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The Global Economic and Trade Impact of the U.S.-China Trade War 2018-2020

by

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Abstract

Since the summer of 2018, President Trump's administration has implemented 10%-25% tariffs on $325 billion worth of Chinese goods, and China retaliated with 5%-25% tariff increases on American exports valued at $145 billion. This paper aims to analyze global economic and trade impacts of U.S.-China trade war and estimate the corresponding impact in case of further escalation or – the opposite – de-escalation. By applying the Global Simulation Model (GSIM), this paper finds that the U.S. suffers the heaviest to the size of U.S.D-79.4 billion in welfare loss, while China 's total welfare declines by U.S.D-68.2 billion caused by the 2018-2020 U.S.-China trade conflict. American consumers face higher importing prices and Chinese firms mU.S.t cut exporting prices in order to absorb U.S. tariffs. In the meantime, trade diversion effects benefit third parties proportionally: especially the EU gains U.S.D14.1 billion in welfare and becomes the top trading partner for both the U.S. and China. ASEAN has been another effective immediate and substitute for both countries, and other economies are also affected positively in terms of welfare and trade effects in 2018-2020. In order to identify further impacts of the trade war, escalation and de-escalation scenarios are applied in this research, and we find escalating tariff hikes are not a reasonable and effective tool for President Trump with marginal negative impact on Chinese economy while Chinese reprisals can hurt the U.S. a lot. The de-escalation case alleviates tariff tensions and non-tariff barriers, which will then do down for the U.S. and China. Overall, we conclude from our analysis that de-escalation of trade war would be the best option for all economies in the long term.

Key words: U.S.-China Trade War, Trade diversion, Tariffs

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List of Abbreviations

Terms / Abbreviation	Definition
U.S.	United States of America
BRI	Belt and Road Initiative
SCIO	Information Office of the State Council in The People's Republic of China
IMF	International Monetary Fund
PTA	preferential trade agreement
IP	Intellectual Properties
GI	geographical indications
SPS	phytosanitary measures
U.S.TR	U.S. trade Representatives
ITC	Trade Map of International Trade Center
AHS	Effectively Applied Weight Average Tariff
ASEAN	Association of Southeast Asian Nations
ROF Latin America	Rest of Latin America
WITS	World Integrated Trade Solution
EU	European Union
WTO	World Trade Organization
GSIM	Global Simulation Model

NTM	Non-Tariff Measures
MNC	multinational corporation
GE	General Equilibrium
PE	Partial Equilibrium
VIE	voluntary import expansion
U.S.MCA	United States–Mexico–Canada Agreement
RCEP	Regional Comprehensive Economic Partnership
CPTPP	Comprehensive and Progressive Agreement for Trans-Pacific Partnership
TTIP	Transatlantic Trade and Investment Partner
TPP	Trans-Pacific Partnership

Chapter 1. Introduction

This chapter presents a comprehensive overview of research background and research significance. Thereafter, the chapter addresses research question and several sub-questions serving to answer the main research question. It is then followed by a thesis outline section, which discusses the structure of the following chapters.

1.1 Research Background

The strong U.S.-China bilateral economic relationship has been existing for many years, despite its clear distinction deeply rooted in polarized political and economic systems. Earlier the U.S. President Richard Nixon visited China with hopes of establishment of friendly diplomatic relationship with China, and later the U.S. encourages and accepts China to join WTO, all efforts that the U.S. made were to aim to change Chinese socialist society and guide China into democratic political and economic systems. After joining the WTO, China experienced a rapid economic growth with many changes. As expected by the U.S., China now becomes the threat of American hegemony due to the ambitious Belt and Road Initiative (BRI) and Made in China 2025 project. Prior to Donald Trump's 2016 presidential campaign, he expressed his criticism toward Chinese economic development and huge trade deficit as damaged powers to the U.S. economy (China Briefing, 2020). During campaigning for the Republican Party's presidential nomination, Alongside, President Trump imposed some sanctions to China as the gimmick of attaining votes. The U.S.TR (United States Trade Representative) initiated "Section 301 of the U.S. Trade Act" in March 2018, which aims to investigate into Chinese policies about technology transfer, intellectual property and innovation, etc. This action potentially triggered tit for that tariff sanctions in both countries later (Kwan, 2020).

At the beginning of 2018, Trump administration started to implement tough trade policies again its trade partners include China, as such, first attempt was to increase 20%-30% import tariffs on solar panels and washing machines globally, following by

imposing 10%-25% tariffs on steel and aluminum. Meanwhile, Trump's administration signed memorandum indicating results of 301 section and measures with regard to imports from China, means "Trade War" started. The Trump administration initiated four rounds of tariff hikes（5%-25%）on almost $375 billion worth of Chinese exports, and China retaliated with similar tariff size on $145 billion of American goods. The U.S.-China trade conflict did not only refer to tariff fights, but also penetrate to technological business and education. Non-tariff barriers also raise up due to intensive trade and diplomatic relationships between two countries. The temporary truce happened in the start of 2020 with signature from both sides on Trade Deal Phase One, which was announced as "constructive" deal by Donald Trump. These series of U.S.-China actions are called for "U.S.-China Trade War" (Nicita, 2019).

1.2 Research Significance

The U.S. and China economy are roughly USD 33.5billion in terms of nominal GDP and weight 42% in the world. Also, the U.S. focus. on high and medium value chain extracting profits by offering advanced technology and China focus on medium and low value good at assembling and processing exports, means there is high complementary for Chinese and U.S. products. It is estimated that U.S.-China trade war together with COVID-19 pandemic have made another economic concession since 2008, the most recent financial crisis.

The focus of this thesis is to analyze the economic and trade impacts caused by the U.S.-China trade war, by combining what happened over two years (ex-post analysis) in U.S.-China trade policies with predictions of trade war(ex-ante analysis). Some trade policies changes are reviewed from existing academic literature and news, in which the prominent change would be tariff hikes. The dissertation splits U.S.-China trade policy status quo into two process: the first stage is pure trade war 1/1/2018-1/1/2020, and the other one is trade peace after 1/1/2020. By doing so, the paper offers a more comprehensive overview on economic and trade impacts generated by these two

phases. The GSIM model from Francois and Hall (2002) is applied into the ex-ante analysis for escalated and de-escalated scenarios, and the model works as the typical model of the Partial Equilibrium to provide a relatively flexible and simple framework (Francois&Hall, 2009). As such, it can examine trade values and deliver the impact of a shock on trade values, consumers and producers surpluses and losses, which provides assessment to opportunities and risks brought by trade policy uncertainty in the future (Francois&Hall, 2009).

In relation to existing research in this field, this offers a unique and detailed insights in following aspects. First, the dissertation approaches the U.S.-China trade war in five scenarios with eight main countries and five economic regions expected to affect proportionally. Furthermore, with GSIM results, the paper offers analysis of specific impact on each selective country or region, which grants a global and comprehensive perspective on economic and trade impacts of the US-China actions. Moreover, escalation and de-escalation scenarios help to assess uncertainty coming from US-China trade war in a quantitate approach, which, as far as I am aware, has not been adopted in current literature.

1.3 Research Objectives and Questions

The objectives of our thesis are to estimate the global economic and trade impacts of the U.S.-China trade war 2018-2020 which has already happened and also analyze correspond impacts in further escalation and de-escalation case. With the applied methodology, this paper addresses the economic impact with a main focus on welfare and production effects caused by the U.S.-China trade war, while effects are justified by trade value changes among all selected countries and regions caused by trade diversion.

Considering the observations, the main research question is formulated as follows:

What is the global economic and trade impact of the U.S.-China trade war 2018-2020, and what could be the correspond effect in either further escalation or de-escalation in

the coming years?

In order to achieve research objectives, the following sub-questions are outlined:

1. What are reasons behind U.S.-China trade war? And how does China respond to it?

2. What tariffs and products are exposed to U.S.-China tariff hikes during 2018- 2020 and trade deal phase one after 2020?

3. How do we explain economic and trade impact of U.S.-China trade war in this paper?

4. What is the feasible quantitative method to achieve research objectives?

5. Apart from the impact on the U.S. and China, what is the correspond impact on other third parties like EU, Eastern Asian countries who are not directly involved in?

6. What could be the global economic and trade impact in U.S.- China further escalation or de-escalation cases in the foreseeable future?

1.4 Research Structure

Chapter 1 Introduction provides an overview of research objectives and significance and indicates reasons and background of U.S.-China trade war.

Chapter 2 Literature Review clues the timeline of trade war in 2018-2020 by identifying specific tariff and products involved, also outlines contents and prospect of U.S.-China trade deal phase one.

Chapter 3 Methodology gives the appropriate methodology to achieve research objectives and precise explanation of GSIM model, data source, regional division. This chapter also mentions five specific scenarios with rationales.

Chapter 4 Results and Analysis collects outcomes from five GSIM models and provide comprehensive and detailed analysis on selective countries and regions based on GSIM results.

Chapter 5 Conclusion summarizes results and analysis shortly and also points out limitations about this paper by giving some advices for further research.

Chapter 2. Literature Review

2.1 The U.S.-China Trade War 2018-2020

2.1.1 Background and Scope Shift

China is the largest developing country and the United State acts as the biggest economy. The trade and economic relations of these two countries play a significant role in the growth of world economy and stability (SCIO, 2018). Since China joined into WTO in 2001, China experienced a rapid economic growth and benefitted as a developing latecomer. strong economic partnership based on a high complementarity in U.S.-China bilateral trade boosts mutually beneficial and win-win cooperation (SCIO, 2018).

China was the United States' largest imports source in 2018, accounting for $539.5 billion imported goods, which weights 21.2 % of total the U.S. imports (USTR, 2019). The white paper published by the government of China dedicated "The majority of China's exports to the U.S. are electric products, audio-visual equipment, components and accessories(24.9 %), and nuclear reactor, furnace, mechanical apparatus. and components(21.3%), furniture, bedding, lamps and trailer coach(6.8%), toys, game or sport articles and components and accessories(4.3%) in 2017" (SCIO, 2018).

China also has 7.28% of its imported products from the U.S., reaching to $120.3 billion (USTR, 2019). The white paper indicated "the three major categories of goods are 1.

machinery/electric equipment/ components and accessories, 2. mechanical   apparat

and components, and 3. automobile and components and accessories. Especially

China takes biggest exports of the U.S. airplanes and soybeans, and the second

biggest exports of the U.S. automobiles, IC products and cotton. In 2017 China took

57% of the U.S. soybean exports, 25% of Boeing aircraft, 20% of automobiles, 14% of

ICs and 17% of cotton" (SCIO, 2018).

The strong the U.S.-China bilateral economic relations have been existing for many

years, while the difference of political and economic systems make many issues

emerging behind. Before Trump started running for American president, he clearly

stated his criticism about Chinese economic development as a threat to the U.S.A

(China Briefing, 2020). During campaigning for the Republican Party's presidential

nomination, Trump took imposing some sanctions to China as the gimmick of attaining

votes. The U.S.TR (United States Trade Representative) initiated "Section 301 of the

U.S. Trade Act" in March 2018, which aims to investigate into Chinese policies about

technology transfer, intellectual property and innovation, etc. This action potentially

triggered tit for tat tariff sanctions in both countries later (Kwan, 2020).

President Trump's administration signed memorandum indicating results of 301

section and also measures will be taken to address these issues. Firstly, the list of

goods with increased tariff will be published. Secondly, the WTO report against China

unfair trade practices would be made in 60 days. Thirdly, the U.S.TR propose executive

restrictions in technology and other areas deemed important to national security of the

United States.   (Trump, 2018). As for arguments about the reasons behind trade war,

some American statements indicate China economic growth benefits from being a

latecomer allowing itself to import technology cheaply (Kwan, 2020). Also, some

Chinese policies did massive favors for Chinese companies, which make them attain

unfair competitiveness and advantages globally. Overcapacity in some subsided

industries such as steel and aluminum disrupt world market price (Shea, 2018). "Unfair

Trader" is the Trump administration's criticism about Chinese trade position in the world. While China states the U.S. accuses Chinese economy growth of threating U.S. hegemony, because currently the U.S. stands at the mid-and high-end value chains and grabs largest interest in the U.S.-China bilateral trades, for example, all core technological components of Apple come from the U.S. and only assembly work finish in China due to the cheap labor and great manufactural skills. Moreover, the big trade gap is coming from the U.S. economic structure, and a result of the two countries' comparative strengths (SCIO, 2018). Besides that, many academics argue the U.S. trade deficit is largely an outcome of low U.S. domestic savings. Both arguments appear to have some grain of truth.

The rounds of tariff war were complimented with the U.S. imposed different tariff (30%, 25%, 10%) on total 254 billion of goods, in respond, China put tariffs(25%， 15%， 10%) on the sum of 113 billion goods. With more restriction of American technology transfer and transaction with Chinese tech companies, for example ZTE was fined $1.19 billion for violation of American trade agreements and also banned for 7 years' business within the United States, a famous. Chinese telecommunication brand HUAWEI was blacklisted by the U.S., the trade war was deepen further into tech war.

2.1.2 Timeline of Trade War between U.S.-China in 2018-2020

The tariff war started in January 2018, further escalated in the summer of 2018 and achieved truces at the start of 2020 with announcement of the first phrase of trade deal. The Trump's administration viewed it reasonable and appropriate to deal with discriminatory licensing policies by Section 301 investigation with original intention of imposing 25% tariff on $50 billion Chinese goods, and China immediately responded to the initial duty by imposing 25% retaliating tariffs on the other side. The taxed Chinese products were mostly related to "Made in China 2025" industry plan which included machinery and electrical equipment; optical and cinematographic equipment and parts; railway and tramway rolling stocks and locomotives: other vehicles accessories include aerospace and aircraft parts. On the other hand, China put tariff

hikes on some agricultural products and aquatic products; edible meat offal which are also from somewhere more republican in order to retaliate the Trump's administration. A few negotiation talks were proceeded during tit for tat tariff policies with little results. Due to no common ground on intellectual properties, technology transfer and also financial markets during the negotiation talks, U.S. pursued another $200 billion tariffs on Chinese goods within same range of products exposed to first two rounds of tariffs, and China retaliated with 10% tariffs on $60 billion worth American exports. The fierce and intense tariff sanctions damaged U.S.-China trade relationship further by increase 10% tariffs on subset of third round. Without any agreement and concessions on both sides, Trump administration threatened to add tariffs on remaining Chinese products($300billion) not affected in previous. rounds, means Trump tariffs almost covered all imports from China($557.9 billion in 2018) at that time (USTR, 2019). On the other side, China filed complains to WTO and retaliates by imposing another $75billion tariffs. Hence, U.S.-China trade war reached the peak at the fall of 2019. After a few months' negotiations and talks, the intense trade war ceased temporally with the announcement of trade deal phase one in the start of 2020. The table1 below identifies the timeline of trade war along with involved products.

Table 1 U.S.-China Tariffs War Timeline

Timeline	U.S.		China		Tariffed Products Description
	Goods Value	Imposed tariff	Goods Value	Imposed tariff	
07/02/2018	$8.5b	30%	-	-	solar cells and modules (globally, except those from Canada). - About 8% of U.S. solar panels imports in 2017 came from China
	$1.8b	20%	-	-	washing machines (globally). - Trade value of washing machines from China to U.S. in 2015 reached U.S.D 1.1b

23/03/2018	$29b	25%	-	-	all steel imports (except those from Argentina, Australia, Brazil, and South Korea). - Trade value of steel from China to U.S. in 2017 is U.S.D 1b
	$23.4b	10%	-	-	all aluminum imports (except those from Argentina and Australia). - Trade value of steel from China to U.S. in 2017 is U.S.D 1.8b
02/04/2018	-	-		25%	aluminum, pork in 128 products
	-	-	$3b	15%	fruit, nuts, wine and steel pipes in 128 products
Round 1 06/07/2018	$34b	25%	$34b	25%	U.S. tariffs of 818 Chinese products focuses on products from industrial sectors that contribute to or benefit from the 'Made in China 2025' industrial policy, the majority includes: Machinery and mechanical equipment, electrical accessories; optical and measurement equipment. China tariffs on 545 products the majority includes: foods; edible vegetables and meat offal; aquatic products.
Round 2 23/08/2018	$16b	25%	$16b	25%	U.S. tariffs 279 Chinese goods, the majority includes: plastic products; machinery and mechanical engines, electrical accessories; railway and

					tramway locomotives, rolling-stock parts and other vehicles. China tariffs 333 U.S. products, the majority includes: Miscellaneochemical products; mineral and plastic products; chemical instruments and equipment.
Round 3 24/09/2018	$200b	10%	$60b	10%	U.S. tariffs Chinese products, the majority includes foods, chemical and construction materials; manufactured products; textile articles; commercial electronic equipment and machinery vehicle/automotive parts. China tariffs ranging 5-25% for 5, 207 U.S. products including 25% on 2, 493 products worth $11billion involve: Foods; chemical products; rubber articles; textiles and apparels; construction materials and machinery ; medical and surgical instruments 20% tariffs on 1, 078 products worth $13billion, the majority includes: organic chemical products and electrical parts, paper and their articles.

Date	US tariff value	US %	China tariff value	China %	Description
					10% tariffs on 974 products with worth of $16 billion, the majority involves: chemical products and machinery and electrical accessories. 5% tariffs on 662 products with value worth of $20 billion, the majority includes: Mechanical appliances and metal compounds
02/12/2018					U.S.-China agreed to temporary cease following G20 Summit
10/05/2019	$200b	25%	-	-	U.S. increased previous. round tariffs to 25%
16/05/2019					U.S. places Huawei on its 'entity list', banning it from purchasing from U.S. companies
01/06/2019	-	-	$60b	5-25%	China increased previous round tariffs
Round 4 01/09/2019	$300b ($125b)	15%	$75b ($35b)	5-10%	U.S. imposes 15% tariffs on the products of List4A, including some consumer products such as footwear, foods, clock parts, television images. China retaliates 5-10% tariffs on U.S. products including 5% on crude oil.
15/01/2020	$300b ($125b)	7.5%	$75b ($35b)	2.5-5%	Reach Phase 1 trade deal U.S. announces halve the tariffs of September from 15% to 7.5%, but maintain the previa tariffs.

