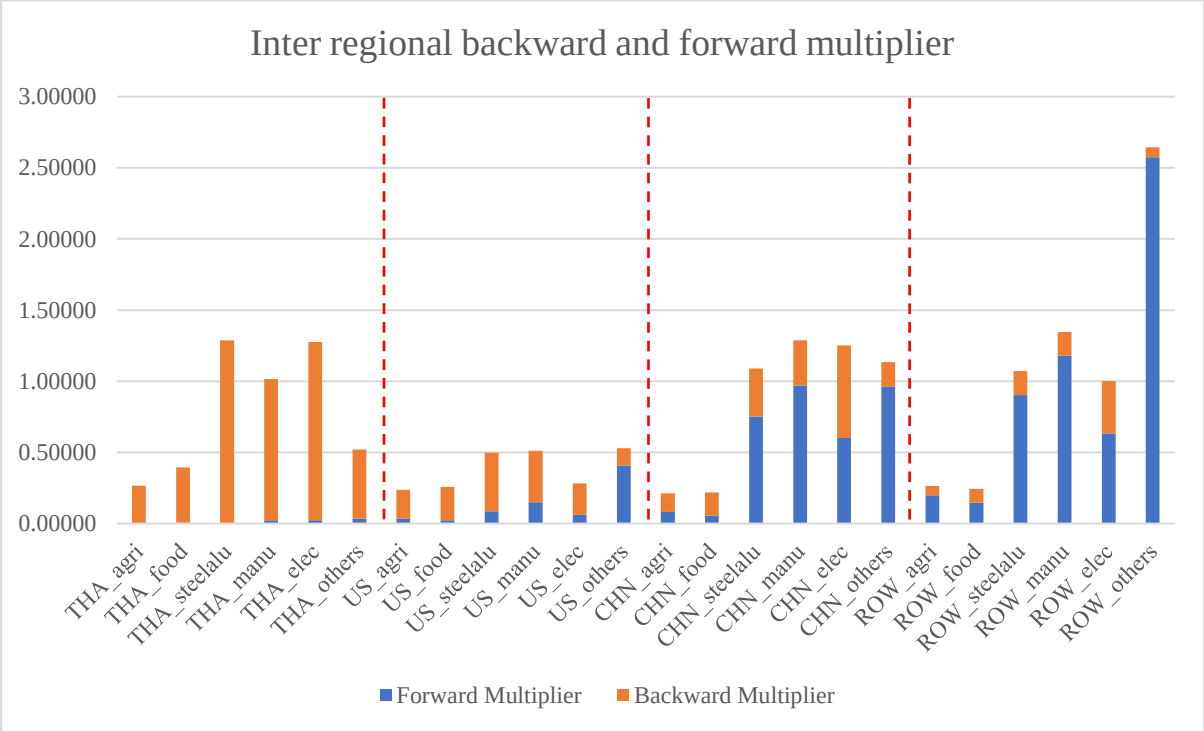


Figure 7: Forward participation of Thailand electronics in global value chain

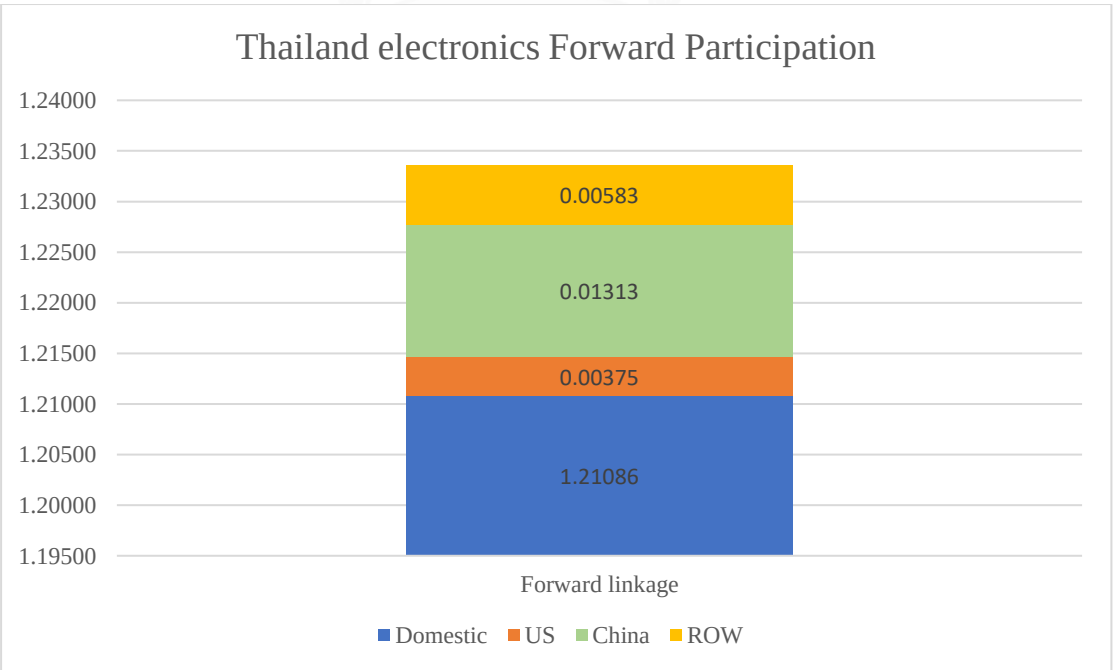
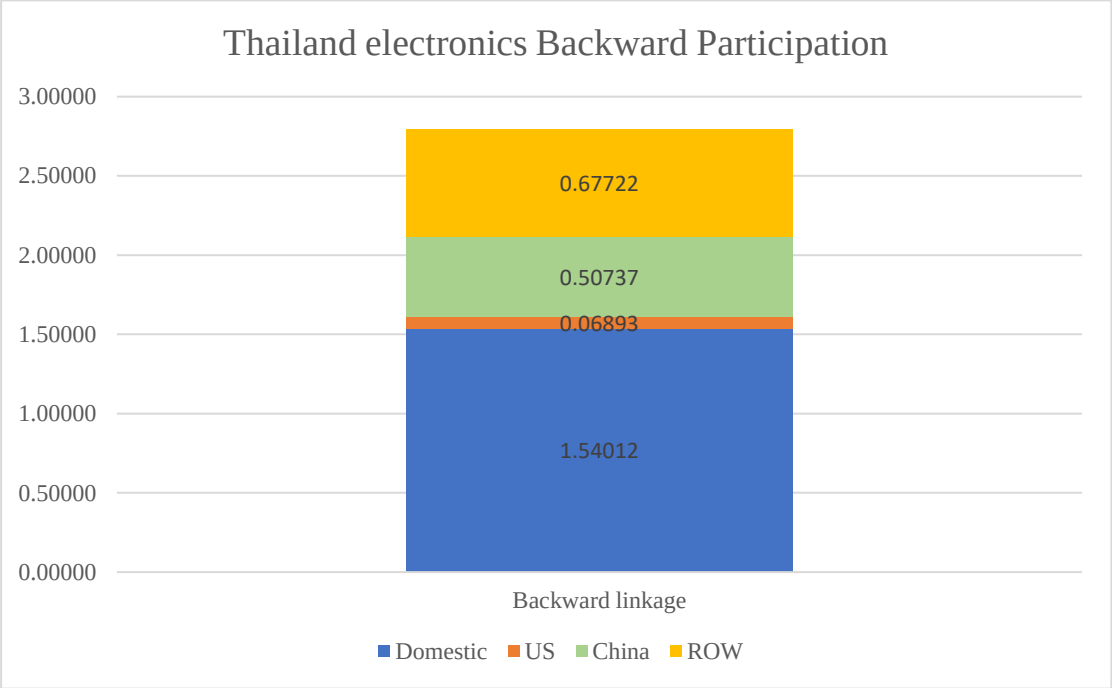


