Saint Petersburg State University

Department of World Economy

US-China trade war from the perspective of GVCs

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I hereby certify
that this is entirely my own work unless otherwise stated

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Content

Introduction

As the largest developing and developed countries in the world, China and the United States are the most important bilateral trading partners in the world today, and are also important forces to promote the growth of international trade in the division of GVCs. In 2017, bilateral trade between China and the United States was $655.563 billion, nine times as much as in the early part of the century. Of these, the US exports $129.798 billion to China, accounting for 8.4% of the total US exports, and China is the third largest export destination country in the United States after Canada and Mexico, and the US imports $525.765 billion from China, accounting for 21.86% of the total US imports[1].

But with the deepening development of US-China economic and trade relations, the trade balance between the two countries is gradually expanding. In 2017, the trade imbalance reached $300.53 billion, an increase of 11.27% over the same period last year. The trade imbalance between China and the United States is increasingly prominent, and the huge trade imbalance is considered to be the core problem that causes bilateral trade war between China and the United States. For the huge current account imbalance between China and the United States, Krugman(2010) think this is mainly due to China's long-term use of unfair competitive means such as manipulating the exchange rate of Yuan, so the United States should impose punitive tariffs on goods imported from China, which provides a theoretical basis for the United States to launch a trade war. The intensification of US-China trade has made US-China economic and trade relations and even the world economic pattern face great uncertainty.

Nevertheless, in the context of international production networks (Ernst,1998), particularly the deepening development of global value chains (GVCs), the production links of the products are divided into multiple production stages

[1] US-China Trade Summary 2017 Data .
URL-https://wits.worldbank.org/CountryProfile/en/Country/USA/Year/2017/Summary/

distributed in different countries, and the production activities of each country are closely linked together to form an inseparable world market. Against this background, there are serious shortcomings in the official accounting method based on gross value statistics, which is difficult to reflect the GVCs under the true situation of international trade, especially for large processing trade countries such as China. A large number of labor-intensive industries at the low end of the GVCs have been undertaken in the form of processing trade. Gross export trade is more likely to be overvalued, mismatched between trade gains and trade balances, creating "statistical illusions" (Srholec,2007). Therefore, the WTO former Director-General Lamy advocated the establishment of a new trade interest accounting system based on trade in value added in 2011, and OECD and WTO also launched a joint research project on "trade in value added measurement" in 2012. Since then, the method of accounting bilateral trade benefits based on trade in value-added has been widely used, and the related research of GVCs has become the mainstream of international trade.

Current state of knowledge in research area

There is an extensive body of literature with respect to US-China trade war, in which authors provide the general overview of its development and analysis of its causes and impacts. There are many papers of researchers devoted to this theme: Yu Zhen, Chen Zhiyong, Zhang Erzheng, Chen Hong, Ma Xuejun, Xiao Zhimin, Zheng Jian, Zhou Run, Zhou Shudong, Zhou Zhengming.

Studies that specifically focus on the US-China trade war from the perspective of GVCs are relatively limited, such as Li Feng, Lan Qingxin, Dou Kai, Wang Wuqing, Zhang Zhiming, Lou Feng.

Research goal: to evaluate the causes, impacts and development trend of the US-China trade war from the perspective of global value chains.

Research objectives:

1) to characterize the GVCs theory development and measurement and

determine the theory and measurement used in this paper

2) to build model, derive formulas, illustrate indicators and collect data
3) to explain the process of US-China trade war and evaluate its direct and root causes from the perspective of GVCs
4) to evaluate the impacts of US-China trade war on the trade of both countries and the rest of the world based on the tariff lists imposed by U.S. and China
5) to forecast the development trend of US-China trade war

Object of study: US-China trade war

Subject of study: US-China trade war from the perspective of GVCs based on trade in value added

Hypotheses:

1) There are only three countries in the world: S, R, and T. For example, S, R, T can be understood as China, the United States and the other third countries in the world.
2) the fundamental contradiction of US-China trade war can be solved, the trade of both countries and even global trade will get better development.

Methodology:

Quantitative research: This paper decomposes the trade in value added between China and the United States based on WWZ, subdivides it into several sub-items and different levels, collates and illustrates the tariff lists imposed by China and the United States to provide the basis for the causes, impacts and development trend of the US-China trade war.

Scientific novelty of the research:

According to WWZ framework, this paper is using multi-regional input-output (MRIO) model to design a three-country model (assuming China, the United States,

and third countries) to measure the trade effect of US-China trade war. Based on the decomposition of trade in value added by WWZ, the trade in value added of the United States and China in GVCs are calculated, which is the basis for analyzing the causes, impacts and development trend of the US-China trade war. From the perspective of GVCs based on trade in value added, this paper comprehensively analyses the US-China trade war. Most of the previous studies on the impact of US-China trade war on the trade have been carried out by using the total value exports under the traditional customs statistics method. However, under the GVCs, if the measurement of a country's exports by the total value exports under the traditional customs statistics method, it will significantly overestimate the real export benefits of the processing trading countries.

Research structure:

This paper is organized into three chapters. Following the Introduction, Chapter 1 presents the theoretical background for this research, which include the theory of GVCs, the international division of labor and the measurement of GVCs. Chapter 2 designs three-country model according to WWZ, derives some formulas, illustrates indicators and collects statistics. Chapter 3 is devoted to the empirical analysis for the US-China trade war from the perspective of GVCs based on trade in value added: the explanation of the process of US-China trade war, the analysis of the direct and root causes of US-China trade war, the impacts of US-China trade war on the trade of both countries and the rest of the world based on the tariff lists imposed by U.S. and China, and the development trend of US-China trade war in the future. Finally, Conclusion contains brief conclusions based on the chapters and provides recommendations for Chinese government.

1. Theoretical background of GVCs

1.1 The development of the GVCs theory

1) Value chain

Professor Michael E. Porter of Harvard Business School first introduced the concept of a value chain in his book “Competitive Advantage: Creating and Sustaining Superior Performance"(1985). According to his view, a value chain refers to a chain of events which occur in a company right from the procurement of raw materials to the delivery of goods as well as the post sales service also or a set of activities that an organization carries out to create value for its customers. The value chain originally referred to by Porter was mainly aimed at the vertically integrated company, emphasizing that the enterprise should examine the operation effect of the enterprise from the point of view of total cost, rather than one-sided pursuit of the optimization of individual business activities, and strengthen the competitive advantage of the whole enterprise by coordinating the various links of the value chain. Later, as the international outsourcing business began, Porter further proposed the Value System concept, which extended the research perspective to different companies, and it has something in common with the later GVC concept.