				22	China cuts tariffs in half on $75b of U.S. goods, 5% to 2.5%, 10% to 5%.

As presented in Figure 1, the total U.S. tariffs applied on Chinese goods is $325 billion and China responds with $145 billion on U.S. goods. On January 15, 2020, the much-anticipated trade deal phase one is established leading to the intense situation will be de-escalated.

Figure 1.

Source: UNCTAD

2.1.3 The Trade Deal Phase One

At the start of new year, the U.S. and China signed long-waited trade agreement phase one after 18 months' on and off negotiations, which cease war fire superficially. The trade deal cancels partial U.S. tariffs on $300 billion Chinese goods covers almost all consumer products and the U.S. halves the September 1, 2019 tariff to 7.5 % on $120 billion worth of Chinese products in order to comply with commitments in the trade deal (2China Briefing , 2020). On the other side, China pledges to lower tariffs from 10 percent to 5 percent, and from 5 percent to 2.5 percent on partial $75 billion worth of products (China Briefing, 2020). The earlier U.S. tariffs and Chinese retaliatory tariffs remain unchanged, while it may be rolled back in next phase of trade deal (2China

Briefing , 2020). In general, tariffs tensions are lessened between these two biggest economies as tariffs on the remaining consumer products by both parties are suspended at moment.

Going through the document, there are significant commitments by China whilst relatively few by the U.S. In order to analyze the economic and trade impact of trade agreement, some highlights are presented below:

- Intellectual Properties (IP) and Technology Transfer

The theft of intellectual properties has been main concern for American and EU enterprises traded with China, and also trigger two biggest economies tariffs crisis over two years (2China Briefing , 2020). According to China Briefing, the chapter one of deal demands strong protection of intellectual properties including trade secrets, geographical indications(GI), trademarks, patents, copyrights and pharmaceutical intellectual properties (2China Briefing , 2020). The claes also mentions improvement in enforcement of civil and criminal procedures against pirated, counterfeit products and e-commerce infringement (Reuters, 2020).China pledges to submit an IP protection plan within 30 days of trade deal releasement (2China Briefing , 2020).

Whilst the trade agreement includes commitments by China to eliminate technology transfer as conditions for foreign investor to access Chinese market and reach administrative and licensing requirements. (Reuters, 2020). Any decisions of technology acquisition and outbound investment should be voluntary and market-based between natural or legal persons in each country, and should not be interfered (support and direct) by any party of the government (Giesbergen, 2020).

- Trade in food and agricultural products

As other U.S. preferential trade agreements (PTAs), the deal contains intensified cooperation of trade in food and agricultural products, engagement in science-based, non-discriminatory sanitary, phytosanitary measures (SPS). And the other claU.S.es are intended to facilitate Chinese additional purchase includes recognitions of U.S.

legislation in Dairy and Infant Formula and allowance in imports of regulated products like beef, poultry, etc. (USTR, 2020).

- Financial Service

The financial services provisions contain two aspects, firstly China is going to accept and qualify U.S. financial service systems (e.g. bank services, credit rating services, electronic payment services and insurance services and securities, fund management) (USTR, 2020). The main purpose is to focus on opening Chinese market access to U.S. specific financial institutions whilst the U.S. makes soft pledges without concrete obligations and time frame (Caroline Freund, 2020).

- Chinese Purchase

The main pledge by China was to buy additional $200 billion worth of U.S. export which includes goods and services over next two years upon 2017 baseline (2China Briefing , 2020). The details of expanding trade are presented in Table 2 below:

Table 2

China's Increased Purchases under Phase One Trade Deal (2020-2021)		2020	2021	2-year total
Manufactured goods	Industrial machinery, electronic equipment and machinery ,pharmaceutical products, aircraft(orders and deliveries),vehicles, optical and medical instruments, iron and steel	$32.9b	$44.8b	$77.7b
Agricultural goods	Soybeans, oilseeds, meats, cotton, seafood, wheat, fruit, jams, corn, flour, horses ,honey	$12.5b	$19.5b	$32b
Energy goods	Liquified natural gas(LNG),crude oil, refined products ,coal	$18.5b	$33.9b	$52.4b
Services	Business travel and tourism, financial services, reinsurance, insurance, management consulting, telecom services, data hosting, cloud computing Services, charges for use of IP	$12.8b	$25.1b	$37.9b
Total		$76.7b	$123.3b	$200b

Source: US-China Economic and Trade Agreement (Phase One Deal)

- Currency and Dispute Resolution

China pledged to refrain itself from manipulation of exchange rates and the international monetary system to devaluate Chinese currency in order to take advantages in International business under International Monetary Fund (IMF) rules (Caroline Freund, 2020). Moreover, both parties are going to commit an exchange rate

regime on the market basis and ensure transparency and enforcement of the whole processes (Caroline Freund, 2020).

The trade Framework Group was created to surveil the implementation of trade deal, led by the U.S.TR and a designated Vice Premier of China. Compare with other preferential trade agreements (PTAs) of U.S., there is not an independent adjudicated institute in charging for affairs without the U.S. and China involvements.

Summing up, the trade deal phase one obviously ease tensions between these two large economic entities shortly. What is not in the deal are U.S.- China trade war's biggest conflict which respected Chinese government's position on industrial subsidizes and U.S. intellectual properties. Looking through this 'unfair' agreement, most of hard commitments by China seemed to be ambitious and unrealistic while some soft pledges were not achievable effectively in the lack of monitor indicators and enforcement measures. The essential piece of trade deal was China had to buy more products and services from the U.S. in the coming   two years in exchange of tariffs rollback afterwards (Giesbergen, 2020). Moreover, the trade deal phase one is deem to be a "fragile truce", as the dispute procedures make the withdrawal of agreement easier: "If the party complained against considers that the action of the complaining party was taken in bad faith, the remedy is to withdraw from this agreement by providing written notice of withdrawal to the complaining party (USTR, 2020)." Hence, if any party is unsatisfied about commitments by counterpart, the trade deal phase one would collapse immediately (USTR, 2020). In addition, how to meet Chinese commitments to the U.S. and balance the total trades with old overseas partners will be uncertain to some extents. And how China is going to achieve deal with heavy imports tasks under a global pandemic became the concern of both countries (2China Briefing , 2020).

2.2 Predictions on U.S.-China Trade for future

The trade deal phase one was portrayed as a "constructive change" by President Trump, while this agreement does not solve the deep-rooted concerns of U.S. such as Chinese government industrial subsidies, cyber theft did not mention which mechanism would supervise the level of commitments both sides meet and deal with ongoing disputes. This agreement is more like preferential trade agreements (PTAs) grants U.S. exporters preferential access to Chinese market to achieve trade and service expansion targets. Managed trade is better off for U.S. and China with already deteriorated trade relationships, while it is worse off for other participants in the international business because the trade deal could lead to trade diversion in China. Also, China needs to make strategic plans to balance trade volumes in order to achieve commitments in provisions. So, U.S.-China trade deal is quite fragile in some extent, and there are two possibilities towards U.S.-China future trade relationships: further escalated U.S.-China trade war and de-escalated U.S.-China trade war.

2.2.1 Further escalation of trade war

On the one hand, the prediction of future U.S.-China trade relationships was decided by the attainability of obligation of China in managed trade. The Chinese government declares that they would comply with agreements combining with actual market demand, which leaves some space for China pull back. Especially COVID-19 makes it more difficult for China to live up to American expectations. So, if China breaks provisions in trade deal or will not change Chinese business patterns to comply with U.S. requirements, the remaining proposed tariffs will take into effect. The trade war will get escalated and worse after trade deal phase one. Because, in announcement of 2016 presidential election, Trump promised to take hard actions against economic rival. The expansion of trade and service with China makes large benefits for American farmers and manufacturers.

On the other hand, whether Donald Trump will win reelection in November 2020 presidential campaign is quite important for U.S.-China strategic and diplomatic

relationship as well. According to The New York Times updates, the democratic candidate Joe Biden and republican representative Donald Trump will have a chance to be elected for U.S. presidents over next four years (Times, 2020). As the past four years' course of Trump's term, the Trump applies anti-China rhetoric in his election announcement as Biden does, and he promises will employ more harder sanction measures about Chinese issues. As what he said, Trump issues an executive order prohibiting WeChat and TikTok doing business in the United States with the excuse of protecting national security, which converts U.S.-China trade war that has covered tariffs hikes and technological restrictions further into social media areas. The chief reason that anti-China sentiment heighten is Americans believe China did a bad control of corona-virus in earlier stage and lead to severe pandemic outbreak in the U.S.

2.2.2 De-escalation of trade war

In the other way around, if China achieves all pledges as expected in U.S.-China trade deal phase one, they will agree to enter into next stage negotiation with U.S. removing all imposed tariffs in trade deal phase two as Trump promised. Also, the historical experience tells U.S. the democratic presidents of U.S. like Barack Obama, Bill Clinton are more likely to pay attention on economic ties with China. It is believed that China's officials do not want Donald Trump to win reelection in November 2020 by U.S. intelligence community (Marquardt, 2020). Hence, we could predict U.S. -China trade war would be de-escalated in the foreseeable future.

In fact, either party wins the presidential selection, the amiable relationships between U.S. and China would never come back (Kuhn, 2020). Compared with hard lines of Trump, Biden administration may be softer in some extents. therefore, de-escalation of trade war could be expected based on fair and reciprocal commercial principals in the future. In order to make a peaceful business environment, U.S. should not involve in Chinese sovereignty issues and challenge one-party leadership (Kuhn, 2020). And China should respect and value intellectual properties in other countries, provide more freedom and also market-oriented principals to domestic and overseas companies.

Chapter 3. Methodology

3.1 Model selection

When a shock happens in global trade, some changes on trade flows and economies arises, and this is because almost all economies masses are linked very closely nowadays. There are a few offense methodologies applied into stimulating and assessing the impact behind the new measure. Most popular one was the gravity model - a workhorse model for empirical analysis of international trade (Yotov, 2016). Based on Newton's law of gravity, the international trade flows between two countries were positively related to their economic masses and negatively proportional to the trade frictions(trade distance) (Yotov, 2016). So, it was very useful and helpful for ex-post analysis of the shock on basis of a big amount data available in the process. When we are looking at the economic and trade impact of the U.S.-China trade war, we need to stimulate caused effects beforehand. An ex-ante simulation methodology would be suitable for our case.

The General Equilibrium Models (GE) and Partial Equilibrium Models (PE) are to be referred to the trade policy simulation models. The General Equilibrium Models(GE) are very clear and accurate methodology considering both product and factor markets (land, capital, labor, etc.) under the principal that the total income is equal to total expenditure (Piermartini, 2006). When we were making GE simulation model, price elasticities of household demand and household income should be identified and applied into the equilibrium, which together with other calculation factors, make the simulation processes more complicated and time-consuming.

In contrary, the Partial Equilibrium Model only assesses the effect of a given trade policy on specific industry by providing more straightforward transparent results. The World Bank(2010) mentioned the main advantages of the Partial Equilibrium Model, which were simplicity to implement and the ability to be applied in disaggregated and detailed level (Word Bank, 2010). While compare with the GE models, the PE ones may neglect the interactions between markets and feedbacks afterwards. However, we

believe it is the most suitable simulation model for our case due to a few reasons. Firstly, relatively minimal amount of data required in PE model complies with our reality in U.S.-China trade war with limited and fluctuating data available. Secondly, the U.S.-China trade war aims to impose disaggregated industrial-level tariff hikes which are also in line with the PE models. As long as we estimate behavioral elasticities accurately and bear in mind of limitations of PE models, some Useful and reliable insights would be attained via the Partial Equilibrium Models with regards to trade policies change in various. specific industries (Word Bank, 2010).

3.2 The GSIM model

The GSIM model works as the typical model of the Partial Equilibrium providing a relatively flexible and simple framework. Francois and Hall (2002) introduced Global Simulation Model (GSIM) which can examine trade values, the impact of a shock on trade values, consumers and producers surpluses and losses (Francois&Hall, 2009). This model further sorts out shocks by various policy effects such as non-tariff measures (NTMs), tariffs and other trade barriers or liberalizations (Francois&Hall, 2009).

According to Francois and Hall, relatively own and cross-price elasticities are needed to serve to illustrate total consumer, producer surplus. and tariffs revenue. A basic assumption of this methodology is that the import products are all imperfect substitutes for each other and the elasticity of substitution keeps equal and constant (Francois&Hall, 2009). The elasticities of supply and demand would be used to reflect the sensitivity of products. The GSIM model compares the initial situation via the original trade flows with the effect of a given measure. When the new measure established, the global trade will be in a new equilibrium (Francois&Hall, 2009). The initial tariffs and new tariffs provided by databases of WITS are needed to make outcomes.

The principal of GSIM model is explained by an example below. Assume there is a new measure with tariffs change, which is imposing tariff hikes of product from importing country A on exporting country B. And the importer A could be either a big country whose demand has a significant influence on the world price, or a small country affected by the world price. The Figure 2 below presents initial world price of P* with the quantity of supply Q1 and demand Q4. And then the domestic price of country A would be shifted to P*+t by setting up tariffs on products. When world price is P*, the import of country A from country B is Q4-Q1. After tariffs policy is released, the government revenues increase by **c,** and trade loss is the sum of b and d. The consumer welfare reduces significantly by (a + b + c +d) and the producer welfare increases by a, and the new importation is Q3-Q2. Then the domestic market of country A reaches to a new equilibrium.

Figure 2. Tariff increase in the small country case
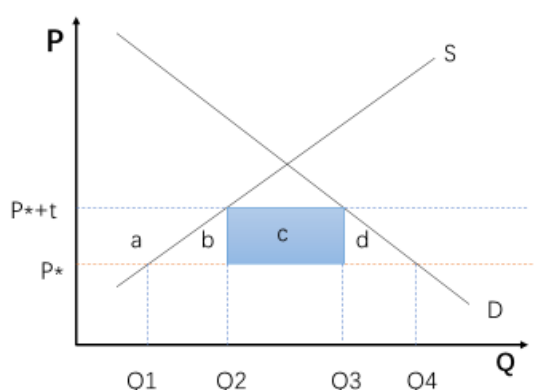
Source: edited by author based on Prof. Berden lecture notes

With regards to superpower country A, the imposed tariff reduces the imports. The fall of demand in country A simultaneoU.S.ly caU.S.es the change of world price from P0 to P*. However, the decrease of domestic price is lesser than the increment of tariffs. Therefore, there will be trade loss with the sum of b and d, and government revenues is the sum of c and e. Consequently, the consumer surplus.   loses significantly by (a +b +c +d) and the domestic producer will gain welfare of a. The domestic market in the large country A enters into a new equilibrium aftershock.

Figure 3. Tariff increase in the superpower country case

In order to calculate trade values, some equations below are applied.

Assume there is an importing country **m**, and the import demand of product category **p** from exporter **x** is as below: the function of some variables (industry price of product **p**, total expenditure on product **p** (Jammes&Olarreaga, 2005).

The import demand:

$$M_{p,m,x} = f\left(P_{p,m,x,}\ P_{p,m,s \neq x,}\ y_{p,m}\right)$$ **Equation (1)** (Jammes&Olarreaga, 2005)

Where $M_{p,m,x}$ is the import demand of product p in country m from the exporter x.

$P_{p,m,x}$ is the domestic price of product p in the country m including imposed tariffs

$P_{p,m,s \neq x}$ is the global price of product p sourced from other countries.

$y_{p,m}$ is the total expenditure of product p in the country m (Jammes&Olarreaga, 2005).

$$p_{p,m,x} = \left(1 + t_{m,p,x}\right)p_{p,x}^* = T_{m,p,x}\,p_{p,x}^*$$ (Jammes&Olarreaga, 2005) **Equation (2)**

Where $P_{p,m,x}$ is the domestic price of product p in the country m including imposed tariffs

$t_{m,p,x}$ is the tariff hikes on product p imports from country x (Jammes&Olarreaga, 2005).

By differentiating equation (1), the following equations could be derived:

$$\varepsilon_{m,p,x} = \theta_{m,p,x}(\varepsilon_{m,p} + \sigma_{m,p})$$ (Jammes&Olarreaga, 2005)   **Equation (3)**

$$\varepsilon_{m,p,\neq x} = \theta_{m,p,\neq x}\varepsilon_{m,p} - (1 - \theta_{m,p,\neq x})$$ (Jammes&Olarreaga, 2005)   **Equation (4)**

Where $\theta_{m,p,x}$ is the expenditure weight of product p imported from x in the total expenditure of product p in the country m.

$\varepsilon_{m,p}$ is the composite import demand function of product p in the country m(Jammes&Olarreaga, 2005).

$\sigma_{m,p}$ is s the elasticity of substitution of product p sourced from different countries(Jammes&Olarreaga, 2005).

$\varepsilon_{m,p,x}$ is the composite import demand function of product p in the country m from the country x(Jammes&Olarreaga, 2005). $\varepsilon_{m,p,\neq x}$ is the cross-price elasticity of import demand of product p exported by x when the global price ($\neq$ x)changes(Jammes&Olarreaga, 2005).

The export supply function of product p is:

$$X_{p,m} = g(p_{p,x}^*)$$(Jammes&Olarreaga, 2005)   **Equation (5):**

Where$p_{p,x}^*$is the global price of the product p imported from the country x.

By differentiating equation 5, we get the export elasticity is:

$$e_{p,m} = X_{p,m}/p_{p,x}^* \text{(Jammes\&Olarreaga, 2005)} \qquad \textbf{Equation(6)}$$

Where $p_{p,x}^*$ is the world price of product p exported by x.

The vector percentage in change of world price is(Jammes&Olarreaga, 2005):

$$p_p^* = (1 - E_p)^{-1}B_p \quad \textbf{Equation (7)}\text{(Jammes\&Olarreaga, 2005)}$$

Where $E_p = \sum_m E_{m,p}$ is the sum of all products in the matrix (Sathe, 2019).

$B_p = \sum_m E_{m,p} T_{m,p}$ is the sum of imposed tariffs on product p of country x (Sathe, 2019).