Figure 8: Backward participation of Thailand electronics in global value chain



5.2 Result from GTAP simulation

5.2.1 Welfare

According to the GTAP analysis, Welfare is shown by the equivalent variation (EV). The welfare represents the economic well-being of each country or region. Due to an increasing of tariff imposed by US and China, the welfare of every region in the World are impacted. This situation can be explained by trade diversion effect in which US and China retaliatory tariff effects the welfare of both countries because US and China will decline their import amount from each other as a result of price increases. Therefore, US products that export to China market and China products that export to US market will fall sharply. Moreover, the impact of the welfare in US is worse than China which can imply that US are more dependent on China products. In contrast,

other countries take benefit in their welfare from an increasing in US and China importer demand that they seek for an alternative product from other countries that can substituted the products rather from its rivalry country. Therefore, it can improve other countries production and it boosts the exports of other countries.

From table 9, the simulation results from 3 scenarios show the different impact of an accumulation in tariff between US and China. From the figure 9 shows that US and China loss their welfare when they desire to increase tariff on each other products. While other countries, including Thailand, Southeast Asia, EU, Oceania, and rest of the world gain more welfare. This implies that other countries benefit from trade diversion effect that they are having an opportunity to increase their export products to US and China.

According to the impact on Thailand welfare, the simulation result shows that Thailand gains more welfare from US-China trade war. From the scenario 1 which is a US impose tariff on China steel and aluminum products, it shows that Thailand gains more welfare around 0.56 million dollars. While scenario 2 and 3 which both US and China have imposed tariff on each other import products, Thailand welfare increase around 17 million dollars in scenario 2 and 18 million dollars in scenario 3. The result is supported the hypothesis that Thailand will benefit from welfare due to a trade war situation. This can be implied that Thailand welfare is increase due to trade diversion effects. The result is compatible with the literature of Bouët and Laborde (2018), Tu et al. (2020), Li et al. (2020), Cui et al. (2019), Carvalho et al. (2019), and Rosyadi and Widodo (2018) which most of them show that since US and China that impose tariff on their products lead to a higher price of US and China products and both of them reduce the number of import from each other and find the alternative destination for the

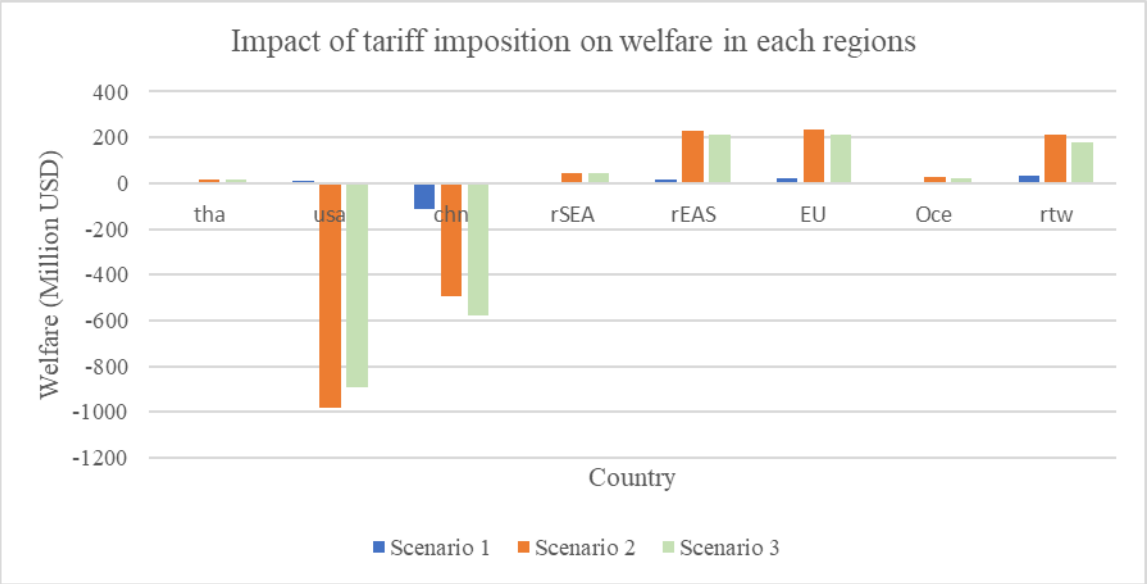
importation. Therefore, there is an improvement of welfare on third countries due to an increasing amount of export to both US and China.