2) Value-added chain

Bruce Kogut used the value-added chain to analyze international strategic advantages in “Designing global strategies: comparative and competitive value-added chains” (1985). When the national comparative advantage determines how each link of the whole value chain is allocated in space between countries or regions, the competitive ability of the enterprise determines which link and technical level of the enterprise should work hard to ensure the competitive advantage in the value chain. He also describes the value-added chain as a value-added process, by which a firm combines technology with the raw materials and labor it invests in producing, marketing, and selling. In this process, a individual firm may be involved in only one

link, or the firm may incorporate the entire value-added process into the enterprise hierarchy system, where the various activities and technologies of the firm are linked to other firms. Compared with Porter's value chain view which emphasizes the competitive advantage of individual enterprises, this view reflects the relationship between the vertical separation of value chain and the global spatial reconfiguration more than Porter, so it is crucial to the formation of global value chains view.

3) Global Commodity Chain (GCC)

In the year of 1994, Gary Gereffi put forward the global commodity chain analysis method based on the value chain research of the retail industry in the United States, combining the value chain analysis method with the industrial organization research. In the context of economic globalization, the production process of commodities is decomposed into different stages, forming a transnational production system around the production of a certain commodity, organizing enterprises and institutions of different sizes around the world in an integrated production network, thus forming a global commodity chain. The implication is that different global enterprises cooperate in a value chain composed of actions such as product design, production and marketing. Gereffi believed that GCC is the driving force to exert the superiority of the global capitalist industrial network and a new tool to study the global industrial network. Gereffi also distinguished between two categories of global commodity chains: buyer-driven and producer-driven. He stressed that there are four parts of the global commodity chain that must be taken into account: (1) the structure of input-output; (2) the regional character; (3) the governance structure; and (4) the institutional framework. At this point, the context of value chain analysis is becoming clearer.

4) Global Value Chains (GVC)

Throughout the 1990s, Gereffi and other researchers did not get rid of the limitation of the concept of commodity and did not highlight the importance of enterprises operating on the value chain in value creation and value acquisition. Until

2001, Gereffi and researchers in this field presented “The Value of Value Chains” in the journal “IDS Bulletin”, which analyzed the process of globalization from the perspective of value chains, arguing that trade in goods and services should be seen as a governance system and that understanding the operation of value chains is of great importance to enterprises and policymakers in developing countries, because the formation process of value chains is also a process in which enterprises are constantly involved in value chains and gain the necessary technical capacity and service support. This article has played a landmark role in global value chains research.

The United Nations Industrial Development Organization(UNIDO), in its “Industrial Development Report 2002/03: Competing Through Innovation and Learning" stated that a global value chains refers to a global cross-enterprise network organization that links processes such as production, marketing, and recycling processes to achieve the value of goods or services on a global scale, involving the collection and transportation of raw materials, the production and distribution of semi-finished products and finished products until the process of final consumption and recycling. It includes all participants and the organization of activities such as production and sales and their distribution of profits, and supports institutional capacity and efficiency through automated business processes and links to suppliers, partners and customers. The definition emphasizes that the global value chains are not only composed of a large number of complementary enterprises, but also an organizational set of enterprise networks linked by various economic activities, focusing not only on enterprises but also on contractual relationships and changing ways of association.

The Institute for Development Research at the University of Sussex in the United Kingdom currently has conducted a broader study of global value chains issues, and it defines global value chains as the range of activities that create value throughout the entire life cycle of products, from conceptual design to use to scrap, including the design, production, marketing, distribution and support and services to end users. The various activities that make up the value chain can be included in an enterprise or

dispersed among the various enterprises; they can be clustered within a particular geographical area or spread around the world. So far, the whole global value chains theory has a landmark definition and formed a certain system.

1.2 International division of labor in the GVCs

The international division of labor originated from the industrial revolution and has experienced three forms since its development: inter-industry model, intra-industry model and intra-product model.

1) Inter-industry model

The division of labor in the inter-industry is the distribution of products belonging to different industrial categories in process. Theory of Absolute Advantage, Theory of Comparative Advantage and Heckscher-Ohlin Theory together constitute the theoretical basis of inter-industry. The theory of absolute advantage and the concept of international division of labor were put forward by Adam Smith (1776) at the same time. According to “The Wealth of Nations”, the division of vocational skills is also applicable to international trade, and countries should specialize in producing their products with absolute cost advantages and use them for international exchange, so as to obtain trade benefits. The limitation of the theory is that assuming that only two countries produce only two goods, labor is the only one factor and the marginal income of labor will not change. The theory of comparative advantage overcomes these limitations.

David Ricardo (1817), the founder of the theory of comparative advantage, pointed out in his book “On the Principles of Political Economy and Taxation” that a country can still conduct international trade even when there is no absolute advantage in the production of all goods. As long as it has a relative cost advantage in terms of labor factor, the country can specialize in the production and export of goods with less relative disadvantage while importing goods with greater relative disadvantage. However, the theory of comparative advantage assumes that there is only labor factor

and does not realize that the comparative advantage is variable and it is a static equilibrium theory.

The factor-proportions theory, also named Heckscher-Ohlin theory, is a supplement and development to the above theory, which was proposed by Heckscher and Ohlin (1933). The theory holds that countries tend to export goods whose production is intensive in factors with which the countries are abundantly endowed. H-O theory breaks the limitation of the theory of comparative advantage and no longer only considers labor as a single factor, but includes various factors of production such as capital.

2) Intra-industry model

Division of labor in the intra-industry is the distribution of products within the same industry in the production process. A complete chain of industries often contains R & D, production and marketing three links, and production also includes parts production, processing and assembly, according to this different production processes for the differential division of labor, that is, the division of labor in the intra-industry. The division of labor in the intra-industry was formed at the end of 19th century and the beginning of 20th century. According to the different participants, the division of labor in the intra-industry can be divided into two basic forms: horizontal and vertical. Horizontal Specialization arises from the economies with relatively similar economic development strengths, which produce the same or similar processes, but produce the same products that differ in appearance, performance, brand or price. Vertical Specialization arises from economies with greater economic development power and it is an international division of labor within the same industry due to technological gaps. Typically, developed countries export products with higher technology intensity, while developing countries export products with lower technology intensity. Alternatively, in the production process of the same product, developed countries are responsible for the higher technical process, while developing countries are responsible for lower technical process. At the background of the division of labor in

the intra-industry, “Theory in Industry Trade” has been put forward by the scholars of new trade theory and become a new theoretical model to analyze international trade. According to its representative, Paul Krugman (1979), intra-industry trade benefits all participants, economies of scale and dumping benefit producers from a division of labor, market share from incomplete competition benefits exporters from trade and product differentiation benefits importers from utility.