These formulas below are used to calculate the result of the shock, which are the consumers welfare and producer welfare:

Equation (8):

The producer surplus is :

$$\Delta ps_{p,x} = p_{p,x}^* X_{p,x} \widehat{p^*}\left(1 + \frac{e_{p,x}\widehat{p_{p,x}^*}}{2}\right) \quad \text{(Jammes\&Olarreaga, 2005)}$$

Where $\widehat{p_{p,m}^*}$ is the percentage change of product price exported from x(Jammes&Olarreaga, 2005).

The consumer surplus is:

$$\Delta cs_{m,p} = \sum_x M_{m,p,x}p_{m,p,x}^* T_{m,p,x}\left(\frac{1}{2}\varepsilon_{m,p}[\widehat{p_{m,p}}]^2 sign(\widehat{p_{m,p}}) - \widehat{p_{m,p}}\right) \qquad \textbf{Equation (9):}$$

(Jammes&Olarreaga, 2005)

Where $\widehat{p_{m,p}} = \sum \theta_{m,p,x}\widehat{p_{p,x}^*} + \widehat{T_{p,x}}$ (Jammes&Olarreaga, 2005)

3.3 Data selection

In order to investigate research questions in this thesis, 2017 trade and tariffs data were founded as baseline, as the trade war had started already from 2018 , trade flows and tariffs were changed in related sectors. And 2020 data is not available at the

moment, especially for import tariffs, so we calculated and estimated them based on 2017 level and tariff hikes to meet research demand. We selected affected countries and regions by the U.S.-China trade war: two biggest economies and participants (the U.S. and China), the EU 27, the United Kingdom, main Asian economies (Japan, South Korea, ASEAN) and Latin American economies (Mexico and Rest of Latin America), Canada and second largest population continent (Africa).

The econometric model requires the data of trade values (import and export), elasticities and tariffs (initial and final). Import values of 2017 for selected countries and regions are accessible in Trade Map of International Trade Center (ITC), and Effectively Applied (AHS) Weight Average which are treated as import tariffs of some specific countries are available in the World Integrated Trade Solution (WITS). Tariffs data for chosen regions (Oceana, ASEAN, Africa) were counted by author in simple average tariff. Moreover, non-tariff barriers (NTBs) were estimated by the author to 5% for domestic trade which means the figures of NTBs in the model are 1.05, and for international and regional trade, non-tariff barriers (NTBs) were estimated to 10%. The final tariffs and non-tariff barriers are calculated based on 2019 tariff hikes and the content of trade deal phase one.

Elasticities data come mostly from previous literatures, Hiau.K &Alessandro. N(2005) and Francois&Hall(2009) conducted a researching estimate that the average import demand elasticities is around -1.2 by taking 315451 import demand elasticities at the six digit level of the HS for 117 countries into account (Hiau Looi Kee, 2008) (Francois&Hall, 2009). For the elasticities of substitution, Broda and Weinstein (2004) and Francois&Hall(2009)outline the average elasticity of 5 is suitable in most research cases. The correspond quantities' changes are related to price fluctuation, and the extent of changeable quantities refers to export supply elasticity. Soderbery (2018) investigates 1.2 million export supply and more than 0.12 million import demand elasticities and the outcome of average export supply elasticity is about 0.8 (Soderbery,

2018).

3.4 Country and Region selection

The following countries and regions are selected to assess the economic and trade impacts of U.S.-China trade war via the model.
Countries:

- U.S.A: The U.S.A remains the largest economy by normal GDP and makes a significant share of world imports &exports. Almost all economies are related to U.S. markets and U.S. dollars have been in dominant roles for many years. Trump administration triggers trade war with China and reach U.S.-CN trade agreement in the start of 2020, which facilitates preferential access of U.S. products to Chinese markets. At the first glance, the U.S.A would be better off in the bilateral trade agreements as compare to tariffs tensions (Caroline Freund, 2020). So, it is crucial to analyze the explicit gains or loss for U.S. welfare from this trade battles.

- China: China is the second largest economy of the world with rapid industrial developments in recent years, in some extent imposing a threat on U.S. hegemony. As the main participant of trade war, China retaliates with three round tariffs, which escalates tariffs tensions and worsens the international business situation. The outcomes of this tariffs battle would be dependent on whether China implements its commitments of trade agreement or not. So the analysis of Chinese behavior and welfare changes would be significant for our research.

- EU: the European union presents important third regions affected by trade war has become the biggest trade partner of China instead of the United States. According to euro statistics, both EU and U.S. have main exports in manufactured products like machinery and vehicles, chemicals (eurostat, 2020). So it would be noteworthy whether U.S.-China trade disrupts benefits EU firms' access to some still protectable Chinese sectors such as financial market or some imports of China would be diverted from America to European Union. The welfare analysis will identify if EU will be chief beneficiary.

- UK: After Brexit the United Kingdom suffers from uncertainty referred to Brexit and fragile global economy affected by U.S.-China trade war. Unlike U.S., China political powers in the world, UK economy mostly depends on multilateralism and deeply open global economies compliable with WTO rules (Basedow, 2019). U.S. negotiates with UK to limit Chinese access to local financial market, and also bans the establishment of Huawei-Chinese telecommunication company's 5G infrastructure together. In reality, UK is implicitly pulled into U.S.-CN trade war. Hence, it will be estimated whether UK could take some advantages from this disrupt or not via the model.

- Japan: As the third largest economy and important trade partner with U.S. and China, the impact of trade war is far more beyond two participants. Japanese multinational corporations(MNCs) in China especially exposed to China-North America trades would be negatively affected by trade war along the value chain (Sun, 2019). So it is significant to illustrate the potential gain or loss caused by tariffs tensions along global value chain.

- South Korea: Following the same logic as Japan, U.S.-China trade war impacts are presented welfare changes along the global value chain. South Korea acts as the top importer of China, benefits from exporting intermediate products to China. And about 28% of intermediate products exports from South Korea to China is used for China's processing exports (Min-hee, 2019). Hence South Korea also plays important role in global value chain, especially in electronics and semiconductors sectors (Jeong-ho, 2018).

- Canada: The U.S. is the largest outspoken ally and the main exporter of Canada with more than three fourth of total exports in Canada. Due to heavy economic dependency on U.S., it is easier for U.S. to catch Canada in the middle of U.S.-China trade war and bring up U.S. visions to against China (Newton, 2019). Diplomatic tensions between Canada and China cause uncertainty of Canada economic trends. So it would be noticeable how Canada positions itself in U.S.-China dispute.

- Mexico: Mexico has strong vertical supply relationship with U.S., and also the third largest trade partner of U.S. after Canada and China. Mexico is estimated to capture most manufacturing capacity relocated from China to U.S., because stable relationships with U.S., proximity to U.S. and convenient geolocation (Blackman, 2020).

- ASEAN: The Association of Southeast Asian Nations (ASEAN) is the fifth largest economy in the world, according to Japanese investment bank reports, five Asian countries in ASEAN such as Vietnam, Thailand, Malaysia are believed to boost their interests by escalating trade war (Reinicke, 2019). As the rapid developing economic regions, it is noticeable whether ASEAN will become new economic power in the foreseeable future.

- Oceania: New Zealand and Australia are two representative economies in South Pacific ecozones, and both countries are closely linked to China 's Market. Briefly, tariffs tensions could change trade flows to Oceania in lesser extent, specifically in primary products. So it should be included into analyzing trade flow and routes impacts.

- Africa: Although Africa is not direct target amid U.S.-China trade war, we cannot ignore the economic impacts on Africa- second largest population continent in the background of worse global business situation.

- Rest of Latin America: Save for Mexico, the rest of Latin America and the Caribbean plays important roles in international business. During U.S.-China trade disputes, Rest of Latin America is expected to face the mix of opportunities and threats.So how the economy group position themselves in global environment and adjU.S.t trading policies despondently would become significant (Piñeiro, 2020).

- Rest of the World: We have included this in order to close the model.

3.5 Scenario definitions

3.5.1 Scenario One: The trade war 1/1/2018-1/1/2020

Trump conducted a series tariff battles in order to achieve "America First" new

economic policy aims to reduce large trade deficit in recent years with its allies and other trade partners. The scenario one focuses on economic and trade impact of U.S.-China trade war and keep other partners' tariffs stable in the model. According to World Integrated Trade Solution (WITS), the Effectively Applied (AHS) weight average tariffs of U.S. imports from China was 2.65 % in 2017, and China's AHS weight average was 6.28 % in 2017 that we considered as the tariff of 1/1/2018. In addition, the United States imported US$525b worth of Chinese goods in 2017 and imported US$154b worth of US goods from China, which can be searched through the trade map of the International Trade Center.

1. Battle One: Global Solar Panels and Washing Machines

The U.S. International Trade Commission recommended Trump to impose tariffs on the imports of solar panels and washing machines with excuse of injuring related domestic industries (Kolb, 2020). In response, Trump administration-imposed safeguard 30% tariff US$8.5b worth of solar panels and 20%tariff on washing machines with value of $1.8b in 2018. According to Datamined Blog, the FOB value of U.S. solar imports from China was $1.5 b in 2016, and also Chinese washing machines weighted 53% in U.S. imports of washer share (Datamyne, 2018). So the rough U.S. tariff on China increased by 0.1% ($1.5 \, billion \times 30\% \div \$525 billion + \$1.8 billion \times 53\% \times 20\% \div \$525 \, billion$), and on the other side China kept the same tariffs on the U.S..

2. Battle Two: Global steel and aluminum

Trump administration levied 25% tariffs on steel imports and 10% tariffs on aluminum imports valued at US$52.4b with excuse of national security threat (Kolb, 2020). The Statista website outlined U.S. imported $1b steel and $1.8 b aluminum from China in 2017 (Wagner, 2019). Hence the tariff increase was around 0.1% ($1 billion \times 25\% \div \$525 billion + \$1.8 billion \times 10\% \div \$525 \, billion$).

3. Battle Three: U.S.-China four rounds tariff hikes

There were four rounds of U.S. tariffs on Chinese goods and four rounds of retaliations on U.S. from China side. The first round started with Trump's imposition of 25% tariff on $34 billion of Chinese goods, and China hit back with 25% tariffs on worth of $34 billion U.S. goods. Hence, U.S. tariffs climbed by 1.6% ($34\ billion \times 25\% \div \$525 billion$), and China's tariffs went up significantly by 5.5 % ($\$34 billion \times 25\% \div \$154 billion$). Following the same logic, in the second round, Trump imposed 25% tariffs on $ 16 billion Chinese goods and China retaliated by 25% tariffs on U.S. goods. Hence U.S. tariffs raised by 0.8 % ($\$16 billion \times 25\% \div \$525 billion$), and China's tariffs had an increasement of 2.6%. The third round of tariff hikes started at 24/09/2018, including 10 % tariffs on $200b Chinese goods and $ 60b U.S. goods, which was revised to 25% tariffs on both sides. And then U.S. tariffs increased rapidly by 9.5% ($\$200 billion \times 25\% \div \$525 billion$), Chinese tariffs increased roughly by 9.7% ($\$60 billion \times 25\% \div \$154 billion$). The last round of tariff hikes were not completed due to the release of "Trade deal phase one", so U.S. tariffs on Chinese imports reached to 18.4% and China's tariffs on U.S. products ended at 18.5%. The total increase of China's tariffs was 12.22%(18.5%-6.28%=12.22%) and U.S. increasedby15.75%(18.4%-2.65%=15.75%).

Moreover, Non-tariff measures (NTM) was improved on both sides , because the U.S. put restrictions on Chinese investment and technology transfer, and also banned some telecommunication companies such as ZTE and HUAWEI doing business. In responds to U.S. sanctions, China also created a blacklist on U.S. companies with consideration of national security threat. So the NTM was estimated to increase by 0.1% from the U.S. to China and 0.05% from China to the U.S. The figure 4 below outlines trends of U.S. and China tariffs with detailed products involved

Figure 4. U.S.-China Tariff trends

Timeline

US tariff (global) for
-30% on Steel ($29b)
-20% on Aluminum($24.3b)

China retaliation on 128 US products($3b)
-25% on aluminum, pork

US tariff (globally)for
-30% on Solar Panels ($8.5b)
-20% on Washing machines ($1.8b)

China cut tariffs on pharmaceuticals ,consumer goods ,automotive and IT

1ˢᵗ China and US specific tariff

2ⁿᵈ China and US specific

3ʳᵈ China and US specific tariff

China cut tariffs on industrial goods

US tariffs 10% on $200b
foods, chemical and construction materials; manufactured products; textile articles; commercial electronic equipment and machinery vehicle/automotive parts.

US tariffs 25% on $16b
plastic products ;machinery and mechanical engines , electrical accessories; railway and tramway locomotives , rolling-stock parts and other vehicles

US tariffs 25% on $34b
Machinery and mechanical equipment ,electrical accessories ,optical and measurement equipment.

China tariff 25% on $34b
foods; edible vegetables and meat offal; aquatic products

China tariffs 25% on $34b
Miscellaneous chemical products; mineral and plastic products ;chemical instruments and

US tariffs 25% on $200b in previous round

China increases tariffs on $60b in previous round

China tariffs 5-25% on $60b
5,207 US products including agriculture ., chemicals , machinery and textile , etc.

China's tariff on US exports — US tariff on Chinese exports

Source: edited by author based on (China Briefing, 2020) (Wikipedia, 2020) *(Bryan, 2018)*

3.5.2 Scenario Two: The trade truce in U.S.-China trade war after 1/1/2020

The Scenario two is about the impact of trade truce happened after 1/1/2020 , as mentioned in 2.1.3 the trade deal phase one, this agreement contained intellectual property rights, technology transfer, trade in food and agricultural products, financial services, Chinese additional purchase, currency and dispute Resolution (2China Briefing , 2020). The releasement of trade deal phase was perceived as a sign of de-escalation of damaging trade war, because it halted imposing tariff hikes further. Besides, China and the U.S. committed to lower tariffs took effect in September 1, 2019. So based on scenario one, the final tariffs of U.S. reduced a little to 16.6% (18.4%-$125 billion \times 7.5\% \div \$525 billion$) and China's tariffs was largely cut to 9.25 % (half reduction on final tariffs from scenario one), which was estimated in reality of Chinese purchase commitments. Because the impact of the scenario two was estimated based on results of scenario one, hence, the initial tariff in scenario two is same as finial tariff in scenario one. Non-tariff measures (NTM) in this case keep stable as pure trade war scenario, as there were no deeply rooted problems solved by trade deal phase one,

and it only repeated existing claU.S.es in domestic laws.

The trade deal phase one outlined general objective for strengthen bilateral relationship by expanding trades. China pledged to purchase additional $200billion worth of specific goods and service on top of partial 2017 level amount ($134.2billion). Also, it stated the target needed to comply with current commercial situation and WTO rules (2China Briefing , 2020). Overall, U.S. export to China in 2020 is expected to be $210.9 billion ($134.2 billion +$76.7 billion =$210.9 billion), and U.S. export to China in 2021 climbs to $257.5 billion ($134.2 billion +$123.3 billion =$257.5 billion) by combining with $134.2 billion worth of American exports in 2017. The figure 5 below explains real total export of the U.S. to China from 2015 to 2019 and forecast export based on trade deal in 2020 and 2021.

In trade theory, the expanding imports is called "voluntary import expansions(VIEs)"-an usual policy tool by the United States to open "foreign market " (Irwin, 1994). It is considered to violate fair, non-discriminatory WTO rules, as VIEs create trade distortion and negative economic influence on the third countries. Compare with trade war scenario, import expansion are better off the exporting country (the U.S.) and worse off all third parties who deal with China definitely, and the impact is ambiguous. for China welfare changes (Caroline Freund, 2020).

Figure 5. U.S. export to China (2015-2021)
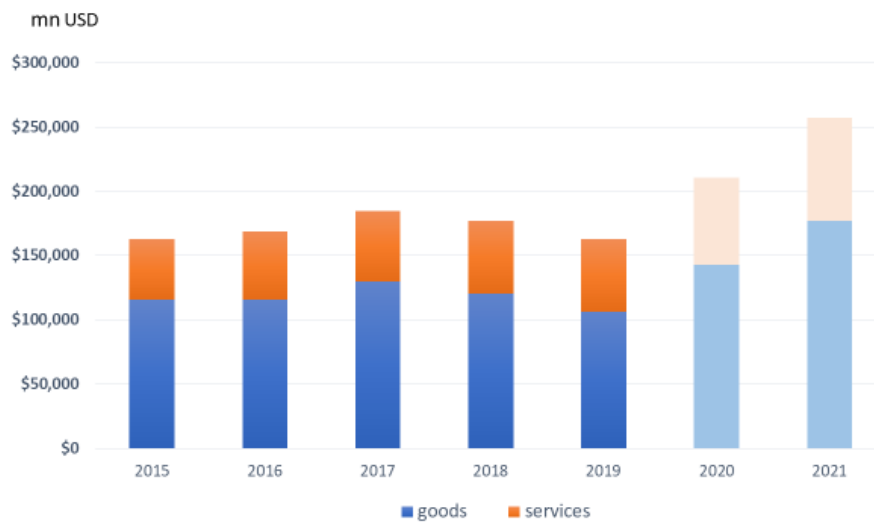
3.5.3 Scenario Three: Trade policy status quo scenario

In order to analyze the whole impact of U.S.-China actions 1/1/2018-now, scenario three combines the model results in pure trade war scenario one and results from trade truce scenario two by simply adding up them in Excel. From a more comprehensive view, econometric model delivers economic and trade impacts of two years' trade conflicts and concessions. The coming outcome is more specific and definite, and it also allows to be compared with previous. scenarios in order to identify the extent of damages caused by trade war and relieved pressure made by trade deal phase one. And scenario four and five are going to base on the results of scenario three to predict economic impacts in the foreseeable future.

3.5.4 Scenario Four: The escalation scenario

As mentioned in 2.2 predictions on U.S.-China trade war, there will be two opportunities mostly happen in the foreseeable future, the further escalation and de-escalation. In order to make ex-ante analysis about further escalation scenario, we believe there will be 10% point increase of tariff on both sides, which means we assume the U.S. tariffs on China from 18.4% to 28.4% and Chinese tariffs on U.S. from 18.5% to 28.5% ,which

is estimated based on historical experience during 1/1/2018-1/1/2020. Although U.S.-China tariffs was rolled back for a little by trade deal initiative signed in start of 2020, here, we assume escalated trade tension will happen without achievement of trade deal phase one. So escalated imposing tariffs will be on top of final tariffs in trade war situation (18.4% vs 18.5%), as presented in scenario one.