Table 9: An impact on welfare in each situation (million US dollar)

EV	***SCENARIO 1***	***SCENARIO 2***	***SCENARIO 3***
THA	0.5642	16.9405	18.0199
USA	10.9193	-982.8560	-890.5850
CHN	-111.4630	-493.0000	-576.2770
RSEA	1.8746	45.5363	44.5919
REAS	16.8476	226.1268	214.2509
EU	22.2675	236.8574	212.0489
OCE	-0.8322	24.4948	21.2112
RTW	35.1295	211.0671	177.7403

Source: Author calculation from GTAP Model

Figure 9: the simulation results on welfare from each scenario (million US dollars)



5.2.2 Trade Balance (Net Export)

Trade balance shows the difference in value of each country export and import. According to impact on trade balance in each country from table 10, it shows that US and China trade balance increase, while other countries trade balanced is reduced. This result is mainly related to trade diversion effect in which US and China has reduce their imports among them, but their products could be exported to other countries and those countries indirectly re-export to both US and China through the third country. The result of this trade diversion higher US and China export volume. They gain from divert their product to other countries. However, the number of US and China imports increase from the trade diversion that they need to source the substitute product from third country but there also still has a shrink of import volume due to a trade restriction between them. Therefore, the trade surplus of both China and US are increase. On the other hand, imports of other countries increase from trade diversion. Moreover, due to the trade friction it may cause the reduction of the value of imports and exports of US and China to third countries.

Table 11 shows the results on trade balance in each sector of US, China, and Thailand. It shows that due to the steel and aluminum scenario (scenario 1), US gains more trade balance at 178 million US dollar in steel and aluminum because they announce to increase tariff on China steel and aluminum, while China loss their trade balance in steel and aluminum from this situation as it shows in table 11 that China loses trade balance in Steel and Aluminum at 492 million US dollar. Thailand also gains more trade balance at 2 million US dollar on Steel and Aluminum from the trade diversion which US looks for other import countries rather than China. However, since the products are all linked, steel and aluminum are being used as an intermediate output

of some sectors. According to scenario 1, electronics and manufacturing sector trade balance in both US and Thailand are reduce by 29, 79 million US dollar and 0.97, 1.5 million US dollar, respectively, because the effect of increase tariff of China steel and aluminum which it is a main intermediate input and it is the upstream industry of these sectors while China electronic and manufacturing sector trade balance are increase as they use their steel and aluminum that they produce. When looking at scenario 2 and scenario 3, which there is an intense on tariff accumulation among US and China, most of US and China sectors loss in the change in their trade balance, only few sectors that has an increase in the change of trade balance.

For US sectors, agricultural and food industries show as a loss in trade balance in scenario 2 and 3 which related to the China retaliation that China impose the tariff on US agricultural product which is a main export industry to China. China steel and aluminum, and electronics industries are having a loss in trade balance due to steel and aluminum industry is a focus of US tariff imposition against China.

For Thailand, comparing with scenario 2 and 3, Thailand faces both increase in trade balance in some sector while mostly of sector suffer from more trade deficit. Thailand can gain more trade surplus from the trade diversion that occur from both US and China that they divert their import country to the third countries. From figure 10 shows that agricultural and manufacturing industry may gain from the trade dispute in which China can import this substitute products from Thailand. However, due to the global value chain impact Thailand still has a trade loss due to some of Thailand industries depend very much on both import from and export to both China and US. Figure 10 shows that most of Thailand industry faces a decline in trade balance from the impact of tariff retaliation among US and China.

From figure 10, Thailand electronics industry, which is a focus of this study, suffers in a negative impact from the global value chain effect that electronics is a main export to both US and China. From table 11, Thailand electronics industry in the first scenario, which US impose tariff on China steel and aluminum, has a decline in trade balance at 0.9766 million dollars. While the intense scenarios in scenario 2 and 3 that both US and China desire to impose more tariff on each other products effect more negative on Thailand trade balance. From table 11 shows that Thailand electronics industry has more trade deficit at 9.05878 million USD in scenario 2 and 5.81313 million USD in scenario 3. The result support hypothesis that Thailand electronic industry suffer from a decline in trade balance. The result also relates to previous scenarios from Cui et al. (2019), Carvalho et al. (2019), Rosyadi and Widodo (2018), and Itakura (2020) which they found that other countries face a reduction in trade balance from the trade war situation. More trade deficit from third countries may come from an increase in number of imports of third countries from US and China market. And because US and China impose tariff on both import product, slowing down both economies and their productions, this leads to a decrease in demand for import intermediate from other countries. Therefore, number of exports in other countries may face a decline from the global value chain disruption. As Thailand electronics also depend much on China market, the trade balance also declines from trade war

Table 10: An impact on trade balance (million US dollar)

DTBAL	*SCENARIO 1*	*SCENARIO 2*	*SCENARIO 3*
THA	-0.9479	-11.4810	-9.9530
USA	69.0819	873.2424	798.9459
CHN	30.5386	363.2981	320.3622
RSEA	-2.7961	-48.6037	-44.7753
REAS	-17.5344	-241.7891	-226.0305
EU	-23.8216	-465.6730	-420.8069
OCE	-2.4459	-45.8694	-40.7885
RTW	-52.0730	-423.1223	-376.9391

Source: Author calculation from GTAP Model

Figure 10: Thailand trade balance in each sector (million US dollars)