3) Intra-product model

The division of labor in the intra-product is the distribution of the same product in different production stages and production processes. With the development of technology, the production process of products is more refined, advanced and intelligent, and countries can rely on their own comparative advantages to participate in the production process of the same product and obtain the benefits of division of labor accordingly. This comparative advantage can be factor advantage or location advantage, the production process of products can be raw material processing, parts production and final product processing or assembly and so on. It can be seen that the division of labor in the intra-product reflects the main idea of comparative advantage and economies of scale. Deardorff (2001) believe that the intra-product model can make full use of the comparative advantages of countries, while improving the trade structure can improve the overall welfare level of the country. Helpman (2006) study found that differences in labor productivity and institutional quality can also become a country's comparative advantage.

Today, in the global value chains the fragmentation of production intensifies. With the progress of science and technology and the further development of globalization, multinational corporations have gradually become the leading force of international industrial division of labor, and their products are divided into different tasks in the process of production and management through investment and business outsourcing, and arranged in different economies according to the principles of factor endowment difference, specialization and transaction efficiency. On the basis of the

rapid development of global technological progress and transnational movement of elements, the global value chains has developed, and the degree of fragmentation of each link of the global value chains has further increased, the proportion of trade in intermediate products has gradually increased, and more and more countries and enterprises have integrated into the global value chains. The fragmentation and decentralization of the global value chains not only lead to the innovation of production mode and business mode such as modular production, service outsourcing, vertical specialized production, but also promote the formation and development of a new national division of labor system. Based on the international division of labor in the global value chains, the original model of inter-industry division of labor has developed into an intra-product division of labor. And the trade in intermediate products gradually increased, various countries and enterprises in the global value chains has completed a product R & D, production and sales in the form of cooperation.

The global value chains and the international division of labor promote and influence each other. It can be said that globalization and the deep development of the scientific and technological revolution lead to the traditional model of one-country production and the global sales is replaced by the model of international production and the global sales, the fragmentation of production process has become the remarkable characteristics of the new international production system. Global value chains and international division of labor are two sides of this new production system, from the point of view of value creation and realization of products, it is global value chains; and from the point of view of production organization, it is international division of labor.

1.3 The measurement of GVCs-Trade in value added

With the rapid growth of international trade in intermediate goods and the deepening of vertical specialization, the global economy enters into the era of global value chains (GVCs), which is characterized by international fragmentation of

production and trade in intermediate inputs. In recent years, studies on global value chains at industry and country levels have been developing extremely fast. Specifically, the measurement of global value chains (also known as trade in value added) emerges as a hot research topic. Driven by investigation on this topic, researches on global value chains evolve from micro-level and case-based management studies to macro-level, economic and statistical studies.

Hummels et al. (2001) (HIY) first proposed the concept of vertical specialization and realized the degree of a country's participation in the GVCs from both import and export aspects based on the input-output method, thus establishing the initial measurement of trade in value added. However, there are many problems in HIY methods: firstly, there are two ways to the import intermediate goods, one is to be processed as final goods by importing countries, other is to be processed as intermediate goods by importing countries then re-export to third countries. HIY method only assumes the first direction of import intermediate goods and obviously ignores the second direction, while the second direction is more common in the context of international division of labor. Secondly, imported intermediate goods may contain both foreign and domestic components, i.e. a country's goods may be exported to another country as intermediate goods and then return to the origianl country as final goods and HIY method igonre the value added in the return goods.

Koopman et al. (2008,2010,2012,2014) (KWW) has modified the input-output table, overcoming the above defects of HIY. Taking into account that processing trade is an important way for countries to trade, Koopman et al. (2008) has constructed the method of domestic value added (DVA), which separates the foreign and domestic components of imported intermediate goods and is suitable for all countries processing trade as the main factor. Koopman et al. (2010) synthesizing the experience of previous scholars, a more perfect measurement method is proposed on the basis of HIY vertical specialization and DVA. The value added of a country's exports can be divided into three main parts according to its source and destination: domestic value added (VT), domestic value added that return home (VSI) and foreign

value added (VS) contained in total exports. Domestic value added can also be further divided into direct domestic value added (domestic value added reflected in final or intermediate goods and services absorbed by direct importers) and indirect domestic value added (domestic value added reflected in intermediate goods, which export to direct importers to re-export to third countries, IV). Based on this, Koopman et al.(2012, 2014) further fully decompose the trade in value added. KWW further decompose the VSI into domestic value added contained in final goods first exported then returned home country, domestic value added contained in intermediate goods first exported then returned home country and the pure double counting from domestic sources; decompose the VS into foreign added value included in exported final goods, foreign added value included in exported intermediate goods and pure double counting from foreign sources. However KWW measurement framework is only applicable to the decomposition of the overall level of the country, but it is not competent for the decomposition work at the bilateral industry level.

To overcome the shortcomings of the KWW, Wang et al 2014 (WWZ) constructed a total exports decomposition framework based on the bilateral industry level and decomposed the total exports at the bilateral industry level. For this, total exports are divided into domestic value added contained in final goods and services exports, domestic value added reflected in intermediate exports absorbed by direct importer, domestic value added contained in intermediate sent to first importer and then re-export to third country, domestic value added first exported then returned home, foreign value added and pure double counted, totally six items, which make it applicable to the sartorial level, bilateral level and sect oral-bilateral levels, and solve the limitation of KWW.