This case occurs on the background that Trump administration will win reelection of presidential campaign, because we believe Trump will have tougher policies on China than Biden Joe. And also, China will not achieve pledges and targets set in trade deal phase one, especially $200b worth of expanding purchase. And U.S. will not be satisfied with slight Chinese improvement in IP protection and technology transfer, etc. The deep rooted distinguish between two countries is ideology, which will not be changed easily, which makes two countries' economic systems and political systems differentiate. The econometric model will provide a projection after 2021.

3.5.5 Scenario Five: The de-escalation scenario

Simulation of de-escalation scenario will happen in the foreseeable future if the U.S. and China intend to alleviate worse trade relationships. They will roll back some imposed tariffs and diminish investment and technical restrictions. Following the same logic as scenario four, we estimate it will de-escalate tariffs by 90%, means Chinese tariff will decrease to 9.25% from 0.925% for U.S. exports and U.S. tariff will drop to 1.66% from 16.6% for Chinese exports. There is a little difference in the degree of increase and decrease tariffs between scenario four and scenario five, because 10% point increase is estimated based on effective tariffs changes on both countries and 90% decrease allow tariffs not to be zeroed and nullified. In fact, there is no returning back to amiable U.S.-China relations, and the U.S. and China need to know genuine U.S.-China cooperation would better off the American, Chinese peoples, and world peoples (Kuhn, 2020). The simulation model will provide a projection for trade truce after 2021.

Chapter 4. Results and Analysis

The impacts of tariffs are not mutually exclusive and normally are mutually influenced: domestic consumers have to bear costs of tariff hikes because of higher prices. And producers in counterparty have to lower export prices in order to maintain competitive in global markets. All third parties are favored by trade diversion proportionally. The models deliver quantitative parameters such as welfare changes, trade effects and productions effects via measuring extent of tariff and NTM changes (Nicita, 2019).

4.1 Economic and trade effects of the trade war 1/1/2018-1/1/2020

In table 3 and Figure 6 we report the economic and trade effects of the U.S.-China trade war 1/1/2018-1/1/2020 where we focus on the total economic welfare effects, production effects and bilateral and total trade effects for two biggest economies. And Figure 7 outlines trade value changes on various. trade routes.

Table 3. Economic and trade effects of the 2018-2019 U.S.-China trade war

Countries	Total welfare effects (mln USD)	Production effects(%change)	Total trade effect (mln USD)	Bilateral trade effect with US (mln USD)	Bilateral trade effect with China (mln USD)
US	-87.846	-0.9	-12.769	0.000	-76.112
China	-74.768	-2.0	-48.024	-315.781	0.000
EU	15.703	0.0	2.084	41.752	6.292
Japan	7.261	0.3	1.957	12.704	2.222
Korea	4.585	0.2	1.228	6.943	2.984
Canada	8.831	1.0	4.027	12.527	-0.672
Mexico	9.199	1.0	4.084	12.900	-0.389
UK	2.557	0.1	0.459	5.694	0.588
ROF Latin America	5.697	0.2	1.513	11.952	2.379
Oceania	1.839	0.1	0.380	1.516	2.303
Africa	2.457	0.1	0.445	3.522	1.783
ASEAN	9.140	0.2	2.004	17.209	4.765
ROW	19.608	0.0	-4.422	28.214	16.997

(Source: Authors' calculation)

4.1.1 U.S. & China

By analyzing outcomes of scenario one presented in Table 3, both participants of trade war (the U.S. and China) are worse off by tariff tensions. The U.S. economy hit heavies due to negative total welfare of U.S.D – 87b and China suffers less with negative total welfare of U.S.D -74b. Also, production effects are negative for both countries,

especially U.S. output drops by -0.95% and Chinese output drops by -2%. Combining the table 3 results with figure 6 surplus changes, we find consumers in the U.S. bear largest cost of U.S. tariffs on Chinese products with U.S.D -96.53b consumer losses, because associated expenses are largely passed to U.S. consumers and firms. Moreover, Chinese companies have to lower prices of exports in order to keep competitive, so the producer welfare is reduced significantly by U.S.D-59.28b. Some Chinese exports collapse due to trade diversion. Though for the U.S. and China, tariff revenues go up (as a result of imposed tariffs) U.S. total net welfare are reduced significantly caused by the big drop of consumers surplus. And Chinese negative net welfare is mainly affected by the drop of producer surplus. From the graph below, we can see the extent of U.S. consumer surplus. decline is larger than China producer surplus. decline, which is the consequence of bilateral trade imbalance(U.S. imports from China worth U.S.D 154b in 2017 vs China imports from the U.S. worth U.S.D 525b in 2017).

The ongoing trade war damages bilateral trade between the U.S. and China as outlined in Table 3 and Figure 7. China exports to the U.S. go down by 60%(U.S.D -315.8 b), and U.S. exports to China also go down by 49.2%(U.S.D -76b), means the lose-lose trade war makes bilateral trade become worse definitely. And the imbalance of trade loss from both sides is caused by U.S. trade deficit with China.

The U.S.-China trade war makes other competitors more attractive in U.S. and China markets and it triggers trade diversion. The table 3 presents EU exports weight much higher in the U.S. market share as an important substitute of Chinese exports, and ASEAN would be second beneficiary from increased bilateral trade with U.S. Also Japan, Canada and Mexico expand exports to the U.S. proportionally due to trade diversion. All third countries seem to increase trade flows with the U.S. While there are still trade loss U.S.D -160b existing by summing up all trade flow effects into the U.S., and that means trade diversion effects are not complete (Nicita, 2019). Compare with

the U.S., Chinese imports changes from other sources are not very obvious., and not only the U.S., Mexico and Canada also diminish trades with China, which could happen actually as Mexico and Canada perform as friendly neighbor countries and allies of the U.S. and they also signed United States–Mexico–Canada Agreement (U.S.MCA) which are not in favor of China. EU and ASEAN are two main substitutes of the U.S. in Chinese market share with the bilateral trade increase around U.S.D 5b. China trades with Japan, Korea, ROF Latin American, Oceania and Africa going up marginally from table results. Meanwhile, China loses imports valued at U.S.D-36b by adding up all trade flows effects into China, which means some third countries would capture parts of trade diversion generated by U.S.-China trade war, with the rest being lost or internalized by U.S. and China (Nicita, 2019).

Figure 6. Welfare changes of all selective countries and regions

(Source: Authors' calculation based on the model)

Figure 7. Change % in trade value
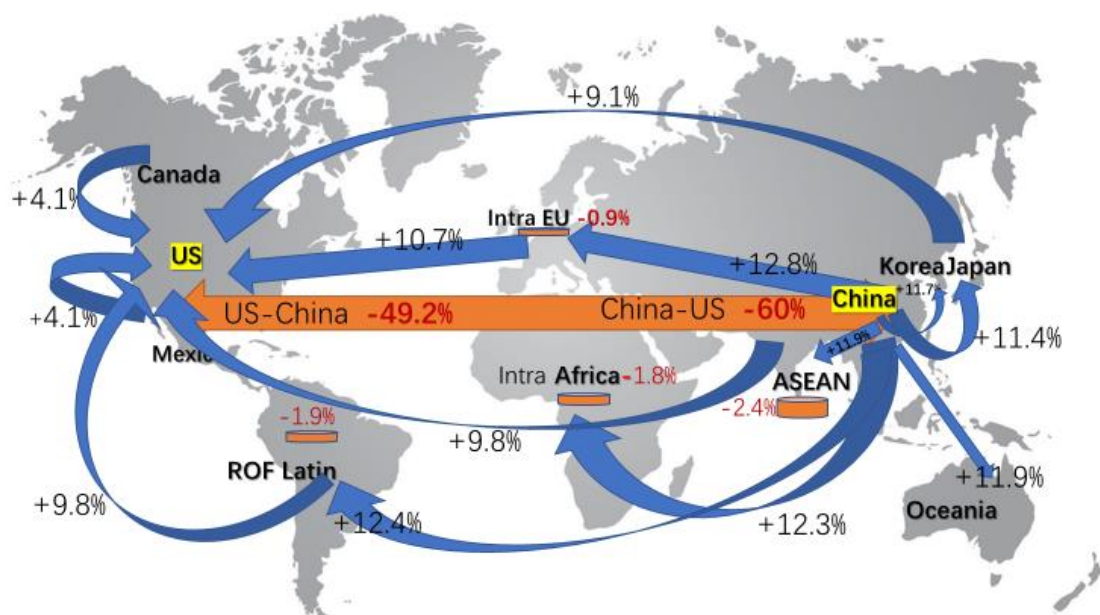
(Source: Authors' calculation based on the model)

4.1.2 EU 27 &UK

EU seems to be the chief beneficiary in this dispute with positive total net welfare of U.S.D15.7b. EU has become top trade partner for both sides, with the EU capturing U.S.D41.7b original Chinese exports to the U.S. and U.S.D 6.3b original U.S. exports to China. This difference is because EU Used to be main exporter of the U.S. and main importer of China. Additional imports and exports bring more benefits for EU consumers and producers, with U.S.D 2.6 b producer surplus. and large U.S.D 12b consumer surplus. While according to figure 7 above, the intra-EU trades are depressed by trade friction, and drop by -0.9% rippled by threat of uncertainty and trade diversion. The UK gains marginally from U.S.-China trade war with U.S.D2.6b, but comparing with other small economies, the UK expands larger amount of exports (U.S.D 5.7b) to the U.S. The domestic consumers and producer are better off with additional suppliers and destinations. In all, the UK would make partial profits from U.S.-China trade friction shown by the model outcomes.

From the model results, EU members gain a lot from trade diversion because EU

exports have high complementarity with Chinese exports (Plummer, 2019). It is estimated EU attracts more Chinese capitals and U.S. investments in the short run, while EU should position itself better than anytime as U.S. inward-looking policies may invoke U.S.-EU trade war later ,which makes EU suffer from fragile global economy driven by geopolitics-based rules (Basedow, 2019). In the long run, British economy as the separate economy without EU protection may suffer from uncertainty as a result of Brexit and trade tensions. Also, the UK will become more reliant on multilateral agreements including WTO rules that is weakened and disrupted by the U.S. and China actions during trade war. The UK is an important ally of intelligence of U.S., so the way that the UK positions and cooperate with both sides would decide the extent of economic growth in the future (Basedow, 2019).

4.1.3 Japan &Korea

Japan as the third economy in the world, preceded by the U.S. and China, are positively affected by U.S.-China trade war. The total welfare increases by U.S.D 7.3b and Japan's expanding trade reaches to U.S.D 2b, which is similar trade size with EU. And Japan is another important substitute of Chinese exports to the U.S. with additional U.S.D 12.7b trade shifts to U.S. In addition, China has U.S.D 2.2b worth of imports from Japan. Following the same logic with EU, Japanese consumers and producers make profits by expanded imports and exports presented in Figure 6. Japan consumers will enjoy more selections of products, which leads to less consumer prices, and the demand of domestic productions stimulates higher producer prices. Hence, in the short term, Japan gains from trade diversion of U.S.-China trade war. South Korea gains form trade diversion as well, with U.S.D 4.6b total welfare increases. And the U.S. and China find more sources and suppliers in South Korea as showed in the Table 3. The domestic customers and producer surplus. increase marginally at the same time. More South Korea exports to China enjoy the advantage of proximity, with U.S.D 3b worth of exports increasement. The model identifies the positive influence on South Korea, whose economy heavily relies on the U.S. markets and Chinese markets.

The negative impact caused by U.S.-China trade war on Japan is quite limited, the U.S. still keeps stable imports from Japan, and China also makes positive fiscal and monetary policies to avoid passive impacts caused by trade tensions to some extents. Most Japanese affiliates and MNCs in China focus. on Chinese customers, and a few exposure to U.S. markets have made strategic plans to move out of China to South Asian or elsewhere due to Chinese rising labor costs and business tariffs (Sato, 2019). The tariffs hikes also make South Korea suffer a little, as 5% Chinese imports from South Korea are Used for Chinese processing to the U.S., such as semiconductors in smartphones and other intermediate products (Jeong-ho, 2018). But the hit on South Korea is quite limited as well, because South Korea could change exports to China to direct exports to the U.S. and South Korea MNCs are planning base away from China to ASEAN in order to maintain business with U.S. markets. Hence, these positive results are reasonable and convinced at the moment (Gallo, 2019)

4.1.4 Canada &Mexico

Canada and Mexico are two important diplomatic and strategic allies and trade partners of the U.S., and because of proximity and recently established United States–Mexico–Canada Agreement (U.S.MCA), Canada and Mexico enjoy some advantages from U.S.-China trade friction. According to the Table 3, Mexico and Canada are the third and fourth beneficiary in the term of total welfare effects (USD 9.2b and USD 8.9b), preceded by EU and ASEAN. From the model results, we conclude Mexico would be the country gains highest interests from U.S.-China trade dispute. And both countries expand a large amount exports (more than USD 12.5b) to the U.S. as two important alternatives of Chinese exports and also reduce exports to China rippled by U.S.-China strains. Mexico captures additional USD 6.6b (3.4 %) imports from China, as there is not tariffs hikes between Mexico and China, and Mexico has highest bilateral trade effects with U.S. These two countries' producers and consumers benefit from rapid demand for domestic productions from the U.S. and lesser import products prices, seen from the Figure 6.

SCB editor mentions a lot of U.S. firms are moving their base from China to Mexico

(Blackman, 2020), and the reasons behind Mexico case would include:1. Friendly and trustworthy relationship between the U.S. and Mexico without any threat for business 2. Convenient transportations and proximity to the U.S. markets 3. USMCA agreements and preferential tariffs on Mexican exports to the U.S. 4. Similar attitudes about IP protection and market rules 5. Cheap labor costs and infrastructure construction (Blackman, 2020).

Canadian economy heavily relies on imports of the U.S., with about 75% total exports of Canada. In addition, USMCA allowed the U.S. against other two countries making free trade agreements with China, which was the reason Canada arrested Huawei CFO under American command (APFC, 2019). U.S.-China trade war made diplomatic relationship between Canada and China worsen by imposing tariffs on Canada exports to China. However, the U.S. market is always the alternative to absorb some Canadian exports to China, which means Canada still wins through listening to the U.S. in this trade war. The Figure 7 and model results mention Canada captures U.S.D 12.5b (4.1%) worth of original Chinese exports to U.S., which leads to lower consumer prices and better consumer surplus.

4.1.5 ROF Latin America

From the outcomes in Table 3, Latin American except Mexico also gains from U.S.-China trade deviation. The total welfare increases by USD 5.7b, and annual output climbs by 0.16% which is responsible for additional USD 12b(9.8%) exports to the U.S. and USD 2.4b (2.1%)exports to China. While from Figure 7, we see ROF Latin America also receives extra USD 12.4b (12.4%) imports value from China. Some Latin American countries like Brazil, Argentina benefit from boosting exports of agricultural products exposed to U.S.-China tariffs in the short term. ROF Latin America acts as a perfect trade partner with U.S. and China, and trade war stimulates domestic consumer surplus by USD3.52b and producer surplus USD1.89b from U.S.-China tariff fights, as shown in Figure 6.

In the long terms, the uncertainty and depressed demand from China make negatives outweighs positives for Latin America by trade diversions, as China is crucial trade partners and investor in Latin America   (Canuto, 2019). In recent years, the U.S. is not interested in engagement in this region that gives China opportunities to make free trade agreements with countries in ROF Latin American. As the second target of Chinese FDI, some Latin American countries make profits from China's infrastructure construction, investment and financial support (EK, 2019). Hence, aggravated Chinese economy caused by domestic issues and trade war results in weak investment and capital supports from China to ROF Latin America in the future (EK, 2019).

4.1.6 ASEAN

From the model results, ASEAN is second-largest region beneficiary from trade dispute, with total welfare increases of U.S.D 9.1b. Also, the additional 0.17% production is stimulated during this period shown by the Table 3. The crucial outcome from the model is ASEAN boosts exports to the U.S. by U.S.D 17.2b and to China by U.S.D 4.8b. Compare with other countries and regions, ASEAN along with EU are important and effective substitutes for the U.S. and China. The output change is positive 0.17%, and ASEAN consumers enjoy lesser prices (-0.5%) and better surplus (U.S.D 6b), which is also the reason why ASEAN owns large positive welfare effects. The ASEAN is the crucial destination for Chinese exports, as the region normally imports inputs or intermediate products from China are used for processing exports to the U.S.

ASEAN seems to receive more interests by trade shifts driven by U.S.-China trade war and it is the key beneficiary for recent Chinese FDI transfer. Most taxed Chinese products can be replaced or processed in this region, that is why ASEAN experiences rapid demand of exports during trade war (Lei, 2019). China+1 Production chooses Vietnam as the competitive and suitable manufacturing base instead of Chinese factories due to proximity to Chinese production, attractive low labor costs and cheap resources , advantageous regional agreements, etc. (Maxfield Brown, 2018). In the

short term, ASEAN garbs some benefits from extra exports and imports showed by the model results. However, if ASEAN would like to maintain stable economic growth, it needs to lean to multilateralism and proactively promote Regional Comprehensive Economic Partnership (RCEP) and Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) under the background of global economic protectionism (Lei, 2019).

4.1.7 Oceania &Africa

Here we consider two main countries in Oceania, Australia and New Zealand. And Africa has been quoted as a potential economic development zone after years. The analysis of the model clues Oceania and Africa experience marginal welfare benefits by USD 1.8b and USD2.5b. From the Table 3, Oceania has the opportunity to capture additional U.S.D 2.3b Chinese imports and USD 1.5 American imports. And according to Eddy Bekkers analysis, China is likely to import more agricultural products, fossil fuels from Oceania (Bekkers, 2020). Moreover, we find total trade effects are quite small, only with 379 men as the consequence of trade losses with other trade partners. Africa acts as less developing region, which has been reliant on foreign aid for many years. U.S.-China trade dispute also provides opportunities to Africa, as some exports of raw materials are diverted to China and the U.S. Given by Figure 7, Africa absorbs some U.S. and Chinese exports at the same time, with 5% and 12.3% trade value rise than trade war. The Figure 6 clues both regional consumers and producers get marginal benefits, while the governments get negative import tax revenues mainly because these two regions' import duty levels for American and Chinese products are lesser than others, and huge trade shifts to the U.S. and China decrease government tariff revenues.