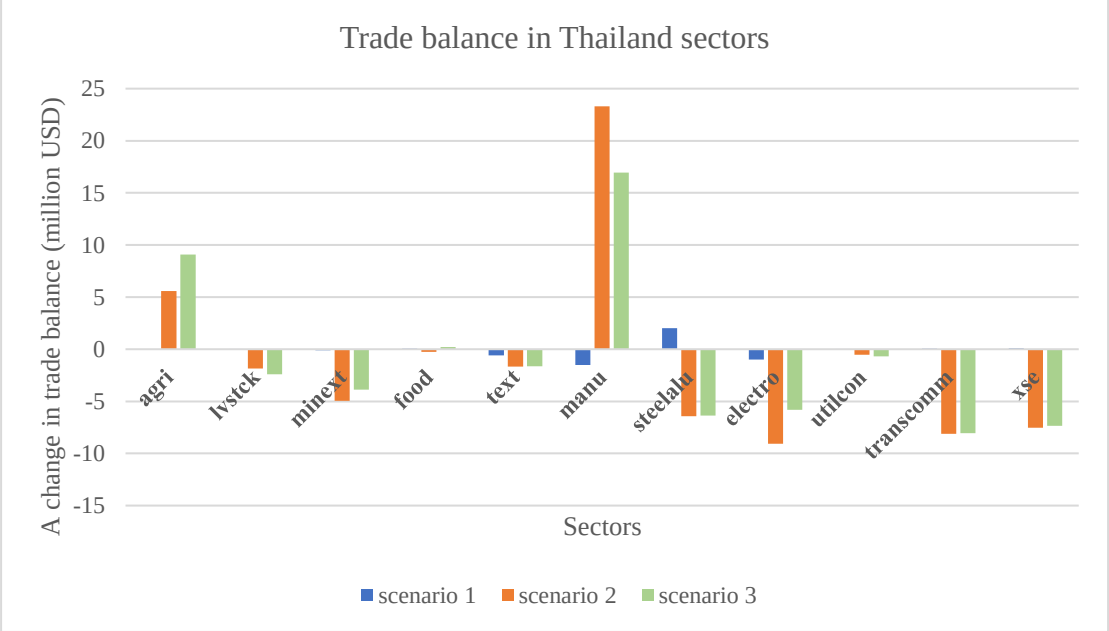


Table 11: An impact on trade balance in each sector (million US dollar)

	SCENARIO 1			***SCENARIO 2***			***SCENARIO 3***		
DTBALI	**tha**	**usa**	**chn**	**tha**	**usa**	**chn**	**tha**	**usa**	**chn**
AGRI	-0.0331	0.2145	4.7724	5.5749	-125.6170	117.8653	9.0791	-230.4580	185.4503
LVSTCK	0.0176	0.4319	3.1625	-1.8402	-16.2670	18.2245	-2.4037	0.9435	6.3623
MINEXT	-0.0878	-5.5536	85.6549	-4.9453	60.9478	-97.3182	-3.8910	39.3788	-65.7404
FOOD	0.0400	0.1060	6.5047	-0.2556	-21.0717	41.1542	0.1946	-56.3629	42.1028
TEXT	-0.5926	-3.2175	40.6741	-1.6606	98.0046	-54.1405	-1.6309	85.5272	-49.0529
MANU	-1.5161	-79.9190	249.4940	23.3111	-501.1830	557.4582	16.9500	-325.6380	450.5374
STEELALU	2.0341	178.0103	-492.2940	-6.4318	129.7620	22.9656	-6.3546	291.5044	-46.9671
ELECTRO	-0.9766	-29.9158	88.2936	-9.0588	352.2029	-214.1890	-5.8131	171.0801	-172.0940
UTILCON	0.0098	1.9868	6.3287	-0.5220	73.9566	26.0581	-0.6687	82.8539	14.0980
TRANSCOMM	0.0601	0.9253	19.7378	-8.1268	269.3470	-25.8575	-8.0636	241.4098	-21.7513
XSE	0.0968	6.0129	18.2097	-7.5260	553.1609	-28.9238	-7.3510	498.7099	-22.5842

Source: Author calculation from GTAP Model

5.2.3 Quantity Output (Domestic production)

The quantity output or the domestic production represents the amount of one's country produces each kind of product in the country. Therefore, table 12 presents the percentage change of domestic production in each country by sector when there is an impact from tariff accumulation from US and China. According to scenario 1 which US apply tariff on China steel and aluminum, the result shows that China reduce their quantity output of steel and aluminum as they suffer from the trade protection while US can produce more of steel and aluminum as well as Thailand, as they can gain from the trade diversion from the trade a China's substitute product to other countries. But when looking at supply chain linkage, productions of sectors which use steel and aluminum as an input such as manufacturing and electronic have slow down due to the lack of imported intermediate input from a tariff imposition which makes the price of steel and aluminum from China increase. For overall scenarios, comparing with each US quantity output sector, electronics, steel and aluminum, utility and construction, and mining and extraction sector tend to produce more output when there is more intense in trade dispute while they are slow down their production in agricultural and food sector, which are the main tariff imposition from China. Oppositional to China, quantity output that agricultural and food sector have an increasing trend because they can stimulate these industries in their country from blocking the import from the US. However, China has slowed down their production in textiles and electronics sectors both in scenario 2 and 3 and steel and aluminum in scenario 1 and 3, which these sectors are the sectors that US increases import tariffs.

Thailand agricultural and manufacturer's production output benefit from trade diversion that US and China look for the alternate countries for their import. These

sectors can be classified as a competitive product which they can increase their production to export their substitute product to both US and China.