The development of the research for the measurement of GVCs benefits from the production and public release of Inter-country input-output (ICIO) tables in recent years. As early as the 1970s, the issue of intermediate trade has been taken seriously, only because of the difficulty in obtaining real data on intermediate and final goods that can meet the research requirements, the related research has not been

significantly advanced (Baldwin et al, 2013). Economists try to solve and deal with key data problems in many ways. Before 2011, some economists distinguished between intermediate and final trade based on HS codes and descriptions of their product characteristics and uses, but it was difficult to fully identify all intermediate trade. Hummels et al (2001) take use of input-output tables to track the use of imported goods, and VS (vertical specification) indicators are proposed. Recent studies, such as the processing of GTAP databases into world ICIO databases (Inter-Country Input-Output table) on the basis of certain assumptions and supporting data, have enabled them to undertake more in-depth and comprehensive research on a Hummels et al (2001) basis. The WIOD database (World Input-Output Database, Timmer et al (2012)), published in 2013, provides trade data on intermediate and final goods of 27 EU countries and 13 major economies in 35 industries from 1995 and 2011, and the establishment of this database strongly contributes to the research on GVCs in the field of international trade (in addition WIOD also provides social, energy and environmental statistics, which promotes research on implied energy and implied carbon in international trade), resulting in many research results (Los et al.(2012), Stehrer (2012), Stehrer et al. (2012), Timmer and Erumban (2012), Timmer and Los (2012), Baldwin (2013), etc.). WIOTs in 2016, in the latest released version of the WIOD database (WIOD2016)[2], is a global ICIO table covering 43 countries or regions and 56 sectors for the period from 2000 to 2014. The representative World ICIO database also contains OECDICIO、EORA and Asian Development Bank ICIO tables. These databases have different characteristics in the number of countries or regions, the number of industrial sectors, the time span.

[2] World Input-Output Tables, 2016 Release. URL-http://www.wiod.org/database/wiots16

2. Model and data description

This paper uses the trade decomposition framework WWZ to decompose the bilateral trade based on WIOD_2016, and then combines the GVC-participation and GVC-position indexes proposed by Koopman et al. to construct domestic value added (DVA) and foreign value added (FVA) indexes.

2.1 GVC decomposition based on WWZ framework

As shown in Table 2-1, the correlation between the various links in the real economic system can be characterized by the Multi-Country Input-Output (MCIO) table.

Table 2-1 Multi-Country Input-Output (MCIO) table

Output/Input		**Intermediate output**					**Final output**					**Total Outputs**
		S	R	T	…	M	S	R	T	…	M	
Intermediate Input	S	Z ss	Z sr	Z st	…	Z sm	Y ss	Y sr	Y st	…	Y sm	X s
	R	Z rs	Z rr	Z rt	…	Z rm	Y rs	Y rr	Y rt	…	Y rm	X r
	T	Z ts	Z tr	Z tt	…	Z tm	Y ts	Y tr	Y tt	…	Y tm	X t
	…	…	…	…	…	…	…	…	…	…	…	…
	M	Z ms	Z mr	Z mt	…	Z mm	Y ms	Y mr	Y mt	…	Y mm	X m
Value added		VAs	VAr	VAt	…	VAm						
Total Inputs		(X s)'	(X r)'	(X t)'	…	(Xm)'						

In order to understand the basic decomposition ideas of intermediate trade, we will simplify the international input-output table. Suppose that there are only three countries in the world: S, R, and T, now we construct a new input-output model, as

shown in Table 2-2. For example, S、R、T can be understood as China, the United States and the third country.

Table 2-2 Input-output table of three countries for N sectors

Output/Input		Intermediate output			Final output			Total Outputs
		S	R	T	S	R	T	
Intermediate Input	S	*Z ss*	*Z sr*	*Z st*	*Y ss*	*Y sr*	*Y st*	*X s*
	R	*Z rs*	*Z rr*	*Z rt*	*Y rs*	*Y rr*	*Y rt*	*X r*
	T	*Z ts*	*Z tr*	*Z tt*	*Y ts*	*Y tr*	*Y tt*	*X t*
Value added		*VAs*	*VAr*	*VAt*				
Total Inputs		$(X\,s\,)'$	$(X\,r\,)'$	$(X\,t\,)'$				

In the I-O table of three countries N sectors, the horizontal lines are output indicators. X is the total output produced by each sector over a period of time; the intermediate output Z reflects the amount consumed in the redistribution of goods or services provided by each sector to each sector; and the final output Y refers to the goods and services used to meet the final demand. Thus the input-output table has the equation of horizontal equilibrium.

$$\begin{Bmatrix} Z^{ss}+Z^{sr}+Z^{st} \\ Z^{rs}+Z^{rr}+Z^{rt} \\ Z^{ts}+Z^{tr}+Z^{tt} \end{Bmatrix} + \begin{Bmatrix} Y^{ss}+Y^{sr}+Y^{st} \\ Y^{rs}+Y^{rr}+Y^{rt} \\ Y^{ts}+Y^{tr}+Y^{tt} \end{Bmatrix} = \begin{Bmatrix} X^{s} \\ X^{r} \\ X^{t} \end{Bmatrix} \quad (2.1)$$

The author defines the input coefficient as $A \equiv Z\ (X)^{-1}$, and multiply it by X on both sides we can get Z =AX, the equation of horizontal equilibrium can be changed to:

$$\begin{Bmatrix} A^{ss} & A^{sr} & A^{st} \\ A^{rs} & A^{rr} & A^{rt} \\ A^{ts} & A^{tr} & A^{tt} \end{Bmatrix} \begin{Bmatrix} X^{s} \\ X^{r} \\ X^{t} \end{Bmatrix} + \begin{Bmatrix} Y^{ss}+Y^{sr}+Y^{st} \\ Y^{rs}+Y^{rr}+Y^{rt} \\ Y^{ts}+Y^{tr}+Y^{tt} \end{Bmatrix} = \begin{Bmatrix} X^{s} \\ X^{r} \\ X^{t} \end{Bmatrix} \quad (2.2)$$

So we can simplify equation 2.1 to $AX + Y = X$ and calculate this output matrix:

$X = (1 - A)^{-1} Y$

Equation 3.2 can be transformed by the Leontief inverse matrix into:

$$\begin{Bmatrix} X^{s} \\ X^{r} \\ X^{t} \end{Bmatrix} = \begin{Bmatrix} B^{ss} & B^{sr} & B^{st} \\ B^{rs} & B^{rr} & B^{rt} \\ B^{ts} & B^{tr} & B^{tt} \end{Bmatrix} \begin{Bmatrix} Y^{ss}+Y^{sr}+Y^{st} \\ Y^{rs}+Y^{rr}+Y^{rt} \\ Y^{ts}+Y^{tr}+Y^{tt} \end{Bmatrix} \quad (2.3)$$

Calculated on the right side of equation 2.3, X^{r} can be divided into different final outputs:

$$X^{r} = B^{rs}Y^{ss} + B^{rs}Y^{sr} + B^{rs}Y^{st} + B^{rr}Y^{rs} + B^{rr}Y^{rr} + B^{rr}Y^{rt} + B^{rt}Y^{ts} + B^{rt}Y^{tr} + B^{rt}Y^{tt}$$

(2.4)

Thus, country (S)'s exports of intermediate goods to country (R) can bedivided into the following nine parts: $Z^{sr} = A^{sr}X^{r}$

$$= A^{sr}B^{rs}Y^{ss} + A^{sr}B^{rs}Y^{sr} + A^{sr}B^{rs}Y^{st} + A^{sr}B^{rr}Y^{rs} + A^{sr}B^{rr}Y^{rr} + A^{sr}B^{rr}Y^{rt} + A^{sr}B^{rt}Y^{ts} + A^{sr}B^{rt}Y^{tr} + A^{sr}B^{rt}Y^{tt}$$

(2.5)

In the I-O table of three countries N sectors, the vertical columns are input indicators. Total input $(X)'$ refers to the total input of each department engaged in production activities over a period of time, including intermediate input and value added. Intermediate input is a one-time transfer of goods and services in the production process, that is, intermediate consumption; value added (VA) that is, initial input, refers to the new value and transfer value created by various departments through production activities.