Australia and New Zealand are strong allies of the U.S. in the South Pacific, and also follows some political policies against China, such as the ban against Huawei. The model results outline positive impacts for Oceania that is rich in raw materials and resources. The increases of exports and imports are promoting domestic consumption

and production. While in the long term, weak demand driven by fragile world economy may depress international business with Oceania. Following the same logic, Africa gains from trade deviation at the moment. However, the trade war may affect the African economy negatively in indirect way, especially weaken Chinese demand for raw materials and capital investment. And the self-independence target could be postponed unfortunately (Devermont, 2019).

4.2 Economic and trade effects of the truce in U.S.-China trade war after 1/1/2020

In table 4 and Figure 8 we report the economic and trade effects of the truce in U.S.-China trade war after 1/1/2020 where we focus. on the total economic welfare effects, production effects and bilateral and total trade effects for two biggest economies. And Figure 9 outlines trade value changes on various. trade routes.

Table 4 Economic and trade effects of the truce in U.S.-China trade war after 1/1/2020

| Countries	Total welfare effects (mln USD)	Production effects(%change)	Total trade effect (mln USD)	Bilateral trade effect with US (mln USD)	Bilateral trade effect with China (mln USD)
US	8.433	0.4	4.522	0.000	32.042
China	6.552	0.1	1.925	12.957	0.000
EU	-1.572	0.0	-0.119	-1.996	-2.669
Japan	-0.813	0.0	-0.275	-0.360	-1.580
Korea	-0.651	-0.1	-0.268	-0.142	-1.595
Canada	-1.271	-0.1	-0.203	-0.495	-0.169
Mexico	-1.119	-0.1	-0.183	-0.627	-0.102
UK	-0.343	0.0	-0.035	-0.266	-0.263
ROF Latin America	-0.808	0.0	-0.183	-0.474	-1.241
Oceania	-0.313	-0.1	-0.150	-0.019	-0.898
Africa	-0.264	0.0	-0.105	-0.117	-0.785
ASEAN	-0.944	0.0	-0.344	-0.577	-2.415
ROW	-1.239	0.0	-0.462	-1.318	-6.437

(Source: Authors' calculation)

4.2.1 U.S. & China

The Table 4 outlines economic and trade effects of U.S.-China trade deal phase one, the conspicuous point is the U.S. and China reverse pure losses to positive gains by signing the deal. The total welfare of the U.S. raises by U.S.D 8.4b and China also gains U.S.D 6.5b net welfare, means the trade deals to some extents curtails further

escalation of trade war and alleviates losses generated in previous situations. While the positive influence driven by U.S.-China trade deal is negligible, with only U.S.D 13b worth of Chinese exports to the U.S. and U.S.D 32 b U.S. exports to China. Base on new trade value extracted from scenario two, presented in Figure 9, the Chinese exports to U.S. increase by 6.8% and the counterparty increase by 44.8%. Tough this executive is initiated by the Trump administration; China also benefits from halved tariffs of fourth round. The Figure 8 shows the U.S. producers especially in selective sectors of trade deal would enjoy highest interests (U.S.D 5.6b) due to forced imports from the U.S,. And Chinese consumers also get large benefits (U.S.D 7.9b) because Chinese government will give subsidies or take correspond measures to achieve commitments, which make importing products' price acceptable and competitive. Compare with trade war situation, the import tax effects change negatively as well, which makes sense due to Chinese governments subsidies for domestic companies and lesser tax revenues.

In all, two participants of trade war (U.S. and China) are better off from the trade deal phase one. And the U.S. is definitely key beneficiary by managed trade with China, and all third countries are worse off by trade deviation from the deal. But the trade losses are unproportionate, with EU suffer most and Canada and Mexico suffer at similar level(U.S.D 1b) in term of total welfare change. And according to trade value changes on various routes in Figure 9, we find U.S.-China bilateral trade and intra-regional trade get rapid improvement, but trade flows on other trade routes, in particular between third parties and two biggest economies face proportional decline, because China has to purchase American products at the expanse of trade loss with other partners. While trade values among third parties become positive by model results, means U.S.-China trade deal also helps to stimulate and expand trade deals among all economies.

Figure 8. Welfare changes of all selective countries and regions
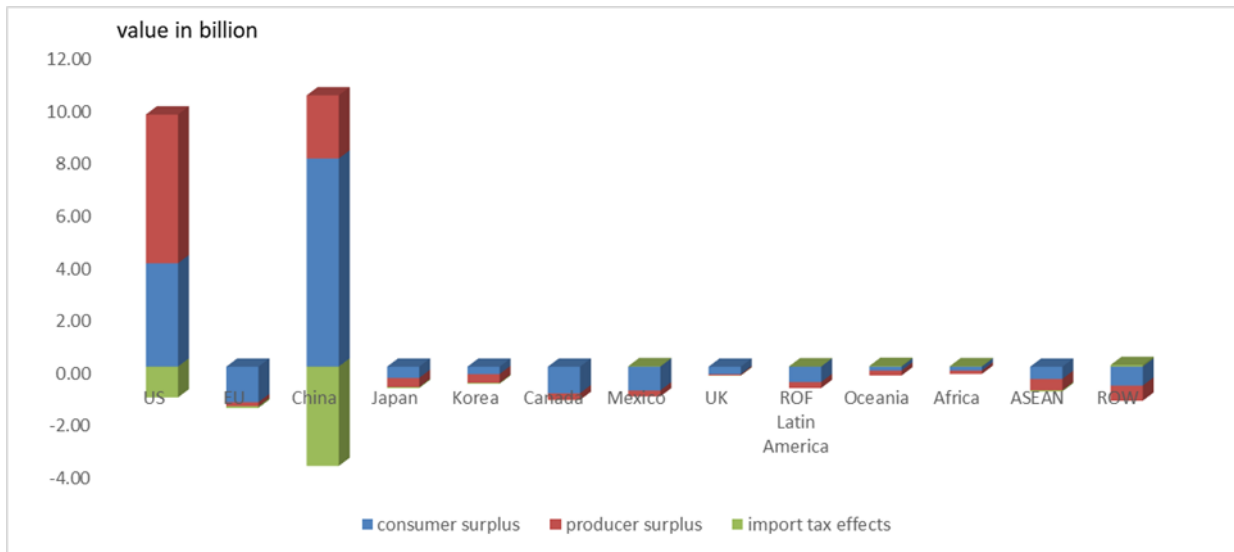
(Source: Authors' calculation based on the model)

The positive impacts of trade deal on world economy is limited and negligible, with many uncertainties and unsolved issues in U.S.-China trade war. The center piece of trade deal phase one is undoubtedly $200b worth of expanding trade in coming two years, which is also the pact Trump always mentions and makes proud of. However, the extent of reaching this promise is decided by U.S. supplement and Chinese demand. The recent depressed U.S. export capacity and long-time production process in special sectors such as liquified natural gas make it difficult to achieve targeted exports quantity (SCHOTT, 2020). On the other hand, Chinese ability to purchase is market and demand-oriented, which is impact negatively by economic downturn in recent years. Therefore, the trade deal is ambitious at the moment, and whether crucial issues between China and U.S. are going to be solved in the next phase also depends on results of U.S. presidential campaign in November.

Figure 9. Change % in trade value
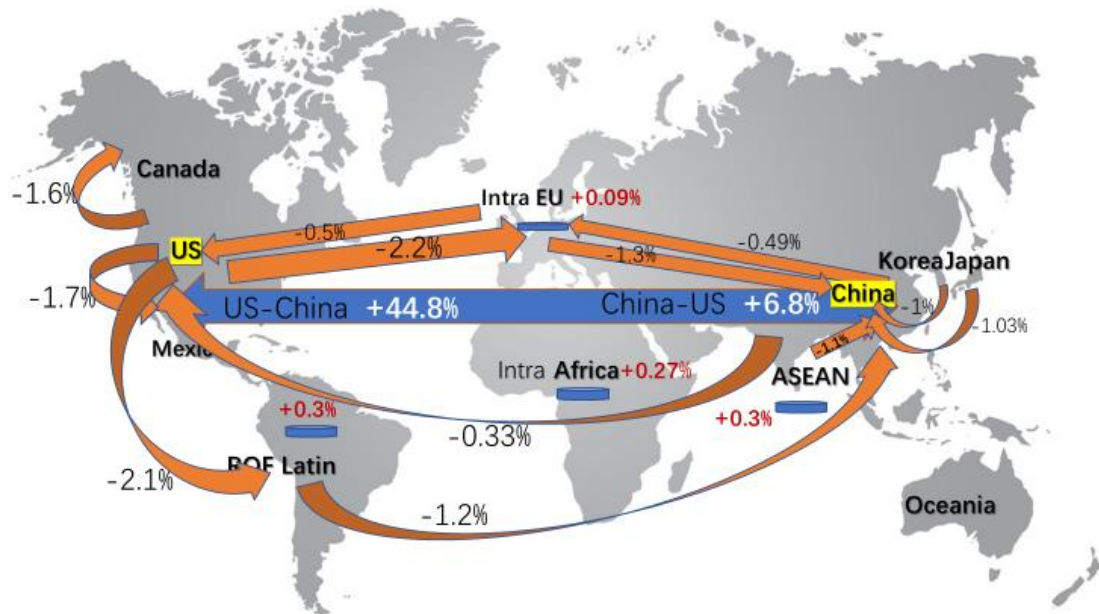
4.2.2 EU 27 &UK

The model shows, EU is the main loser in this stage, and was chief winner in last stage in terms of welfare effects. Based on earns from trade diversion caused by trade war, the total welfare declines by U.S.D 1.6b because China redirects imports from the U.S. away from EU. However, total trade effects are not exaggerated as many economists thought, with only U.S.D -119mln export loss. This means competitiveness of EU products make EU exports attractive in other markets as well. The U.S.-China bilateral trade agreement prompts economic cooperation and deals between these two countries, lead to the reduction of U.S. imports from EU by U.S.D2b and Chinese imports from EU by significant U.S.D2.7b. EU consumers are affected massively by U.S.D -1.35b and EU producers suffer less by U.S.D -148 mln. Compare with previous scenarios, the U.S. exports go down by -2.2% and Chinese imports from EU companies go down by -1.3%, as presented in Figure 9. According to Daniel Lacalle analysis, some sectors in EU exports especially projected in trade deal phase one

would suffer mostly, such as agriculture products, transport equipment, precision devices and mechanical appliances (Lacalle, 2020). The model also clues intra-regional trades of EU increase by 0.09%, as less demand from China and supplement from U.S.

The UK loses less than other large economies like Japan, Canada, with negative welfare effects of U.S.D -343mln. The imports demand from U.S. reduces by U.S.D-266mln and from China by U.S.D -263mln, the trade loss is negligible compare with the UK GDP ($2.83 trillion). After Brexit, the priority for the UK is negotiating with some powers EU, U.S. or China to make trade agreements in order to keep economic stability and prompts multilateralism for sustainable development (Reuters, 2020).

4.2.3 Japan &Korea

Japan and Korea have similar negative impacts by U.S.-China pact, with U.S.D-813 mln welfare loss for Japan and U.S.D -651mln welfare loss for Korea. The Table 4 and Figure 9 explain the bilateral trade effects of both countries with U.S. is quite small, but the contraction of Chinese imports is extensive, with -1.03%(U.S.D-1.6 b) for Japan and -1%(U.S.D-1.6b) for Korea. While from analysis in the model, we find the gains from U.S.-China trade war scenario outweighs the loss caused by U.S. managed trade, as Japanese and Korean exporters benefit from highly effective preferences in both U.S. and Chinese markets (Freund, 2020). Two countries' consumer welfare and producer welfare face marginal declines by sharing same reasons with EU. Summing up, the U.S.-China pact ripples marginal negative effects on these two East Asian countries, mainly on manufacturing and electronical products.

4.2.4 Canada &Mexico

Canada and Mexico are two countries suffer most in selected countries of the model. There are U.S.D-1.3b and U.S.D-1.1b welfare loss for Canada and Mexico caused by the expansion of U.S. exports to China. Canada loses more bilateral trades (U.S.D-495 mln)with U.S., as U.S. is the major trade partner of Canadian agricultural products and food include beef, soybeans, canola oil, etc (MCKENNA, 2020). Mexico's trade

effects change in a similar way, with lesser exports worth (U.S.D-627mln) to the U.S. due to trade shifts. According to Figure9, 1.6% of U.S.-Canada trade value and 1.7% of U.S.-Mexico trade value are cut by forced deal between U.S. and China. These two countries consumer and producer welfare go down proportionally as the result of trade loss. Compare with pure trade war scenario one, the degree of decline caused by U.S.-China trade pact is much smaller than gains from the previous. scenario because the trade deal phase one is quite limited functionally without feasibility of purchase plan. While there are also indirect positive influences not presented via the model. The improved access for U.S. exports stimulates the demand for manufacturing inputs in Mexico, and the benefits will be expanded if U.S.-Mexico strengthen economic cooperation and distribution network as expected in U.S.MCA (Freund, 2020).

4.2.5 ROF Latin America

The total welfare change of ROF Latin America is U.S.D-808mln, and the conspicuous negative impact is on bilateral trade with China, with U.S.D-1.2b contraction. And trade loss with U.S. is lesser, with U.S.D-474mln worth. The total trade effects are not significant because the region increases exports to other alternatives, with Canada and Mexico receive most supplement from ROF Latin America (U.S.D 9.4b and U.S.D9b) by given results. Meantime, the intra-regional trade in ROF Latin America goes up by 0.3% (U.S.D36.9b), means output change(-0.02%) is positively impacted by trade deal. The domestic consumer and producer welfare are reduced proportionally due to U.S. managed purchase. Many Latin American countries have high dependence levels on Chinese imports. Crude oil, copper minerals, soy products and iron ore are four main commodities that Latin America are rich in and account for the majority of exports to China (Casanova, 2015). And some countries and correspond sectors are likely to be affected negatively are Brazil, Argentina and Uruguay in soybeans and oilseeds, Colombia and Venezuela in crude oil, etc (Casanova, 2015).

4.2.6 ASEAN

Similar with ROF Latin America in Table 4, the bilateral trade with China is hit heavily

by U.S.-China pact, lead to trade losses valued at U.S.D-2.4b. The total welfare changes from positive U.S.D 9.1b in scenario one to negative U.S.D944mln in trade deal scenario, the fluctuation means ASEAN has high dependence levels to some extents with these two biggest economy. The influence on bilateral trade with China is larger than with the U.S. with -1.1% of ASEAN export loss in Figure 9, as China had strong trade ties with neighbor countries with 514.8 billion U.S. dollars trade value in 2017 (CGTN, 2018). The model outcome also mentions not only consumer and producer welfare, but also import tax revenues decline marginally due to trade diversion. According to Freund's analysis, the painful sector will be manufacturing products exports from ASEAN to China (Freund, 2020).

4.2.7 Oceania &Africa

From results in Table 4, Oceania and Africa are negatively driven by U.S.-China trade deal, with U.S.D-313mln and U.S.D-264 mln welfare losses. Compare with bilateral trade effects with U.S., the Chinese purchases are mostly influenced by U.S.D-18.9 mln for Oceania and U.S.D-117 mln for Africa, the effects are negligible actually. Domestic consumers and producers welfare are less than trade dispute scenario by given model results. The PIIE specialists identifies China would target trades in cereal and liquefied natural gas sectors away from Australia to the U.S. (PIIE, 2020). However, some trade partners with long-time contracts will not affected significantly in the short time. There are also many resource-rich economies in Africa relying on metal and mineral exports to China are expected to be panic after signature in the deal (Dahir, 2019).

4.3 Economic and trade effects of the U.S.-China Trade policy status quo scenario

In table 5 and Figure 10 we report the economic and the trade policy status quo (trade war +trade deal) where we focus on the total economic welfare effects, production effects and bilateral and total trade effects for two biggest economies. And Figure 11 outlines trade value changes on various trade routes.

Table 5 Economic and trade effects of the U.S.-China Trade policy status quo

| Countries	Total welfare effects (mln USD)	Production effects(%change)	Total trade effect (mln USD)	Bilateral trade effect with US (mln USD)	Bilateral trade effect with China (mln USD)
US	-79.413	-0.6	-8.248	0.000	-44.071
China	-68.217	-1.9	-46.099	-302.824	0.000
EU	14.131	0.0	1.965	39.757	3.624
Japan	6.448	0.2	1.681	12.344	0.641
Korea	3.934	0.2	0.961	6.801	1.389
Canada	7.559	1.0	3.824	12.032	-0.841
Mexico	8.080	1.0	3.901	12.273	-0.491
UK	2.215	0.1	0.425	5.428	0.326
ROF Latin America	4.889	0.1	1.330	11.477	1.137
Oceania	1.526	0.1	0.229	1.497	1.404
Africa	2.193	0.1	0.340	3.405	0.998
ASEAN	8.196	0.1	1.661	16.632	2.350
ROW	18.369	0.0	-4.885	26.896	10.560

(Source: Authors' calculation)

4.3.1 U.S. & China

By analyzing the model outcomes of scenario three presented in Table 5, the U.S. and China are worse off by trade fights. The U.S. initiates trade deal phase one in exchange for further imposing tariffs on Chinese exports, which alleviates loss marginally for both countries. Compare with trade war scenario, the U.S. suffers less by U.S.D8.4b in term of total welfare effects and China less by U.S.D6.5b. And total welfare declines reach U.S.D-79.4b for the U.S. and U.S.D -68.2b for China, the massive negative effects still exist because tariffs are not mentioned in trade deal. The bilateral trade effects of U.S. are getting better, as China commits to purchase $200b extra over next two years. The Chinese exports reduce by U.S.D-46b caused by U.S.-China trade policy status. quo, U.S.D-1.9b lesser than pure trade dispute. Combining the table 5 results with figure 10 welfare changes, we also find consumers in the U.S. bear largest cost of U.S. tariffs on Chinese products with U.S.D -91b consumer welfare losses, as associated expenses are largely passed to U.S. consumers and importing firms. Moreover, Chinese companies have to lower the prices of their exports in order to keep competitive, so the producer welfare is reduced significantly by U.S.D-56b. Both countries' consumers and producers welfare are worse off by tariff tensions, but losses become diminished through U.S.-China trade deal phase one. The existing tariffs and

non-tariff barriers damages bilateral trade between the U.S. and China as explained in Table 5 and Figure 11. China exports to the U.S. significantly goes down by 57.59%(U.S.D -302 b), and U.S. exports to China also go down by 28.5%(U.S.D -44b), means the bilateral trade between the U.S. and China is hit heaviest, and U.S. exports loss is a little less because of managed purchase with China.