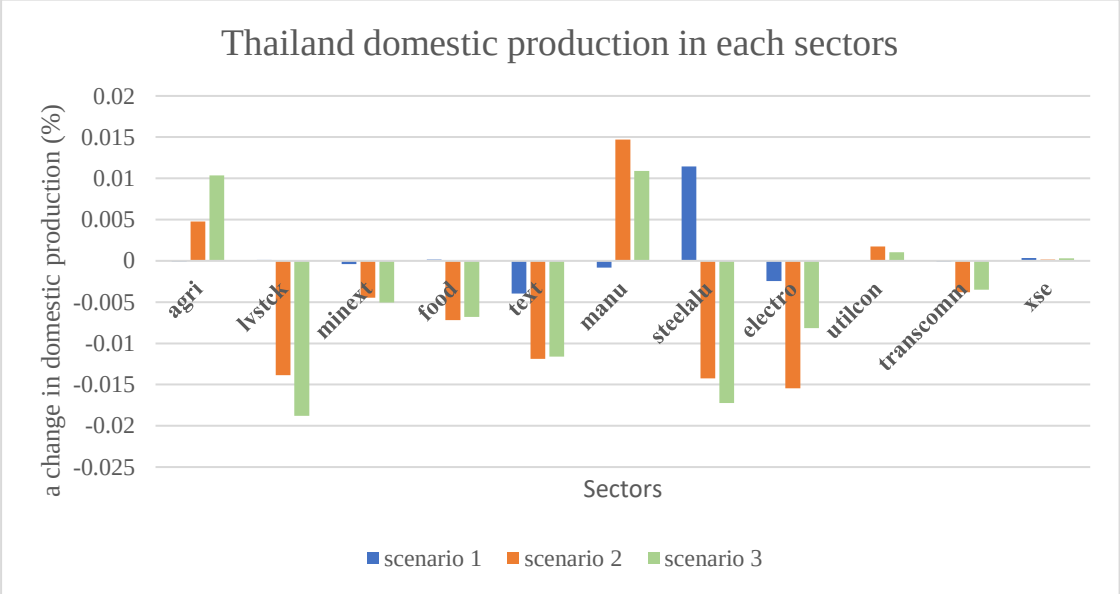
The result supports the hypothesis that Thailand electronics sector suffer from the reduction of domestic production output. For the impact of Thailand electronics industry, 3 scenarios show that electronics industry reduces their domestic production (From figure 11). This can be caused by the position of supply chain since Thailand electronics participate in the middle to downstream industry. It means that Thailand electronics product relies on intermediate input import from foreign countries, which is China, and also exports those products to China and US. The trade war will make both China and US slowdown in their economy, and causes Thailand to loss from the decline in export of electronics part to both countries. Therefore, the protection between US and China will hurt Thailand electronic supply chain. It can be predicted from previous research from Itakura (2020) that decline of import demand from US and China will pass through to other countries trade for it intermediate inputs.

Table 12: An impact on quantity output in each situation (% change)

QO	***SCENARIO 1***			***SCENARIO 2***			***SCENARIO 3***		
	tha	**usa**	**chn**	**tha**	**usa**	**chn**	**tha**	**usa**	**chn**
AGRI	-0.0001	0.0001	0.0023	0.0048	-0.0488	0.0312	0.0103	-0.0990	0.0496
LVSTCK	0.0001	0.0001	0.0013	-0.0139	-0.0041	0.0051	-0.0188	0.0046	0.0010
MINEXT	-0.0004	-0.0003	-0.0005	-0.0045	0.0158	0.0010	-0.0050	0.0134	0.0003
FOOD	0.0002	-0.0001	0.0012	-0.0072	-0.0050	0.0057	-0.0068	-0.0088	0.0056
TEXT	-0.0040	-0.0025	0.0092	-0.0119	0.0365	-0.0136	-0.0116	0.0321	-0.0129
MANU	-0.0008	-0.0033	0.0053	0.0147	-0.0163	0.0143	0.0109	-0.0115	0.0128
STEELALU	0.0114	0.0280	-0.0241	-0.0142	0.0250	0.0047	-0.0172	0.0501	-0.0009
ELECTRO	-0.0025	-0.0086	0.0133	-0.0155	0.0726	-0.0328	-0.0081	0.0353	-0.0269
UTILCON	0.0001	0.0006	-0.0036	0.0017	0.0010	0.0061	0.0011	0.0023	0.0032
TRANSCOMM	-0.0001	-0.0001	0.0010	-0.0038	0.0033	-0.0027	-0.0035	0.0026	-0.0031
XSE	0.0003	-0.0002	-0.0008	0.0002	-0.0001	-0.0070	0.0003	-0.0004	-0.0071
CGDS	0.0011	-0.0022	-0.0020	0.0156	-0.0231	-0.0131	0.0143	-0.0213	-0.0125

Source: Author calculation from GTAP Model

Figure 11: Thailand domestic production in each sector (% change)



5.2.4 Gross domestic production (vGDP)

Due to the impact of imposing in tariff between China and US, there will be impacts to the GDP in both US and China, and, due to the global value chain, the impact of both US and China will also has an impact in other countries. Table 13 shows that the value of GDP of the US decline while China and other countries GDP benefit from tariff imposition. The impact of scenario 1 shows that China is the country that has the most impact in their GDP contraction around 0.04109 percent while US and other countries gain from this situation. The result can be explained that China, which is the main target of US tariff imposition, is suffered from US increase tariff because China main export is US and steel and aluminum sectors is a key industry of China. When looking at scenario 2 and 3, US is suffered from this trade dispute which there is a contraction in value of GDP of US in scenario 2 and 3. However, China seems benefit

from the scenario 2 and 3. Imported products from the industries of China are mainly in the upstream industry and their products are imported in term of export to the other countries major for export to other which other countries. For other countries such as Thailand, EU, Southeast Asia, East Asia or Oceania, countries have benefit from the trade war where most of GDP of these countries are increasing due to the trade diversion effect. This situation can be concluded that USA and China are suffered from the tariff war while the trade diversion from US-China trade war makes other countries gain from the situation. GDP of Thailand, EU, Southeast Asia, East Asia country increase in all 3 scenarios (See in figure 12).