The author can define the direct value added coefficient is $V^{s} = VA^{s}(X)^{-1}$ and

then the total value added coefficient is $W_{ij} = \sum_{k=1}^{n} v_{ik} b_{kj}$, of which V_{ik} represents the value added of the sector (I) driven by the sector (K), b_{kj} represents the coefficient of consumption sector (K) in the sector(J). so, we can get the total value added coefficient matrix = the direct value added coefficient matrix * Leontief inverse matrix.

$$VB = \left\{V^s V^r V^t\right\} \begin{Bmatrix} B^{ss} & B^{sr} & B^{st} \\ B^{rs} & B^{rr} & B^{rt} \\ B^{ts} & B^{tr} & B^{tt} \end{Bmatrix}$$

$$= (V^s B^{ss} + V^r B^{rs} + V^t B^{ts}, V^s B^{sr} + V^r B^{rr} + V^t B^{tr}, V^s B^{st} + V^r B^{rt} + V^t B^{tt})$$

(2.6)

Because the unit final output can be completely decomposed into the value added of all countries and all sectors, and at the same time, the 2 and 3 quadrants of the I-O table need to be balanced, the corresponding value added of the unit final use is also 1, so the total value added coefficient of any one sector (or country) is 1. As a result, for country S, there are:

$$V^s B^{ss} + V^r B^{rs} + V^t B^{ts} = u \quad u = (1,1,.....,1) \qquad (2.7)$$

$V^s B^{ss}$ means fully consumption of country S's own inputs as a proportion of total output.

Taking into account that country (S)'s export E^s , and it consists of two parts:country(S)'s export to country (R) and country(S)'s export to country (T), that is $E^s = E^{sr} + E^{st}$, the E^{sr} can be divided intocountry (S)'s final exports to the country(R) and the country (S)'s intermediate exports to country (R), that is, $E^{sr} = Y^{sr} + Z^{sr} = Y^{sr} + A^{sr} X^r$.

So, the total output of country(S)is

$$E^s = E^{sr} + E^{st} = A^{sr} X^r + A^{st} X^t + Y^{sr} + Y^{st}$$

And we will get : $E^r = E^{rs} + E^{rt} = A^{rt} X^t + A^{rs} X^s + Y^{rt} + Y^{rs}$

$$E^t = E^{ts} + E^{tr} = A^{ts} X^s + A^{tr} X^r + Y^{ts} + Y^{tr}$$

$$Y^{sr} + Y^{st} = E^s - A^{sr} X^r - A^{st} X^t$$
$$Y^{rt} + Y^{rs} = E^r - A^{rt} X^t - A^{rs} X^s$$
$$Y^{ts} + Y^{tr} = E^t - A^{ts} X^s - A^{tr} X^r$$

Re-arranging equation (2.2):

$$\begin{Bmatrix} A^{ss} X^s + A^{sr} X^r + A^{st} X^t \\ A^{rs} X^s + A^{rr} X^r + A^{rt} X^t \\ A^{ts} X^s + A^{tr} X^r + A^{tt} X^t \end{Bmatrix} + \begin{Bmatrix} E^s - A^{sr} X^r - A^{st} X^t + Y^{ss} \\ E^r - A^{rt} X^t - A^{rs} X^s + Y^{rr} \\ E^t - A^{ts} X^s - A^{tr} X^r + Y^{tt} \end{Bmatrix} = \begin{Bmatrix} X^s \\ X^r \\ X^t \end{Bmatrix}$$ So we can

get

$$\begin{Bmatrix} A^{ss} X^s \\ A^{rr} X^r \\ A^{tt} X^t \end{Bmatrix} + \begin{Bmatrix} E^s + Y^{ss} \\ E^r + Y^{rr} \\ E^t + Y^{tt} \end{Bmatrix} = \begin{Bmatrix} X^s \\ X^r \\ X^t \end{Bmatrix} \quad (2.8)$$

And then $A^{ss} X^s + E^s + Y^{ss} = X^s$

So, $X^s = (1 - A^{ss})^{-1} (E^s + Y^{ss})$

Where $L^{ss} = (1 - A^{ss})^{-1}$, L^{ss} is the local Leontief inverse.

$$L^{ss} = \begin{Bmatrix} 1 - A^{ss} & 0 & 0 \\ 0 & 1 - A^{rr} & 0 \\ 0 & 0 & 1 - A^{tt} \end{Bmatrix}^{-1}$$ So,

$$\begin{Bmatrix} X^s \\ X^r \\ X^t \end{Bmatrix} = \left\{ L^{ss} + L^{rr} + L^{tt} \right\} \begin{Bmatrix} E^s + Y^{ss} \\ E^r + Y^{rr} \\ E^t + Y^{tt} \end{Bmatrix} = \begin{Bmatrix} L^{ss} E^s + L^{ss} Y^{ss} \\ L^{rr} E^r + L^{rr} Y^{rr} \\ L^{tt} E^t + L^{tt} Y^{tt} \end{Bmatrix} \quad (2.9)$$

And we can get the single country model: $X^s = L^{ss} (E^s + Y^{ss})$

As aggregate demand equals aggregate supply, it is known that country (S)'s total output is devoted entirely to domestic consumption and exports.

Country (S)'s intermediate goods export to country (R)'s can be expressed as:

$$Z^{sr} = A^{sr} X^{r} = A^{sr} L^{rr} (E^{r} + Y^{rr}) = A^{sr} L^{rr} Y^{rr} + A^{sr} L^{rr} E^{r} \quad (2.10)$$

$A^{sr} L^{rr} Y^{rr}$ means that intermediate exports from country (S) used by direct importer (R) to produce local final goods consumed in (R). $A^{sr} L^{rr} E^{r}$ indicates that intermediate exports from country (S) used by the direct importer (R) to produce exports ultimately consumed by third country (T).