Although these two participants have trade deal phase one, the current trade circumstance for two countries are still not optimistic, as many economist keep skeptical about feasibility of the deal. The trade targets are based on 2017 level, the level covers $134.2 billion trade volume partial of total U.S. exports to China($185.8 billion). The imports of uncovered products valued at $51.6 billion are shifted from the U.S. to other trade partners of China in order to compensate them (PIIE, 2020). So trade war brings massive negative effects to American and Chinese economy and the negatives far outweigh positives brought by the peaceful U.S.-China trade pact. U.S.'s protectionism damages not only trade peace, but also strong trade relationship with China as 2017 pre-war trade boost. Tariff is an unadvisable tool to balance trade flows and managed purchase cannot solve bilateral problems.

Figure 10. Welfare changes of all selective countries and regions
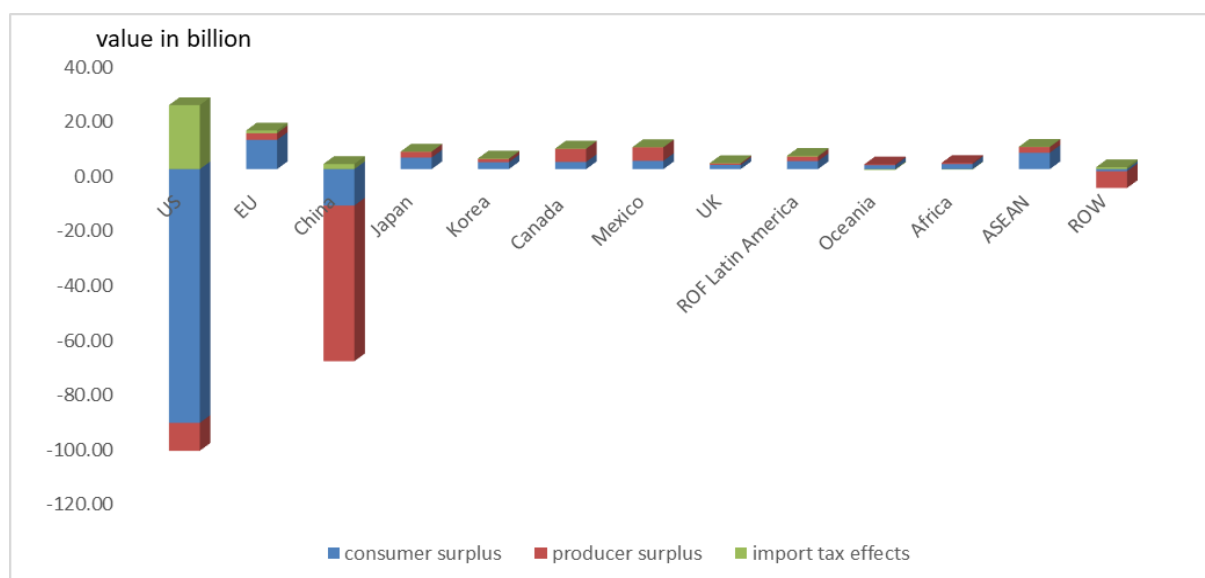
(Source: Authors' calculation based on the model)

From the analysis, we know trade war is an unsuccessful policy that Trump makes, as it hits American economy heaviest. Although tariffs tensions make Chinese

concessions in the trade deal, the U.S. losses cannot be recouped shortly. Trump's "America First" policy encourages the U.S. to withdraw Transatlantic Trade and Investment Partner(TTIP) and Trans-Pacific Partnership(TPP), and threaten its allies, partners with hard weapons-tariff hikes (O'Grady, 2017). Trump actions included U.S.-China trade war worsen American economic growth and business environment further in the long term, and also violated WTO rules. Hence, all issues will have a bigger negative influence on the U.S. trade and economy in the foreseeable future.

On the other side, in response to Trump tough tariffs, China retaliated in the same way and alleviated domestic stress by lowering import tariffs with other partners, which helped to find other competitive sources (Nicita, 2019). Chinese actions made itself suffer less by U.S.-China trade war, and also are great solutions at current stage.

Figure 11. Change % in trade value
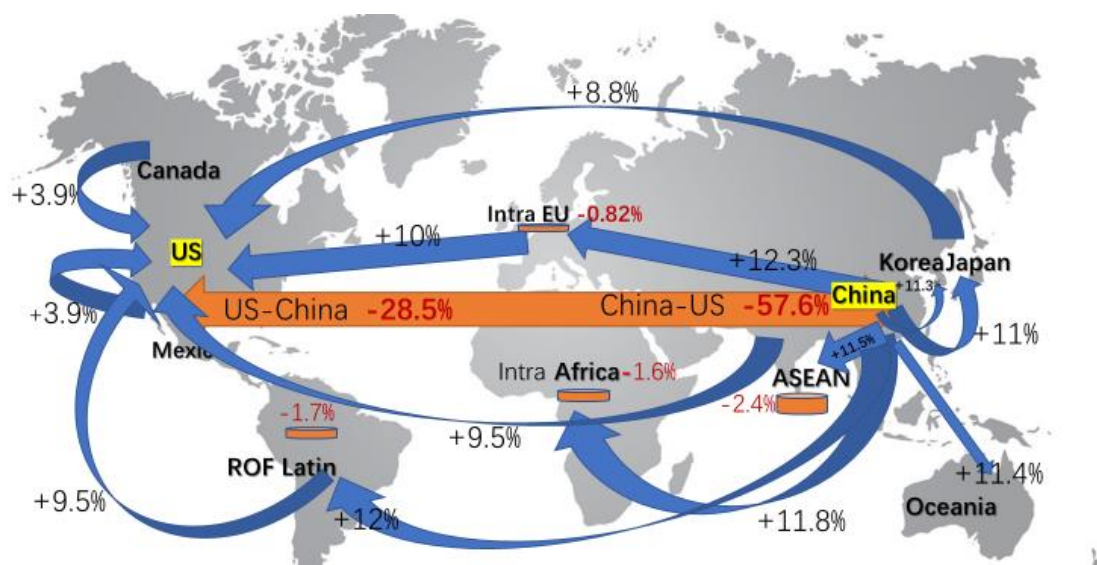
(Source: Authors' calculation based on the model)

4.3.2 EU 27 &UK

EU still is the key beneficiary of U.S.-China trade conflict, with the increase of total welfare valued at U.S.D 14b. Compare with pure trade war scenario, EU benefits less with reduction of U.S.D-1.5 b on total welfare and U.S.D-118.86 mln on trade effects. The changes are mostly triggered by U.S. forced purchase on China, China shifts imports worth U.S.D2.67b away from EU suppliers to the U.S. alternatives, as presented in Table 4. Also the bilateral trade ties between the U.S. and EU become a little loose,

down to U.S.D 39.8b. The model results in Figure 11, the intra-Europe trades up by marginal 0.09% trade value, as Chinese commitments to deal more with the U.S., lead to lower demand for EU products and EU expands trades within the region at the advantage of no border tariffs. Hence, the trade impact of U.S.-China trade war on intra-EU trade is -0.82% of trade value, as shown in Figure 11. With the same outcome with scenario one, EU has become top trade partner for both sides, with the EU capturing U.S.D39.7b(12.3%) original Chinese exports to the U.S. and U.S.D 3.6b (10%)original U.S. exports to China. This trade gap is because EU is used to be main exporter of the U.S. and main importer of China. The U.S.-china trade dispute brings massive benefits for EU consumers and producers, with U.S.D 2.4 b producer surplus. and large U.S.D 10.5b consumer surplus.. EU consumers gain due to improved effective suppliers from China and the U.S., and EU producers benefit by providing extra supplement in the background of worse U.S.-China economic relationships.

EU has strong advantages in agricultural and manufacturing sectors, means EU exports can fill up shortfall of U.S.-China bilateral trades with majority of agricultural and mechanical commodities. While trade deal phase one signing up is in favor of U.S. farmers and producers at the expanse of EU exporters. The model also outlines uncertainties of these two economies and fluctuation related to diplomatic relationship are of concern for third parties. Besides positive spillovers from trade diversion, the indirect negative impacts on investment and commercial confidence is not negligible. Hence, EU is making changes on economic policies in order to counter detrimental spillovers generated by Trump's new inward-looking policies (Plummer, 2019). Asia-Pacific region revised TPP into CPTPP which was expected to deliver leadership of global trade system in the future (Plummer, 2019). EU needs to endeavor to cooperate closely with these potential markets, China and U.S., and makes efforts to improve multilateralism and shared economy.

The UK gains a little by U.S.D2.2b in term of total welfare effects, because there is

U.S.D-343mln welfare loss in scenario two. The rapid decrease of UK exports to China generates by U.S.-China trade deal. The UK can get small positives from trade diversion, and also loses a little in the trade deal. Moreover, some analysists propose opening access to Chinese financial sectors and bringing up protection of IP will deliver more opportunities to EU enterprises, which also make sense, but the extent of gains from removing non-tariffs barriers is dependent on Chinese real actions (Colback, 2020).

4.3.3 Japan &Korea

Both Japan and Korea gain from trade diversion, and the total welfare increase by U.S.D6.45b for Japan, and U.S.D 3.9b for South Korea. There is total welfare decrease U.S.D 812mln for Japan, and U.S.D651mln for South Korea compared with scenario one, rippled by U.S.-China trade pact. Japan enjoys large improvement in bilateral trade with U.S., and become an important effective alternative of Chinese products with U.S. In addition, Japan also captures more than 11% trade value of Chinese exports, with U.S.D 18b, which is significant as Japan is third largest Chinese trade partner. Following the same logic with EU, Japanese consumers and producers wmake profits through expanding imports and exports, as presented in Figure 10. Japan consumers will have more options of importing sources, which leads to less consumer prices, and the higher demand of domestic productions stimulates higher producer prices. And Japanese exports has high complementarity with U.S.-China trades in manufacturing sectors, in particular industrial machinery, vehicles, optical and precision instruments, which allows Japanese vendors gain diverted market share away from China or America (PIIE, 2020). Hence, in the short term, Japan gains from trade diversion of U.S.-China trade war.

South Korea gains U.S.D 3.9b welfare in total. And South Korea acts as competitive immediate absorbing 11.3% of Chinese exports (U.S.D11b) and capturing 9.26% of U.S. importing market share (U.S.D 6.8b). Compare with other countries' bilateral trade effects with China, South Korea has massive positives as it has been Chinese crucial

importer at the advantage of proximity. Given model results, the total trade value of Korea exports to China reaches U.S.D178b, the largest one in term of trades between countries. The positive influences of U.S.-China trade diversion in South Korea is conspicuous in manufacturing sectors, in particular semi-finished products, semiconductors, electronical equipment and machineries. While, South Korea gains less than Japan, because there are more Korean exports in China exposed to tariffs hikes and U.S.-China trade war disrupts global supply chain at the expense of lower demand for Korean immediate goods.

4.3.4 Canada &Mexico

Canada and Mexico are two chief beneficiaries from U.S.-China trade conflict by comparing with other countries. Canada and Mexico get massive positives by virtue of proximity. Canada and Mexico enjoys the similar advantages from U.S.-China trade friction. As presented in Table 5, Canada and Mexico gain U.S.D7.6b and U.S.D8 b in total welfare separately. And both countries seem to be competitive and effective substitutes of Chinese exports, as U.S. shifts imports away from China to Canada by 3.93%(U.S.D 12b) and 3.89%(U.S.D12.27b)to Mexico. Following the same logic with scenario one, Canada and Mexico trade less with China caused by U.S.-China trade tension and tough diplomatic relationships. These two countries' producers and consumers extract benefits from rapid demand for domestic productions from the U.S. and lower importing prices, as presented in the Figure 10. Canada's agricultural products allow it capture some interests from U.S.-China tensions, while it also adversely affected by the trade deal made by U.S.

Mexico seems to be top winner during this period, with USMCA signing up. The model clues there are large positives existing in Mexico. There is no doubt that Mexico gains temporarily by worse U.S.-China conditions. In the long run, Mexico might bear higher costs due to less efficiency and "rules of origin" under USMCA (Chiquiar, 2020).Though Mexico receives rising foreign investment and acquires U.S. market share by replacing Chinese exports, the requirements and restrictions about labor wage and original

materials under US.CA make Mexican economy develop difficulty, especially in automobile sectors. The disruptive global supply chain also decreases efficiency in Mexican production process (Chiquiar, 2020).

4.3.5 ROF Latin America

As showed in Table 5, ROF Latin America gains by U.S.D4.89 b in terms of total welfare effects, less than Canada and Mexico. But the bilateral trades with U.S. and China are more dynamic, lead to trade value increase of U.S.D11.48 b with U.S. and U.S.D 1.14b with China. The annual output climbs by 0.14%, the majority of output increase comes from expanding trades with U.S. and China. According to Figure 11, the model also identifies emerging Chinese exports to ROF Latin America reaches U.S.D 12b(12%), as the important substitute of U.S. imports for China. This region is expected to import more manufactural and industrial products from China and exports more agricultural goods and mineral products to China. On the other hand, ROF Latin America becomes the crucial source and supplier for U.S. markets, with U.S.D11b (9.5%) worth of Latin American exports to U.S., as presented in Figure 11. The new trade value after shock between ROF Latin America and U.S. is around U.S.D120b. While to some extents, ROF Latin America decreases trade flows with other countries and regions, means its economic development will be more dependent on two biggest economies. In addition, ROF Latin American producers benefit from rapid demand from the U.S. and lesser import products prices, as presented in the Figure 9.

4.3.6 ASEAN

The model outcome identifies ASEAN is another key beneficiary from U.S.-China trade tensions, with total welfare increase of U.S.D 8.1b. In the table 5, the conspicuous change for ASEAN is massive growth in bilateral trade with U.S. by U.S.D16b. Although the trade deal makes ASEAN suffer U.S.D943mln in terms of welfare, and lose U.S.D 2.4b in terms of bilateral trade with China, the overall result is positive for ASEAN. And additional 0.17% production is stimulated when ASEAN provides extra U.S.D16.6b supplement for U.S. and U.S.D 2.34b supplement for China. SEAN along with EU are two important and effective suppliers and destinations for U.S. and China.

In the medium term, some MNCs and foreign affiliates in China tend to move out in bid to avoid tariff costs and they treat Vietnam as the best option of manufacturing base. However, the quality and capacity of rebuilt logistical and supply chain are not guaranteed at the moment. Differentiate with Mexico's restriction under USMCA, ASEAN faces limited ability to take manufacturing role. Hence, manufacturers in the global supply chain would get pain by newly converted structure (Colback, 2020). Outsourcing lower-end assembly and maintain valuable components in China is the part of current Chinese strategic innovations (Colback, 2020).

4.3.7 Oceania &Africa

From the Table 5, we find Oceania and Africa experience marginal welfare benefits by U.S.D 1.5b and U.S.D2.1b, lower than scenario one due to U.S.'s managed purchase with China. Oceania and Africa become effective destinations for Chinese export by receiving U.S.D 6b and U.S.D 9b goods separately. And these two regions expand exports to the U.S. and China proportionally as well, as presented in Figure 11. Trade diversion enhances trade ties between Africa and two biggest economies, which may be against strategical economic independence of Africa. Following the same logic with ROF Latin America, there are more Chinese manufacturing goods flowing into Africa and Oceania, and more African and Australian agricultural ,mineral products flowing into the U.S. and China. The expanded destinations and sources promote domestic consumption and production in these two regions.

In the long run, apart from U.S. and China, Austria and New Zealand will assist with intensifying regional CPTPP and promote dynamic Asian-Pacific economy zone, where is predicted as potential emerging economy in the foreseeable future. African countries also attract more outside investors in order to overcome damages caused by global economic uncertainty.

4.4 Economic and trade effects of the U.S.-China trade war escalation scenario

In table 6 and Figure 12 we report the economic and trade effects of the U.S.-China trade war escalation scenario where we focus. on the total economic welfare effects,

production effects and bilateral and total trade effects for two biggest economies. And Figure 13 outlines trade value changes on various trade routes.