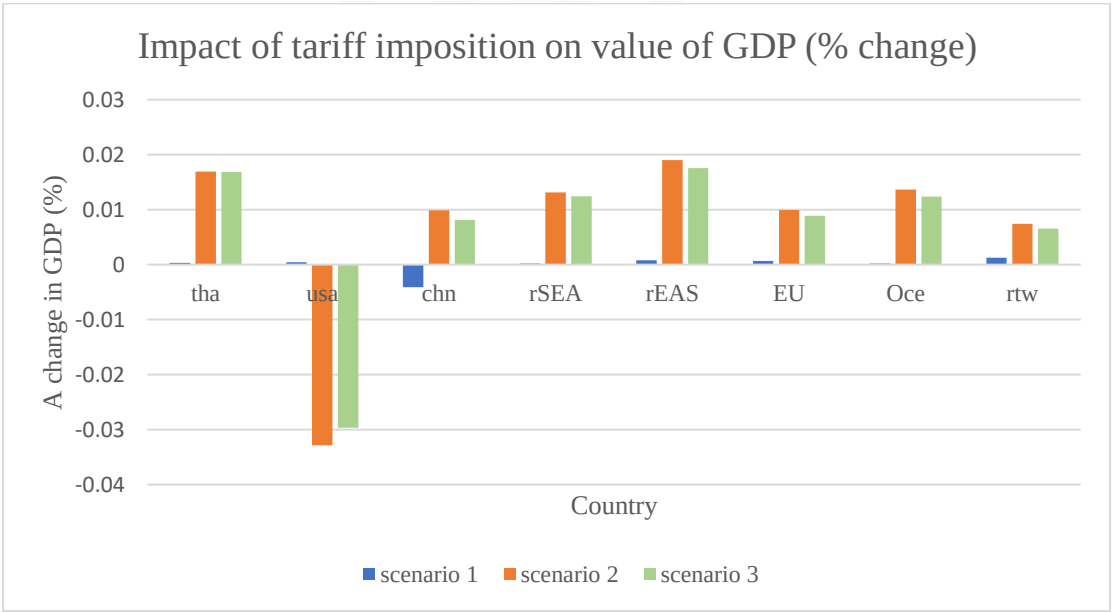
Thailand has a positive benefit in the value of gross domestic production. The result also supports the hypothesis that Thailand will gain more GDP from trade war situation. This may imply that Thailand enhances amount of export to US and China from the trade diversion that US and China are looking for other import destination. The result also relates to the previous literatures from Itakura (2020); Taufikurahman and Firdaus (2019); Cui et al. (2019); Nugroho et al. (2021); Rosyadi and Widodo (2018) which conclude that other countries gain more GDP from trade diversion which the decline in US and China import from each other will divert to other countries.

Table 13: An impact on value of gross domestic production (vGDP) (% change)

VGDP	SCENARIO 1	SCENARIO 2	SCENARIO 3
THA	0.0003	0.0169	0.0168
USA	0.0004	-0.0328	-0.0296
CHN	-0.0041	0.0099	0.0081
RSEA	0.0002	0.0131	0.0125
REAS	0.0008	0.0190	0.0176
EU	0.0007	0.0099	0.0089
OCE	0.0002	0.0137	0.0124
RTW	0.0012	0.0074	0.0065

Source: Author calculation from GTAP Model

Figure 12: A change of value of gross domestic production (GDP) in each region (million US dollars)



5.2.5 Market price of import products (PIM)

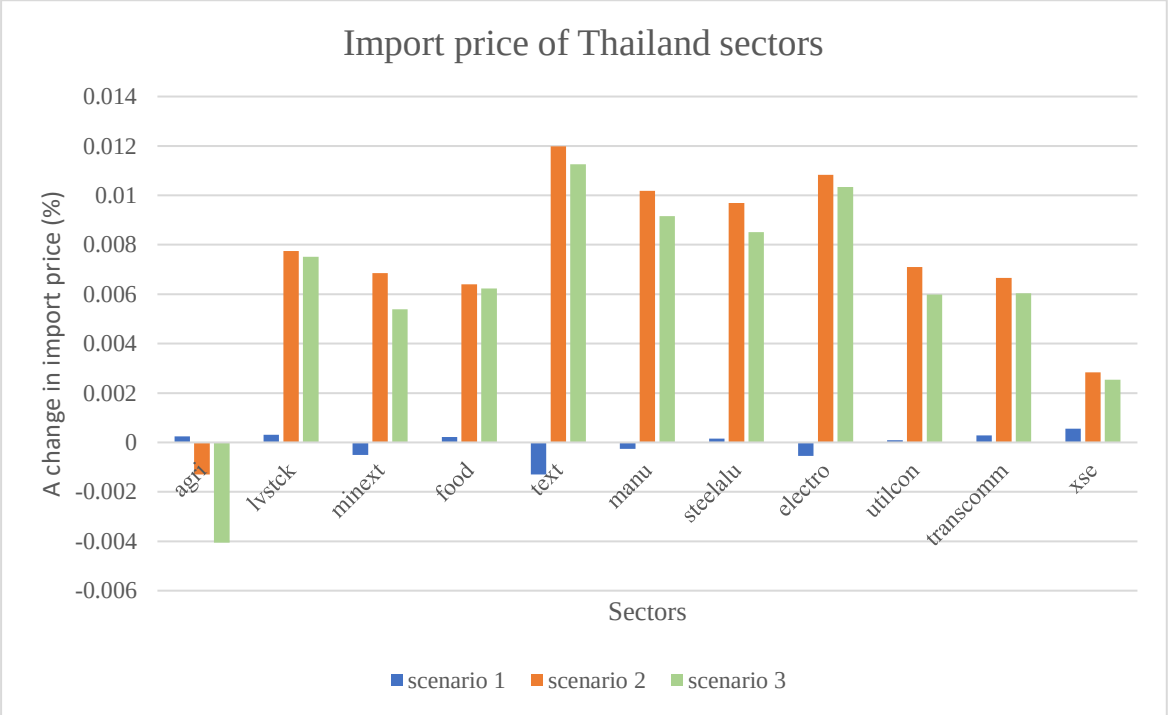
According to the price of import products, it is related with the trade war situation that when there is an increase in tariff of one product, it will have an effect to every product of every country due to global value chain. Table 14 shows the percentage change on the market price of import product of US, China, and Thailand. In scenario 1 to scenario 3 we can conclude that the price of import product for all sectors in each country are increase. This situation is related to the global value chain that when there is a trade friction it may cause the impact to global production chain due to increasing tariff of the production from US and China. When the price of US and China products increase, it impacts other countries in the supply chain.