So, Country(S)'s gross exports E^{sr} to Country (R) as follows:

$$E^{sr} = \underbrace{(V^{s} B^{ss})' \# Y^{sr}}_{DVA\_FIN} + \underbrace{(V^{s} L^{ss})' \# (A^{sr} B^{rr} Y^{rr})}_{DVA\_INT}$$

$$+ \underbrace{(V^{S} L^{SS})' \# (A^{sr} B^{rt} Y^{tt}) + (V^{s} L^{ss})' \# (A^{sr} B^{rr} Y^{rt}) + (V^{s} L^{ss})' \# (A^{sr} B^{rt} Y^{tr})}_{DVA-INTrex}$$

$$+ \underbrace{(V^{s} L^{ss})' \# (A^{sr} B^{rr} Y^{rs}) + (V^{s} L^{ss})' \# (A^{sr} B^{rt} Y^{ts}) + (V^{s} L^{ss})' \# (A^{sr} B^{rs} Y^{ss})}_{RDV}$$

$$+ \underbrace{(V^{r} B^{rs})' \# Y^{sr} + (V^{r} B^{rs})' \# (A^{sr} L^{rr} Y^{rr})}_{MVA}$$

$$+ \underbrace{(V^{t} B^{ts})' \# Y^{sr} + (V^{t} B^{ts})' \# (A^{sr} L^{rr} Y^{rr})}_{OVA}$$

$$+ \underbrace{(V^{s} L^{ss})' \# [A^{sr} B^{rs} (Y^{sr} + Y^{st})] + (V^{s} B^{ss} - V^{s} L^{ss})' \# (A^{sr} X^{r})}_{DDC}$$

$$+ \underbrace{(V^{r} B^{rs})' \# (A^{sr} L^{rr} E^{r}) + (V^{t} B^{ts})' \# (A^{sr} L^{rr} E^{r})}_{FDC} \quad (2.11)$$

Equation (2.11) indicates that the gross exports from Country S to Country R at sector levels can be completely decomposed into the sum of 16 detailed terms in 8 major categories. To better understand each category in this accounting equation, we provide the following economic interpretations:

The 1st category, $(V^{s} B^{ss})' \# Y^{sr}$, is domestic value added (DVA for short) embodied in final goods exports. We label it as DVA_FIN for short.

The 2nd category, $(V^{s}L^{ss})'\#(A^{sr}B^{rr}Y^{rr})$, is DVA in intermediate exports used by direct importer (R) to produce local final goods consumed in (R). We label it as DVA_INT for short.

The 3rd category is DVA in intermediate exports used by the direct importer (R) to produce exports ultimately consumed by third country (T). We name them as DVA_INTrex for short. It includes three detailed terms: $(V^{s}L^{ss})'\#(A^{sr}B^{rt}Y^{tt})$ is DVA in intermediate exports that areused by Country (R) to produce intermediates that it re-exports to third Country (T) for production of local final goods; $(V^{s}L^{ss})'\#(A^{sr}B^{rr}Y^{rt})$ is DVA in intermediate exports used by Country (R) to produce final goods that it re-exports to third Country (T); $(V^{s}L^{ss})'\#(A^{sr}B^{rt}Y^{tr})$ is DVA in intermediate exports used by Country (R) to produce intermediates that it re-exports to third Country (T) for production of final goods exports that are shipped to Country (R).

The 4th category is DVA in intermediate exports that are returned to Country （S） and consumed at home. We name them as RDV for short. It also includes three detailed terms: $(V^{s}L^{ss})'\#(A^{sr}B^{rr}Y^{rs})$ is DVA that returns home via its final imports from the direct importer (R); $(V^{s}L^{ss})'\#(A^{sr}B^{rt}Y^{ts})$ is DVA that returns home via final imports from third country (T) ; and $(V^{s}L^{ss})'\#(A^{sr}B^{rs}Y^{ss})$ is DVA that returns home via its intermediate imports from country (R) and used to produce domestic final products.

The 5th category includes two terms: the first term , $(V^{r}B^{rs})'\#Y^{sr}$ is foreign value added(FVA) from the importer (R) embodied in final exports; the second term, $(V^{r}B^{rs})'\#(A^{sr}L^{rr}Y^{rr})$ is FVA from the importer (R) embodied in intermediate exports, which are then used by R to produce its domestic final goods. We label them as MVA for short.

The 6th category also includes two terms: the first term, $(V^t B^{ts})' \# Y^{sr}$ is FVA from other Country (T) embodied in final exports. The second term, $(V^t B^{ts})' \#(A^{sr} L^{rr} Y^{rr})$ is FVA from third Country (T) embodied in intermediate exports, which are then used by Country (R) to produce its local final goods. We name them as OVA for short.

Summing the 5th and 6th categories yield the total foreign value added embodied in Country (S)'s sector level gross exports to Country (R). We name them as FVA for short.

The 7th category has two terms. The first term, $(V^s L^{ss})' \#[A^{sr} B^{rs} (Y^{sr} + Y^{st})]$ is DVA embodied in its intermediate exports to Country (R) but return home as its intermediate imports, and used for production of its final exports, which are parts of DVA in Country (S)'s final exports and are already counted once in the first category. For this reason, they are a portion of domestic double counted terms caused by the back and forth intermediate goods trade in order to produce exports of final products in Country (S). The second term, $(V^S B^{SS} - V^S L^{SS})' \#(A^{sr} X^r)$, is DVA in intermediate exports to Country (R) that returns home as intermediate imports and used for production of its intermediate exports. It is also a domestic double counted portion caused by the back and forth intermediate trade to produce intermediate exports in Country (S) (repeat counting of Country (S)'s intermediate goods exports).We name them as DDC for short.

The last category is double counted terms in Country(S)'s gross exports originating from foreign countries. Similar to category7, it also includes two terms: the first term, $(V^r B^{rs})' \#(A^{sr} L^{rr} E^r)$ is FVA from the importer (R) embodied in intermediate exports to produce its exports, which is a pure double counted term of (R)'s value added in (S)'s exports. The second term, $(V^t B^{ts})' \#(A^{sr} L^{rr} E^r)$ is FVA from third Country (T) embodied in intermediate exports to produce its exports to the world. We label them as FDC for short.

Summing the 7th and 8th categories are the pure double counted terms and we

name them as PDC for short.