Table 6 Economic and trade effects of the U.S.-China trade war escalation scenario

| Countries	Total welfare effects (mln USD)	Production effects(%change)	Total trade effect (mln USD)	Bilateral trade effect with US (mln USD)	Bilateral trade effect with China (mln USD)
US	-35.385	-0.7	-11.114	0.000	-55.331
China	-25.595	-0.5	-17.860	-78.234	0.000
EU	4.925	0.0	1.551	12.226	4.804
Japan	2.485	0.1	0.946	3.333	2.458
Korea	1.747	0.1	0.736	1.759	2.649
Canada	3.403	0.4	1.303	3.337	0.068
Mexico	3.291	0.4	1.292	3.574	0.044
UK	0.918	0.0	0.210	1.657	0.466
ROF Latin America	2.151	0.1	0.705	3.353	2.102
Oceania	0.750	0.1	0.331	0.370	1.632
Africa	0.802	0.1	0.296	0.956	1.383
ASEAN	2.971	0.1	1.231	4.670	4.092
ROW	4.704	0.0	0.673	8.308	12.135

(Source: Authors' calculation)

4.4.1 U.S. & China

The Table 6 presents effects when U.S.-China trade dispute will be intensified further in the future, and U.S. and China suffer more than in status quo, by U.S.D-35.4b for the U.S. and by U.S.D-25.6b for China in aspect of total welfare effects. The U.S. reduces -0.72% production further based on-0.57% decrease caused by U.S.-China tariff tensions, and China faces -0.54% output decrease on top of significant -1.92% productive loss in trade war period. And according to Figure 13, both Chinese exports to the U.S. and U.S. exports to China suffer roughly 50% decline in terms of trade values if Trump imposes another 10%-point tariffs. The model offers new bilateral trade value of worth U.S.D 106b between U.S. and China, which is one-seventh of total trade value(U.S.D737b) in 2018. This means escalated tough policy will decouple two economies further. And compare with scenario three, total trade effects and bilateral trade effects with China in escalation situation are not so massive, with total drop of Chinese exports by U.S.D-17.86 b and especially China to U.S. by U.S.D-78 b. The extent of negative influence on China side is smaller, mainly because existing tariff sanctions already hit two-third of Chinese exports to the U.S. and increasing tariff hikes

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can only destroy one-third more, which means Donald Trump further pressures 10% point more tariffs is not effective politically. And when China retaliates with 10% point more tariffs, Trump's tariff policy may not function well as expect, as both sides will bear tariff costs. The welfare changes of domestic consumers and producers in two countries follow the same direction as scenario three, with more consumer welfare loss in U.S. and more producer welfare loss in China. Compare with scenario one, the extent of loss is diminishing, as Chinese suppliers and American consumers has found alternatives of imports exposed to tariff hikes in U.S.-China trade war. In escalation scenario, presented by model results, 10%-point tariff hikes is not reasonable and effective as Trump expects and it will hurt American economy heavily due to Chinese retaliation by the same level on massive U.S. exports.

Figure 12. Welfare changes of all selective countries and regions
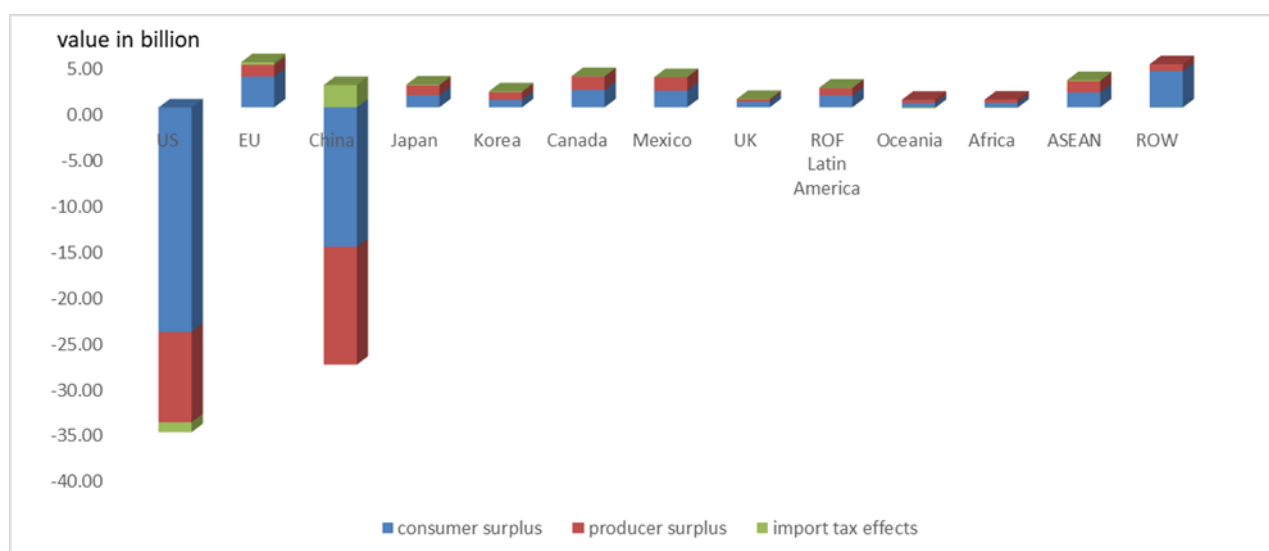
(Source: Authors' calculation based on the model)

According to Brookings, trade war along with trade deal shrank U.S.-China trade deficit to U.S.D 345b in 2019, and mainly because of reduced bilateral trades, and U.S. trade deficit with other partners increased due to trade diversion (Hass, 2020). The COVID-19 pandemic together with impractical trade deal disrupt global supply chain and make American economy worse. By given results, Trump should consider if enforcement of trade pact and continuous tariff sanctions worth rising unemployment, devastating farming industries and downward domestic economy at the background of pandemic

spread (Hass, 2020).

Figure 13. Change % in trade value
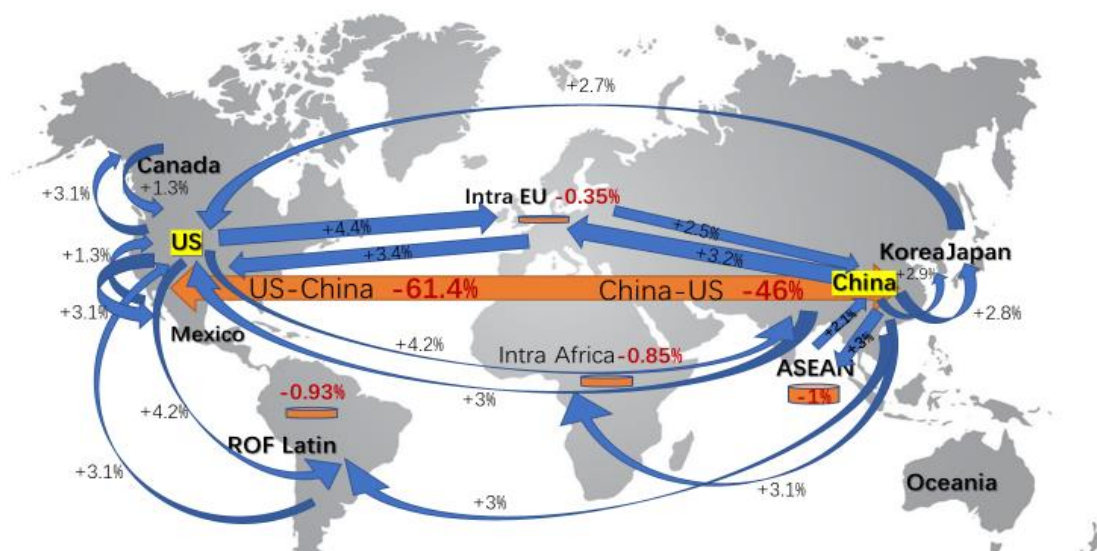
(Source: Authors' calculation based on the model)

4.4.2 EU 27 &UK

By analysis in Table 6, EU is still the winner under escalation situation, with positive net welfare valued at U.S.D4.9b, and that is less than U.S.D14b created in U.S.-China status quo. EU continues to increase exports to the U.S. by U.S.D12b and to China by U.S.D4.8b at the expense of diminished trade deals with other partners. The escalated tariff hikes better off EU consumers in some extents, as shown by model, especially EU grabs more Chinese cost-effective exports and American qualified products and services, and that is the reason why the majority of EU total welfare gains come from consumer surplus(U.S.D3.3b). While the output effect affected by additional tariffs is quite limited with 0.02% increase. Following the same logic with scenario three, the model clues EU benefits from trade diversion caused by U.S.-China decoupling partnership, but some indirect effects such as disruptive logistical networks and destroyed investment confidence also affect negatively on EU economic growth. The losses from escalated trade war far outweigh gains from trade diversion. So the escalated situation worse off every economy including superficial key beneficiary-EU

from trade diversion.

The UK also benefits a little, with positive U.S.D918mln in terms of total welfare, less than U.S.D2.2b in scenario three, which share the same reason with EU that another 10% point increase only affects minority of Chinese exports and most tariff affected enterprises in both countries may find alternatives and solutions in bid to avoid U.S.-China unstable trade policies. The Table 6 identifies the UK expand exports(U.S.D 1.6b) to the U.S. and receive additional imports(U.S.D 3.8b) from China and the U.S., so the domestic consumers and producer would better off with substituted suppliers and destinations.

4.4.3 Japan &Korea

Japan and Korea have been maintain strong trade ties with China, and China is Japan's largest trading partner with bilateral trade valued at U.S.D330 b in 2018 (Johnston, 2019). Korean export has high reliance on China economy as China has been its largest destination, with 25.1% of total South Korean exports (Workman, 2020).From outcome in Table 6, we find positive total welfare effects for these two countries, but general growth rate is less than trade war scenario, which shares the same reason with the change UK and EU. The conspicuous impact presented in the table 6 is the bilateral trade with China effects, Japan and Korea supple a larger amount of goods (around U.S.D2.5b) to China, which also means higher tariff hike split U.S. and China into two economy spheres where each side has its own economic influence and governance without reliance and compliance on counterparty. And Korea and Japan become critical and crucial trade partners of China by virtue of proximity, with more trade flows with China. The positives on these two countries brought by trade diversion come with reduction of trade value with other economies, as seen from marginal increase on output(0.15%). Domestic consumers and producers in Japan and Korea make profits by expanding imports and exports in the short term, as presented in Figure 12. While high independence on U.S.-China economies makes Japan and Korea suffer indirectly from disrupted value chain in the long run.

4.4.4 Canada &Mexico

From the calculation of the model, Canada and Mexico are another two beneficiaries, benefits from escalated trade war by more than U.S.D3b. And they both expand a large amount exports (U.S.D3b) to the U.S. as two important alternatives of Chinese exports and also export in small amounts to China caused by trade diversion. According to Figure13, trade flows among North America become more dynamic, as Canada and Mexico become effective suppliers and destinations for U.S. products. Following the same logic as Japan and Korea, Canadian and Mexican exports heavily rely on American market with 75% of total exports of these two countries. When two rivals U.S. and China decouple further, Canada and Mexico will be in American sphere of economy and technology (Colback, 2020). Hence, the bilateral trade effects with the U.S. are large positives, but the effects with China are margins. Moreover, in order to offset trade gap of Chinese exports to the U.S., Canada and Mexico decrease supplements to other partners, which strengthen regional economic integration in North America and lessen the U.S. 's reliance on Chinese manufacturing industries. In addition, Canadian and Mexican producers and consumers benefits from rapid demand for domestic productions from the U.S. and lesser import products prices, as presented in the Figure 12.

4.4.5 ROF Latin America

ROF Latin America still gains from trade diversion in escalation scenario, with U.S.D 2b increase in terms of welfare effects, and annual output climbs by 0.08% which is proportionally responsible for additional U.S.D 3.4b(3.1%) exports to the U.S. and U.S.D 2b (2.2%)exports to China. Moreover, we find ROF Latin America receives extra U.S.D4.3b(4.2%) worth imports from the U.S. and U.S.D2.8b (3%) imports from China, as an important trade substitute for U.S. and China. Differentiate with U.S.-China trade policy status quo scenario three, the bilateral trade with the U.S. increase less and bilateral trade with China climbs by U.S.D 1b, which means Latin American products are more attractive for Chinese customers. Another distinction with previous outcomes is ROF Latin America receives lesser Chinese shipments, since U.S. has imposed the

majority of Chinese exports during 2018-2020, which leads to huge trade diversion happen in previous. scenarios and further escalated trade tensions will no longer have a huge impact on trade diversion. But China's escalated retaliatory tariff hikes will cover another half of goods, so ROF Latin America will have more American alternatives in the future. However, in the escalation situation, downward global economy and devastating investment confidence also affect Latin America negatively, in particular it is the second target for Chinese FDI. The Belt and Road initiative in Latin America may be postponed by stagnant economy and demand in China.

4.4.6 ASEAN

ASEAN is expected to be key beneficiary in U.S.-China trade frictions, because it has high complementarity with Chinese exports. And Vietnam is treated and trained to be next "World Factory" as China after trade war, predicted by some specialist. Consistent with changes in other countries, ASEAN experiences positive U.S.D 2.9b worth of increase in terms of total welfare effects. Also the additional 0.1% production is stimulated when 10% point increase of tariffs in place, as shown in Table 6. Meantime, ASEAN acts as the important intermediate sharing huge trade deals with U.S. and China in escalated case, as outlined in Figure 13. New trade value calculated by the model identifies ASEAN is the second largest export market of China with U.S.D219 b, and the region's customers and producers are getting huge benefits relative to more cost-effective sources in China and enormous demands from China. When U.S. and China threaten to decouple, ASEAN, EU, together with Mexico and Canada take larger proportions in American market, in particular trade gap from China exports. ASEAN seems to grab large interests from trade shifts caused by the escalation of U.S.-China trade war. While tensions also makes global supply chain and value chain at risks which indirectly affect ASEAN economy as well, especially when the U.S. threatens to impose tariffs on products contain Chinese components, which would really damages global value chain, as Chinese manufactures and components are very competitive.

4.4.7 Oceania &Africa

Consistent with similar changes in scenario three, Oceania (Australia and New

Zealand) and Africa gain marginally, with welfare increase of U.S.D749 mln for Oceania and welfare increase of U.S.D802 mln for Africa. The analysis of the model clues Oceania and Africa boost over U.S.D1b worth of supplement separately, since China will retaliate with 10% point increase on another half non-tariff American products in escalation situation, which stimulates large trade diversion towards other countries and regions. Two regions' consumers surplus. and producers surplus. are rising, but import duties down by U.S.D-79 mln for Africa and U.S.D-38mln for Oceania, as the region's customers and producers are getting huge benefits relative to more cost-effective sources in China and U.S..

Following the same logic, marginal revenue of 10%point tariff for Oceania and Africa is quite small and potential indirect negative impacts and risks may outweigh gains from trade diversion. The shared economy and economic regional integration are principal for global economic growth in the future.

4.5 Economic and trade effects of the U.S.-China trade war de-escalation scenario

In table 7 and Figure 14 we report the economic and trade effects of the U.S.-China trade war de-escalation scenario where we focus. on the total economic welfare effects, production effects and bilateral and total trade effects for two biggest economies. And Figure 15 outlines trade value changes on various. trade routes.

Table 7 Economic and trade effects of the U.S.-China trade war de-escalation scenario

| Countries	Total welfare effects (mln USD)	Production effects(%change)	Total trade effect (mln USD)	Bilateral trade effect with US (mln USD)	Bilateral trade effect with China (mln USD)
US	39.176	0.9	13.738	0.000	63.683
China	40.287	1.3	43.797	187.353	0.000
EU	-9.447	0.0	-2.009	-24.123	-4.773
Japan	-4.480	-0.2	-1.339	-7.199	-1.991
Korea	-2.891	-0.2	-0.892	-3.915	-2.417
Canada	-5.659	-0.7	-2.546	-7.104	0.276
Mexico	-5.768	-0.7	-2.566	-7.388	0.157
UK	-1.625	-0.1	-0.303	-3.275	-0.449
ROF Latin America	-3.605	-0.1	-1.015	-6.842	-1.910
Oceania	-1.190	-0.1	-0.312	-0.851	-1.705
Africa	-1.502	-0.1	-0.329	-2.006	-1.358
ASEAN	-5.520	-0.1	-1.589	-9.844	-3.842
ROW	-11.379	0.0	2.383	-16.252	-12.417

(Source: Authors' calculation)

4.5.1 U.S. & China

From results in Table 7, U.S.-China de-escalated trade tensions better off bilateral trades between China and the U.S., and worse off trades between two biggest economies and other partners. The U.S. pulls down 10% tariffs, followed by China initiates 10% decrease of tariffs. Both sides' concessions alleviate risks and uncertainty of global economy in some extents, which leads to positive welfare effects for two countries(U.S.D39b for U.S. and U.S.D40b for China). And Chinese total trade effect is significant with positive U.S.D43b, the majority of expanded trades(U.S.D 187b) is intended to satisfy American demand. Moreover, U.S. decrease imports from other suppliers, as Chinese manufactures are very competitive and powerful. On the other hand, China captures extra U.S.D63b worth of U.S. exports that stimulates U.S. output by 0.91%, as presented in Table 7. The Figure 14 presents American consumers gain the most followed by Chinese producers, and these two parties suffered most in scenario one. In de-escalated situation, U.S.-China bilateral trade ties strengthen further at the expanse of losing deals with third parties. But economic pressure relieved for both countries is smaller than profits they made from previous trade tensions, because firstly U.S. and China slapped more than 18% tariffs on each other during U.S.-China war period, which means 10% decrease of tariffs could not compensate all losses caused by tariff hikes and secondly although they roll back tariffs and sanctions against Chinese companies, there are still non-tariff measures existing in order to curb Chinese companies. Thirdly, the global value chain and supply chain are damaged by U.S.-China actions lead to much uncertainty for trade companies and investors.

Bilateral trades between U.S. and China benefit immediately by improved trade conditions. De-escalation makes two countries deal without much barriers, and global supply chain become more completed by combining comparative advantages from two countries. Hence, long-term positive impacts of de-escalations are not negligible, which include improving global economic stability, raising investment confidence and stimulate international business.