Figure 13 shows the change in import price of Thailand sectors compare with 3 scenarios. The result shows that import price of electronic industry increase drastically when there is a tariff imposition among US and China. Since Thailand electronic depends much on both US and China product, the tariff imposition on both US and China product will make a price of their product become higher, which it will pass through global value chain who are reliance on both US and China products for their production.

Table 14: An impact on the market price of import product (% change)

PIM	***SCENARIO 1***			***SCENARIO 2***			***SCENARIO 3***		
	tha	**usa**	**chn**	**tha**	**usa**	**chn**	**tha**	**usa**	**chn**
AGRI	0.00025	0.00075	0.00060	-0.00130	0.00849	0.11525	-0.00405	0.00885	0.17900
LVSTCK	0.00031	0.00062	0.00052	0.00775	0.00999	0.09991	0.00752	0.00966	0.08801
MINEXT	-0.00051	-0.00040	-0.00049	0.00685	0.00629	0.00803	0.00539	0.00490	0.00687
FOOD	0.00022	0.00054	0.00055	0.00640	0.00901	0.11246	0.00624	0.00847	0.13845
TEXT	-0.00130	-0.00097	0.00030	0.01198	0.01118	0.03961	0.01126	0.01015	0.03711
MANU	-0.00026	-0.00005	0.00055	0.01018	0.01031	0.08966	0.00915	0.00905	0.07894
STEELALU	0.00015	0.05810	0.00089	0.00969	0.00875	0.03199	0.00851	0.00754	0.00737
ELECTRO	-0.00054	-0.00098	0.00021	0.01083	0.01256	0.02006	0.01034	0.01193	0.02412
UTILCON	0.00009	0.00031	0.00019	0.00710	0.00704	0.05030	0.00599	0.00590	0.03267
TRANSCOMM	0.00029	0.00052	0.00066	0.00666	0.01024	0.00820	0.00603	0.00925	0.00747
XSE	0.00056	0.00063	0.00068	0.00284	0.01005	0.00240	0.00254	0.00903	0.00219

Figure 13: Import price of each Thailand sectors (% change)



Source: Author calculation from GTAP Model

Chapter 6

Conclusion and Policy Recommendation

6.1 Conclusion

According to the US-China trade war, which US and China announce to impose tariff on each other products since 2018, this situation of tariff accumulation between US and China will cause a supply chain disruption and effect on global economy. From this study we use Inter-country input output table (ICIO Table) to explain the linkage and the relationship of global value chain. Moreover, this study uses GTAP model to analyze the impact on US-China trade war that there is an increase in import tariff on global economy. We create 3 scenarios to compare and see how the trade dispute impact the global value chain.

The result from ICIO table from this study explains the relationship of whole economy's industries production and the participation of each industry in global value chain. The study shows that China industries, including steel and aluminum and electronics sectors, play a significant role as an output distribution where their products is being used as an intermediate input for other inter-regional industries. While US and Thailand industries seems to rely on other output from inter-regional suppliers to use as their intermediate input for their industries. For Thailand, steel and aluminum and electronics industries is also rely on the inter-regional suppliers' output for their production as well.

The simulation result from GTAP model on the impact of global economy from US-China trade war shows that Thailand welfare and GDP increase. This benefit may be caused by trade diversion that US and China decide to import substituted products

from other countries with less price, and Thailand is one of them. The results support our hypothesis that Thailand gain more welfare and GDP.

If we focus on electronics sectors in Thailand, even though Thai electronics sector is a main export product for Thailand, Thai electronics industry is classified as a midstream to downstream industry in global value chains which most of electronics production is in the process of assembly and packaging and re-export to use as an intermediate input further. Thailand electronic production still rely much on import upstream intermediate input as they still lack capability to produce high technology products and Thailand major import of electronic input is China (according to the result from ICIO). Moreover, Thailand main export countries of these products are US, China, Hongkong etc. which the tariff imposition between US and China may affect Thailand electronics sector indirectly.

The result approves the hypothesis of the study. As the GTAP analysis suggested, which we have study the impact of tariff retaliation among US and China, the result of the factors that we have focus shows that Thai electronics industry will be affected as a slowdown trend of trade from trade dispute causing US and China economic slowdown. The analysis from GTAP shows that there is a lower domestic production in Thai electronics industry which related to China electronics industry. Also, in the trade balance for Thai electronics industry, it shows a loss in trade balance of this sector which correspond to China electronics sectors. Furthermore, the price of import products in electronics industry also increase due to the tariff imposition that make the input for production increase. The result of GTAP can be explained through Thailand electronics sector when compared to the global economy. It shows that Thailand electronics industry participates in the midstream to downstream of the global

value chain. This means that it depends on other electronic or other intermediate inputs from other country, and Thai electronics productions seriously depends on China input for its production. Therefore, the trade restriction that US mainly impose on the products imported from China, mainly on steel and aluminum, electronics sectors, and manufacturing products and high technology products, will impact on Thailand electronic exports through global value chain.

6.2 Policy Recommendation

Trade war between US and China, which they have a policy of imposing tariff on import product, leads to a supply chain disruption and affect to global economy from a shock that price of two superpowers product become more expensive. This study shows that the situation causes negative impact on Thai electronic industry through global value chain, and Thailand electronic product relies heavily on both US and China.