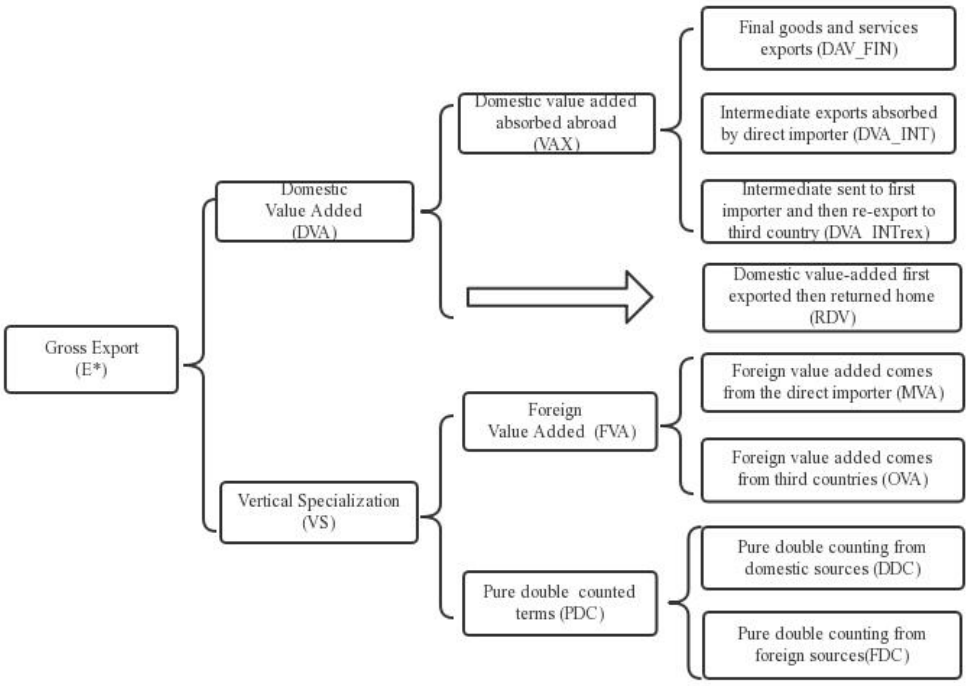

Figure 2-1 Gross trade accounting: Conceptual framework

2.2 Indicators and data description

From Equation 2.11 and figure 2-1 the conceptual framework, we will get:

1) Domestic value added (DVA) = Final goods and services exports (DVA_FIN) + Intermediate exports absorbed by direct importer (DVA_INT) + Intermediate sent to first importer and then re-export to third country (DVA_INTrex) + Domestic value added first exported then returned home (RDV). And the domestic value added (DVA) is used to measure the real trade benefits from country (S) to country (R).

2) Foreign value added (FVA) = foreign value added contained in direct importing country (MVA) + foreign value added contained in third country (OVA), and the foreign value added is used to measure the import value added in country (S)'s export to country (R), and to measure the vertical specialization labor division in the global value chains.

3) GVC-Participation (GP) index

$$GVC\_participation = \frac{IV_{is}}{E_{is}} + \frac{FV_{is}}{E_{is}} \quad (2.12)$$

In equation 2.12, IV is means DVA in intermediate exports from industry (I) of country(S) used by the direct importer to produce exports ultimately consumed by third country, actually it is DVA_INTrex; FV is means foreign value added contained in exports from industry (I) of country (S), and it is FVA; E is means the total gross exports of industry (I) in country (S), it is TE. IVis/Eis refers to forward participation, indicating the proportion of indirect value-added exports of industry (I) in country (S), the larger the value, the more the industry (I) is upstream of the global value chains; FVis/Eis refers to backward participation, the proportion of the foreign value added exports of industry (I) in country(S), the larger the value, the more industry (I) is downstream of the global value chains. To sum up, the greater is the value of the GVC -Participation index, the deeper the country's participation in GVCs; conversely, the lower the country's participation in GVCs.

4) GVC -Position index

$$GVC\_position = \ln(1 + \frac{IV_{is}}{E_{is}}) - \ln(1 + \frac{FV_{is}}{E_{is}}) \quad (2.13)$$

The meanings of IVis、FVis、Eis、IVis /Eis、FVis /Eis in the Equation 2.13 are the same with equation 2.12. The higher is GVC -Position index, the better position of the country in the global value chains. Typically, if GVC -Position >0, it indicates that industry (I) of country(S) is in a favorable position in the global value chains; if GVC -Position＜0, it indicates that the industry (I) of country(S) is in a disadvantageous position in the global value chains.

Statistics in this paper come from Research Institute for Global Value Chains, University of International Business and Economics (UIBE GVC)[3], this institute

[3] RIGVC UIBE, 2016, UIBE GVC Index.

URL- http://rigvc.uibe.edu.cn/english/D_E/database_database/index.htm.

combed the GVC accounting and its related indicators and constructed a set of UIBE GVC Index. According to representative studies in GVCs accounting, such as: KWW(2014), WWZ(2013) and WWYZ (2017a ,2017b), Professor Wang Zhi leads and constructs the secondary (derived) databases based on the original world ICIO table. Taking into account of national and industry coverage, this paper selects derived data from the UIBE GVC Index based on the world input-output database (World Input-Output Database, WIOD_2016) released in 2016. WIOD_2016 contains 43 countries and 56 industries with a time span of 2000-2014.One of the major innovations of the WIOD was the inclusion of detailed data on bilateral trade, the integration of a range of international data sources, including UN, OECD, Eurostat and WTO, as well as trade in services and intangible products, which allowed for a more in-depth analysis of the division of global value chains.

For a more detailed analysis, the 56 industrial sectors involved in the WIOD_2016 are divided into 8 categories according to input factor endowment and the nature of the product, as shown in Table 2-3.