Figure 14. Welfare changes of all selective countries and regions
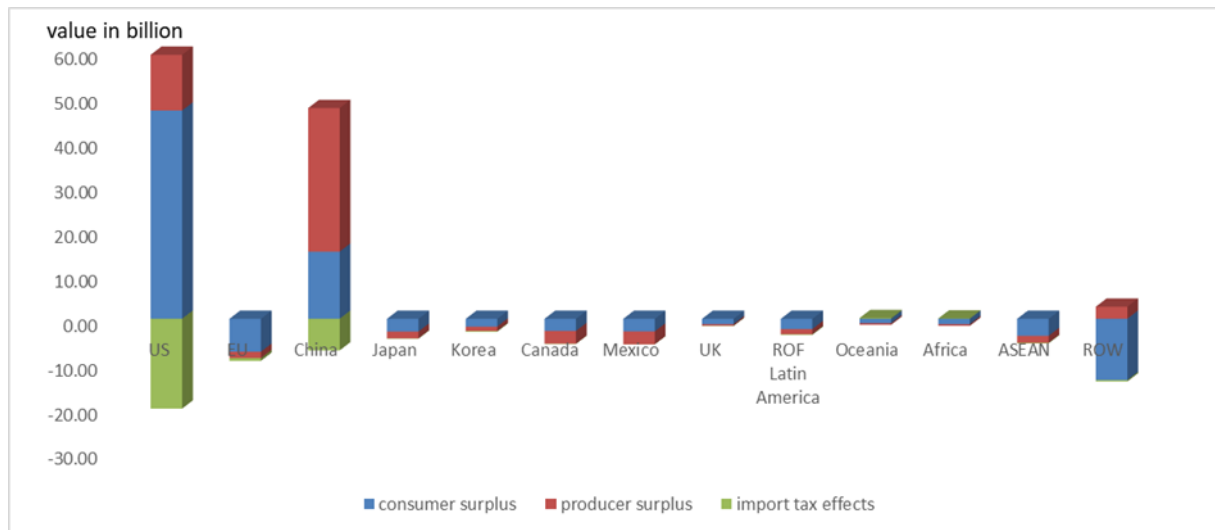
(Source: Authors' calculation based on the model)

By the results from Figure 14, de-escalated case reorganizes trade routes in favor of bilateral trade between U.S. and China, EU would stand most of trade loss with U.S. and China, and Canada and Mexico have been trading significantly with U.S., in particular during U.S.-China trade war, also face -2.7% decline of trade value caused by trade diversion. South Korea and Japan encounter similar situation with Canada and Mexico, affected negatively by de-escalation trade relationship. While new trade flows would be mainly from China to the U.S., as Chinese components and manufactures are competitive in American market. Hence, some third parties exposed to import from China and export to the U.S. would be impacted in this scenario.

Figure 15. Change % in trade value
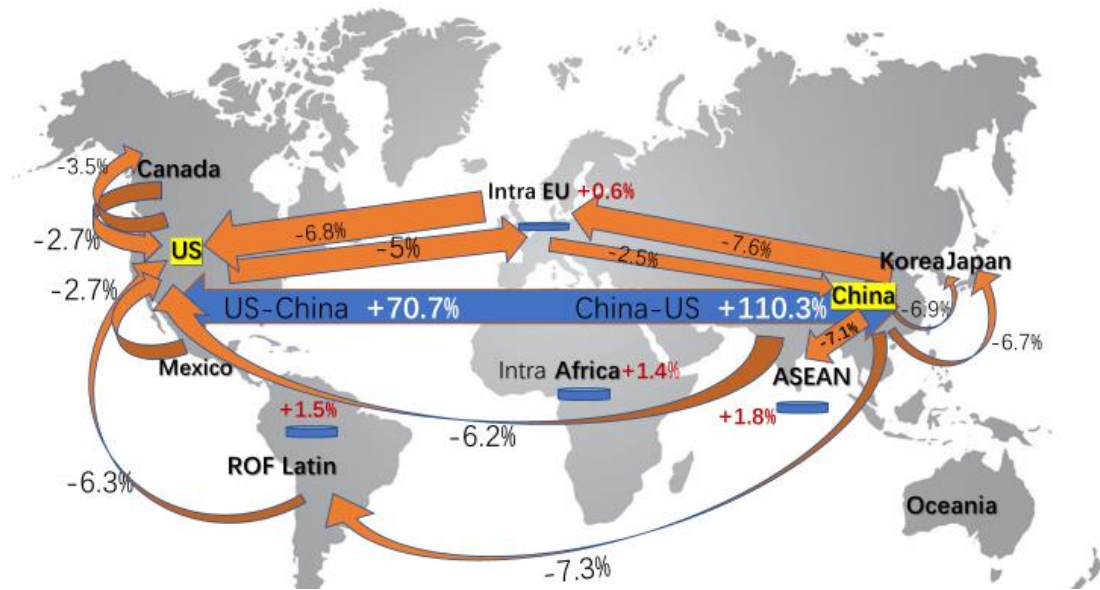
(Source: Authors' calculation based on the model)

4.5.2 EU 27 &UK

By analysis in Table 7, EU lost U.S.D9.4b worth of total welfare as the result of trade diversion caused by de-escalated relationship between U.S. and China. The decrease of bilateral trade with China is significant about U.S.D24 b, and total trade down by U.S.D2b. Compare with trade war escalation scenario, de-escalated U.S.-China trade war makes more loss in EU and worse off EU consumers largely by U.S.D7.4b, as the U.S. chooses effective Chinese manufacturers at the expanse of lower EU exports to the U.S.. By calculation from the model, there are U.S.D 31b worth of Chinese exports are diverted to American market, which results in domestic products prices in EU become higher and less consumers welfare. Also diminished U.S. demand (U.S.D 24b)for EU manufactures caU.S.es EU producers suffer to some extents. Therefore, EU27 is the largest loser in de-escalated scenario from all selective countries and regions. However, global economies include EU would benefit from stable economic environment and global economic integration.

The UK also suffers a little with negatives U.S.D1.6b in terms of total welfare, differentiating with positive results in scenario three. The Table 7 identifies the UK

decreases exports(U.S.D 3.2b) to the U.S. and a small amount of exports to China. The difference is because China used to export a large amount of products to the U.S., which means without tariff hikes, Chinese goods will flow into the U.S. market again, So UK exports to U.S. will decrease. Moreover, UK consumers and producers are worse off with higher prices caused by less Chinese suppliers and lower producer prices. EU27 and UK experience similar negative outcomes caused by trade diversion, while long-time impacts could be positive for these two economies as shared and connected economy boost cooperation and competition, which are key contributors of economy growth.

4.5.3 Japan &Korea

In U.S.-China trade policy status. quo, Japan and South Korea who make similar products with Chinese commodities exposed to tariffs hikes, and they are likely to gain through trade diversion. When U.S.-China trade relationship is de-escalated , all third parties include Japan and Korea will lose comparative advantages by comparison with Chinese manufactures. Japan suffer more with U.S.D-4.5b welfare loss, and U.S.D-2.9b welfare loss for South Korea. Japanese products are affected significantly in U.S. market with U.S.D-7.2b worth of exports loss. As Japanese products have a higher complementarity of Chinese exports, Japan benefits significantly by working as an important substitute in U.S. market during trade war period.

Korea reduces exports(U.S.D-2.4b)to China proportionally, as South Korea has been the largest importer of China. Domestic consumers and producers in Japan and Korea suffer from trade diverted back to China in the short term, as presented in Figure 14. However, the strengthened U.S.-China bilateral trade increases Chinese demand for components from Japan and U.S., and also Japanese and Korean MNCs and affiliates in China which access to U.S. markets would continue to provide supplements. That means de-escalated U.S.-China diplomatic and trade relationship better off Japan and Korea economy definitely in the long run.

4.5.4 Canada &Mexico

According to Table 7, Canada and Mexico are another two victims in de-escalated U.S.-China trade war, with around negative U.S.D5.5b loss in terms of total welfare, differentiating with benefits from escalated trade war. And they both lose a large amount exports (U.S.D7b)to the U.S. as they are replaced by Chinese exports. But they expand exports to China affected by trade diversion. In selective countries, Canadian and Mexican exports have heavy reliance on U.S. demands with more than three fourth of total exports. Hence, when the U.S. and China rebuild trade ties by rolling back 10% tariffs, Canada and Mexico have to face the drop of exports by comparison with competitive Chinese manufactures and integrated processed supply chain. Therefore bilateral trade effects in these two countries with U.S. are negatively impacted.   And also some American exports are diverted to China instead of Canada and Mexico, so economic cooperation among all third parties become close in some aspects. We find the bilateral trade effects with China are positive, as alleviated trade relations between two rival powers also reduce business risks for North American companies with China. Moreover, Canadian and Mexican producer and consumer welfare drop by U.S.D5.5b, which is affected by less supply and demand from the U.S. and lower import producer prices, as presented in the Figure 14.

4.5.5 ROF Latin America

According to Table 7, ROF Latin America is also on the sufferer list, responsible for more than U.S.D1b exports loss and U.S.D3.6 b welfare loss. Following the same logic with Canada and Mexico, bilateral trades with China and the U.S. are affected negatively by U.S.D 6.8b and U.S.D2b, which make large proportions of exports loss. The big quantitative difference of lost American market and Chinese market comes from large amount of tariffed Chinese products back to occupy American markets again in de-escalated situation. Moreover, we find ROF Latin America will spread trade deals with other partners. ROF Latin American welfare changes with U.S.D -2.3b reduction in consumer surplus. and U.S.D-1.2b in producer surplus., as showed in Figure 14. Actually the economic and trade reduction caused by trades diverted to China in de-

escalated scenario is smaller than increased degree in the scenarios three, which is mainly because de-escalated case makes every economy enjoy better business environment and cooperative opportunities along global value chain.

4.5.6 ASEAN

Consistent with changes in other countries, ASEAN experiences negative U.S.D -5.5b worth drop in terms of total welfare effects. ASEAN used to be key beneficiary in U.S.-China trade frictions with large interests (U.S.D 8.2b), as predicted in the model. When U.S.-China plan to roll back 10% tariffs, there is a potential decrease about -0.12%on ASEAN output. And ASEAN loses -6.2%(U.S.D-9.8b) of American destinations and -2%(U.S.D-3.8b) of Chinese destinations. Although ASEAN experiences big drop in bilateral trades with the U.S., total trade effects are not significant by comparison with its GDP size. Because ASEAN has comparative advantages in manufacturing sectors and assembling progress, means it could also find other alternatives or destinations replacing U.S. and China. Moreover, the region's customers and producers are losing some benefits relative to more cost-effective sources in China and enormous. demands from China and U.S.. While eliminated tensions between two biggest rivals also make global supply chain and value chain complete and effective which indirectly affect ASEAN economy as well, especially when the U.S. stops to impose tariffs on products contain Chinese components, which would really help ASEAN manufacturers favor Chinese parts.

4.5.7 Oceania &Africa

Compare with changes in U.S.-China trade policy status. quo scenario, Oceania and Africa suffer marginally in aspect of total welfare effects, with decrease of U.S.D1.2b for Oceania and U.S.D1.5 b for Africa, as presented in Table 7. The analysis of the model identifies Oceania and Africa face over U.S.D-300mln worth down in overseas exports including U.S.D-2b on Oceania-U.S. trade route and over U.S.D-1b on Oceania/Africa- China trade route by sharing same reasons with other countries and regions. Two regions' consumers surplus. and producers surplus. are declining, as the region's customers and producers are losing benefits relative to more cost-effective

sources in China and huge U.S. demand in trade war period. Following the same logic, eliminating 10% tariff on both U.S. and China side is influencing positively on Oceanian and African economies and gains may outweigh pains from trade diversion, since these two regions would connect other third parties closely and reduce risks and reliance of trading largely with U.S. and China.

Chapter 5. Conclusion

The US-China trade war lasted for two years, and tit for tot tariff retaliation damages U.S. economy the heaviest following by China. The impacts of U.S.-China tariffs were not mutually exclusive and normally were mutually influenced. The U.S. slapped heavy tariffs on USD325b Chinese goods and then China retaliated by same tariffs on U.S.D145b American exports, lead to a sharp drop (57.6%) of US imports from China. The U.S. consumers have to bear the costs of tariff hikes by paying higher importing prices. Chinese firms have to lower profits in a bid to keep competitive internationally. This analysis indicates that the US consumer suffered mostly by USD96b and Chinese producers bore tariff costs of USD21b caused by the US-China trade war. The positives sides brought by trade deal are limited, and two participants of trade war (U.S. and China) are better off from the trade deal phase one, with welfare increases of USD8.4b worth for U.S. and USD6.5b for China. The U.S. is definitely key beneficiary by managing trade with China, and all third countries are worse off by trade diversion from the deal.

When these two biggest economies decouple further, the extent of negative influence on China is diminishing. This is mainly due to the existing tariff sanctions have already hit two thirds of Chinese exports to the US and the increasing tariff hikes can only destroy above one-third. And when Chinese retaliatory imposition of 10% point tariff hits back, Trump's tariff policy may not function well as expect, as both sides have to bear tariff costs. This paper also qualifies bilateral trades between US and China. From the perspective of de-escalation scenario, both countries benefits immediately, as

Chinese exports to the US increase significantly by 110% of trade value and 71% rise from US to China. Improved trade conditions allow two countries deal without much barriers, and global supply chain becomes more completed by combining comparative advantages of two countries.

This paper finds sufficient evidence that some third parties are favored from trade diversion, for example EU gains USD 14b and has been the top beneficiary followed by ASEAN in terms of total welfare effects. The export from Canada and Mexico goes up by a large amount, as they are viable supply alternatives of the US. Meanwhile, Japan, South Korea become more important destinations for Chinese exports due to the proximity Furthermore, trade losses results are mentioned in this paper, which are caused by the lack of supplement capacity of third parties. Besides, in the de-escalated scenario, all third parties experience welfare loss and trade loss, in particular EU and ASEAN lose large trade deals with US and China, but every economy links closely and faces less risks and economic reliance with US and China.

Both countries should realize neither side will change political system, which helps to avoid trade disputes and frictions (Kaeser, 2020). The economic principal of 21st century should be cooperation and competition, and "America First" and polarization not only damage domestic production, but also break global economy orders and supply chain. In all ,de-escalation of US-China trade tensions should be the target that both presidents make efforts to do.

The applied methodology in the thesis is GSIM, a typical model of the Partial Equilibrium providing a relatively flexible and simple framework. The model delivers economic effects (welfare and output changes) and trade effects (import and export) for accordant countries and regions. By combining with five scenarios, the model provides a more comprehensive view on trade war impacts.

The limitation in our paper that there is no exploration of industrial sectors, while many researchers have already discussed about US-China trade war impact on industries. Hence, there is no reference in this paper about industrial areas. And because of limitation of the model , this analysis does not involve impacts on supply chain or value chain which aims to identify the extent of negative impacts of US-China. The U.S.-China trade war impacts on value chain can be investigated in the future.

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Appendix 1

The major products imposed with tariffs in 3 rounds of trade war

	US -China	China-US
Round 1	HTS 84 Machinery and Mechanical appliances and parts. HTS 85 electrical equipment ,sound recorders and reproducers and accessories. HTS 86 railway and tramway locomotives and rolling-stock and parts. HTS 87 Category: vehicles accessories. HTS 88-89 aircraft and spacecraft ,floating structures and parts. HTS 90 Category: optical ,photographic and measuring equipment and medical ,surgical instruments.	HTS 02 meat and edible meat offal. HTS 03 fish and crustaceans and other aquatic products. HTS 04,07,08,16 dairy products and edible vegetables, fruits . HTS 10,24 cereals and tobacco HTS 87 vehicles
Round 2	HTS 39 ,73 plastics, iron and steel products HTS 84 Machinery and Mechanical appliances and parts. HTS 85 electrical equipment ,sound recorders and reproducers and accessories. HTS 86.87 Railway or tramway locomotives, rolling-stock parts and other vehicles. HTS 90 Category: optical ,photographic and measuring equipment and medical ,surgical instruments.	HTS 27 mineral fuels and oils ,products of their distillation and bituminous substances HTS 38 Miscellaneous chemical products HTS 39 plastic products HTS 90 chemical instruments and equipment.
Round 3	HTS 03,16 fish and crustaceans and other aquatic products and preparations of them HTS 07,08 editable fruits and vegetables including roots and tubers. HTS 20 preparations of vegetables, fruit, nuts. HTS 24,25,26 tobacco products and mineral materials, plastering materials ,lime and cements. Ores and ash. HTS 27,28,29 mineral fuels and oils ,products of their distillation and bituminous substances, Chemical products and organic and inorganic compounds of metal, organic chemicals. HTS 32,34,37 tanning and dyeing extracts ,essential oils and cosmetic	25% tariffs on : HTS 20 preparation of nuts, vegetables and other nuts. HTS25,28,29,32,33,37,38,39 products and Miscellaneous chemical products and plastics articles in allied industries, photographic or cinematographic goods , HTS 40 ,41,42 rubber articles. leather and leather articles , cork products. HTS 52,54,55,56,58 textile fabric products and cotton HTS 60,62,63,64 apparel articles and clothing accessories, footwears. HTS 68,69,70 Articles of stone, plaster, cement, mineral materials, and ceramic products ,and glass products HTS 72-83 Basic metals(iron and steel, nickel and aluminum)and their articles

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Round 3	preparations, and photographic or cinematographic goods HTS 38,39,40 Miscellaneous chemical products and plastics articles, rubber articles. HTS 41,42,44 leather and leather articles, woods and article of woods ,cork and article of corks HTS 48 paper ,paper pulp and articles HTS 51 wool ,fine or coarse animal hair , some wool products and fabric HTS 52,54 ,55,57,58 ,60cotton and cotton products, and filaments, staple fibers and textile fabrics ,knitted textile articles HTS 68,69 Articles of stone, plaster, cement, mineral materials, and ceramic products HTS 70,71 glass and glassware and precious metal , stones and articles. HTS 72-83 Basic metals(iron and steel, nickel and aluminum)and their articles HTS 84 Machinery and Mechanical appliances and parts. HTS 85 electrical equipment ,sound recorders and reproducers and accessories. HTS 87 vehicles accessories. HTS 90,91 optical ,photographic and measuring equipment and medical ,surgical instruments and clock parts HTS 94 Miscellaneous Manufactured Articles	HTS 84 Machinery and Mechanical appliances and parts. HTS 90,91 optical ,photographic and measuring equipment and medical ,surgical instruments and clock parts HTS 94 Miscellaneous Manufactured Articles 20% tariffs on: HTS 29 organic chemical products HTS 48 paper ,paper pulp and articles HTS 84 Machinery and Mechanical appliances and parts. HTS 85 electrical equipment ,sound recorders and reproducers and accessories. 10% tariffs on: HTS 29 organic chemical products HTS 84 Machinery and Mechanical appliances and parts. HTS 90 optical ,photographic and measuring equipment and medical ,surgical instruments and clock parts 5% tariffs on: HTS 28,29 Chemical products and organic and inorganic compounds of metal, organic chemicals. HTS 84 Machinery and Mechanical appliances and parts. HTS 85 electrical equipment ,sound recorders and reproducers and accessories. HTS 87 vehicles accessories. HTS 90 optical ,photographic and measuring equipment and medical ,surgical instruments and clock parts.

(Source : Author made based on   (transcustom.com, 2019) (USITC, 2020))