To maintain the exports and the production of electronic products which it is the main export industry in Thailand, Thailand government should design for a supply chain resilience to enhance a strong electronic supply chain and cope with a shock from US-China tariff imposition. Thailand should diversify their electronic network to other countries or regions, such as neighboring countries in ASEAN or country that Thailand has FTA with, for lowering a risk from supply chain disruption and make Thailand electronic supply chain become more independent from US and China. Thailand needs to find new source of input for electronic production. Moreover, Thailand also needs to diversify their export destination to other countries to make electronic supply chain more resilience. Furthermore, Thai government should support research and

development on electronics sector to push the industry upstream on the global value chain. This may make the Thai electronic sector become more independent from both US and China.

6.3 Limitation of the study

The limitation of this study is that the study focuses on the impact of US-China trade war in the short period which we examine the impact on trade war with occur after the policy implementation in 2018 to 2019 which the results from the study will show the impact only in short term. I recommend further research to simulate the impact of trade war in further longer after 2019 to examine the long-term effects of US-China trade war. Moreover, this study classifies a limited perspective of sectors and countries which the result from simulation will be narrow. Therefore, I suggest further research to study on the impact of trade war in wider sectors and countries.

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Appendix

Table 15: The classification of sector from OECD database for Input Output table calculation

No	Aggregate Sectors	Code	Industry details
1	agri	D01T03	Agriculture, forestry, and fishing
2	elec	D26	Computer, electronic and optical products
3	food	D10T12	Food products, beverages, and tobacco
4	steelalu	D24	Basic metals
5		D25	Fabricated metal products
6	manu	D20T21	Chemicals and pharmaceutical products
7		D22	Rubber and plastic products
8		D23	Other non-metallic mineral products
9		D27	Electrical equipment
10		D28	Machinery and equipment, nec
11		D29	Motor vehicles, trailers, and semi-trailers
12		D30	Other transport equipment
13		D31T33	Other manufacturing; repair and installation of machinery and equipment
14		D35T39	Electricity, gas, water supply, sewerage, waste, and remediation services
15	others	D05T06	Mining and extraction of energy producing products
16		D07T08	Mining and quarrying of non-energy producing products
17		D09	Mining support service activities
18		D19	Coke and refined petroleum products
19		D13T15	Textiles, wearing apparel, leather, and related products
20		D16	Wood and products of wood and cork
21		D17T18	Paper products and printing
22		D45T47	Wholesale and retail trade; repair of motor vehicles
23		D49T53	Transportation and storage
24		D55T56	Accommodation and food services
25		D58T60	Publishing, audiovisual and broadcasting activities
26		D61	Telecommunications
27		D62T63	IT and other information services
28		D64T66	Financial and insurance activities

No	Aggregate Sectors	Code	Industry details
29	others	D68	Real estate activities
30		D69T82	Other business sector services
31		D84	Public admin. and defence; compulsory social security
32		D41T43	Construction
33		D85	Education
34		D86T88	Human health and social work
35		D90T96	Arts, entertainment, recreation, and other service activities
36		D97T98	Private households with employed persons

Source: Author calculation from OECD (2021)

Table 16: The classification of region from OECD database for Input Output table calculation

No	Region	Country Details
1	Thailand	Thailand
2	USA	USA
3	China	China, China - Activities excluding export processing, China - Export processing activities
4	Rest of the world	Brunei, Cambodia, Myanmar, Singapore, Indonesia, Vietnam, Australia, New Zealand, Japan, Korea, Taiwan, Hongkong, Austria Belgium Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Slovak Republic, Romania, Slovak Republic, Sweden, Slovenia, Spain, Switzerland, United Kingdom, Cyprus, India, Canada, Mexico, Mexico - Activities excluding Global Manufacturing, Mexico - Global Manufacturing activities, Chile, Brazil, Argentina, Columbia, Israel, Switzerland, Turkey, Bulgaria, Costa Rica, Croatia, Kazakhstan, Morocco, Norway, Peru, Russian Federation, Saudi Arabia, South Africa, Tunisia, Rest of the World

Source: Author calculation from OECD (2021)

Table 17: The classification of region, sector and endowment for GTAP model

Region	Sectors	Factor Endowment
Thailand	Agricultural	Land
US	Livestock	Unskilled Labor
China	Mining and Extraction	Skilles Labor
ASEAN	Food	Capital
East Asia	Textiles	Natural Resources
EU	Steel and Aluminum	
Oceania	Manufacturing	
Rest of the World	Electronics	
	Utilities and Construction	
	Transportation and Communication	
	Rest of the sector	

Source: Author calculation from GTAP database

Table 18: Total US-China tariff imposition situation

No.	Tariff announcement	Situation	Description
1	23/3/2018	US steel aluminum	US tariffs increase on steel and aluminum from China, Canada, Mexico, and EU
2	2/4/2018	China 3b	China's tariffs increase in the 3 billion rounds
3	6/7/2018	China 50b wave 1	China's tariff increase (implemented) in the first wave of the 50 billion rounds
4	8/8/2018	China 50b wave 2	China's tariff increase (pending) in the second wave of the 50 billion rounds
5	6/7/2018	US_CN 50b wave 1	US tariff increase (implemented) in the first wave of the 50 billion rounds
6	8/8/2018	US_CN 50b wave 2	US tariff increase (implemented) in the second wave of the 50 billion rounds
7	18/9/2018	chn60b_tariff_increase 1	China's 60 billion tariff on US imports (first increase)
8	18/9/2018	US200b_tariff_increas e	US 200 billion tariff increase on Chinese products (first increase)
9	13/5/2019	chn60b_tariff_increase 2	China's 60 billion tariff on US imports (second increase)
10	1/9/2019	US300b_tariff_increas e1	US 300 billion tariff increase on Chinese product (first increase)
11	pending	US300b_tariff_increas e2	US 300 billion tariff increase on Chinese product (second increase)
12	1/9/2019	chn75b_tariff_increase s1	China's retaliation for US 300 billion tariff, effective 09/01/2019
13	pending	chn75b_tariff_increase s2	China's retaliation for US 300 billion tariff, effective 12/15/2019

Source: Situation from Li (2018)

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