Table 2-3 Description of 56 sectors based on WIOD_2016

Sector Code	Activity	Sector No.	2016 version WIOD sector description
AGR	Agriculture, Hunting, Forestry and Fishing	c01	Crop and animal production, hunting and related service activities
		c02	Forestry and logging
		c03	Fishing and aquaculture
MIN	Mining and Quarrying	c04	Mining and quarrying
LTI	Medium-low R&D intensive industries	c05	Manufacture of food products, beverages and tobacco products
		c06	Manufacture of textiles, wearing apparel and leather products
		c07	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials

		c08	Manufacture of paper and paper products
		c09	Printing and reproduction of recorded media
		c10	Manufacture of coke and refined petroleum products
		c22	Manufacture of furniture; other manufacturing
		c23	Repair and installation of machinery and equipment
MTI	Medium R&D intensive industries	c13	Manufacture of rubber and plastic products
		c14	Manufacture of other non-metallic mineral products
HTI	High R&D intensive industries	c11	Manufacture of chemicals and chemical products
		c12	Manufacture of basic pharmaceutical products and pharmaceutical preparations
		c15	Manufacture of basic metals
		c16	Manufacture of fabricated metal products, except machinery and equipment
		c17	Manufacture of computer, electronic and optical products
		c18	Manufacture of electrical equipment
		c19	Manufacture of machinery and equipment n.e.c.
		c20	Manufacture of motor vehicles, trailers and semi-trailers
		c21	Manufacture of other transport equipment
TTC	Trade and Transportation	c28	Wholesale and retail trade and repair of motor vehicles and motorcycles
		c29	Wholesale trade, except of motor vehicles and motorcycles

		c30	Retail trade, except of motor vehicles and motorcycles
		c31	Land transport and transport via pipelines
		c32	Water transport
		c33	Air transport
		c34	Warehousing and support activities for transportation
		c35	Postal and courier activities
		c36	Accommodation and food service activities
		c37	Publishing activities
		c38	Motion picture, video and television program production, sound recording and music publishing activities; programming and broadcasting activities
FBS	Post and Telecommunications，Financial and business services	c39	Telecommunications
		c40	Computer programming, consultancy and related activities; information service activities
		c41	Financial service activities, except insurance and pension funding
		c42	Insurance, reinsurance and pension funding, except compulsory social security
		c43	Activities auxiliary to financial services and insurance activities
		c45	Legal and accounting activities; activities of head offices; management consultancy activities
		c46	Architectural and engineering activities; technical testing and analysis
		c47	Scientific research and development

		c48	Advertising and market research
		c49	Other professional, scientific and technical activities; veterinary activities
OSE	Real Estate Activities，Utility，construction and other services	c24	Electricity, gas, steam and air conditioning supply
		c25	Water collection, treatment and supply
		c26	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services
		c27	Construction
		c44	Real estate activities
		c50	Administrative and support service activities
		c51	Public administration and defense; compulsory social security
		c52	Education
		c53	Human health and social work activities
		c54	Other service activities
		c55	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
		c56	Activities of extraterritorial organizations and bodies

Source: World Input-Output Databases (WIOD)

3. Empirical analysis of US-China trade war and its impact to GVCs

The United States and China are the world's two largest national economies, the US has a larger nominal GDP, whereas China has a larger GDP when measured in terms of PPP. China is the world's largest exporter and the United States is the world's largest importer. They have so far been important pillars for the global economy. Since China joined the WTO in 2001, China's foreign trade has developed rapidly, and the United States has become an important partner to China. However, while the total amount of trade expanded, China maintained a long trade surplus with the United States, and the trade imbalance gradually increased, and the United States launched a trade war against China on this basis in 2018. This chapter will comprehensively analyze the causes and impacts of US-China trade war from the perspective of GVCs based on the trade in value added, and forecast the development trend of US-China trade war in the future.

3.1 The outbreak of the US-China trade war

The US-China trade war officially broke out in late March and early April of 2018. On March 22, 2018, Trump asked the United States trade representative (USTR) to investigate applying tariffs on US$50–60 billion worth of Chinese goods. He relied on Section 301 of the Trade Act of 1974 for doing so, stating that the proposed tariffs were "a response to the unfair trade practices of China over the years", including theft of U.S. intellectual property. Over 1,300 categories of Chinese imports were listed for tariffs, including aircraft parts, batteries, flat-panel televisions, medical devices, satellites, and various weapons.

According to the amount and tariff rate imposed by the two sides, the progress of the US-China trade war can be roughly divided into the following four stages:

First, the initial stage of the US-China trade war. China and the United States announced a tariff list worth $50 billion to each other, with an additional tariff rate of 25%: on July 6, 2018, the United States imposed a 25% tariff on Chinese goods worth

of $34 billion, and the Chinese government immediately imposed the same tariff on the same amount of products; on August 23, 2018, the United States continued to impose a 25% tariff on Chinese goods worth of $16 billion , and the Chinese side imposed the same countermeasures against the United States.

Second, the expansion stage of the US-China trade war: on September 24,2018, the United States formally implemented the second batch of tariff lists and imposed an additional 10% tariff on Chinese goods worth of $200 billion. China immediately imposed countermeasures, imposing tariffs of 10% and 5% on US goods worth of $60 billion.

Third, the upgrading stage of the US-China trade war: on May10, 2019, the United States formally implemented the third batch of tariff lists, raising the tariff rate on Chinese goods worth of $200 billion from 10% to 25%. China immediately took countermeasures, raising the tariff rate of 25%, 20%,10% and 5% on US goods worth of $60 billion.

Fourth, the suspension stage of the US-China trade war: on January 15, 2020, China's Vice Premier Liu He and U.S. President Donald Trump signed the US – China Phase One trade deal in Washington DC. "The Economic and Trade Agreement between the United States of America and the Republic of China"[4] is set to take effect from 14 February 2020 and focus on intellectual property rights (Chapter 1), technology transfer (Chapter 2), food and agricultural products (Chapter 3), financial services (Chapter 4), exchange rate matters and transparency (Chapter 5), and expanding trade (Chapter 6), with reference also being made to bilateral evaluation and dispute resolution procedures in Chapter 7. China granted tariff exemptions on 696 US goods to support purchases on February 17, 2020, and USTR granted exemptions to tariffs on various types of medical equipment, after calls from American lawmakers and others to remove tariffs on these products in light of the

[4] The Economic and Trade Agreement between the United States of America and the Republic of China. URL- https://ustr.gov/

Coronavirus (COVID-19) pandemic in the United States on March 5, 2020.

3.2 The causes of US-China trade war

The United States provoked trade war with China on the grounds of trade deficit and used it as an excuse to contain china's trade and investment, but is the trade imbalance really the root cause of the US-China trade war? This is not the case, trade imbalance is only the direct cause of the trade war, but the root cause is the escalation of global value chains' competition.

3.2.1 The direct cause of US-China trade war

The Trump administration has argued that the U.S. interests have been badly damaged by trade imbalances between China and the United States. As shown in Table 3-1, according to total gross exports value (TE), bilateral trade between China and the United States has continued to increase rapidly since China joined WTO in 2001. From 2000 to 2014, bilateral trade between China and the United States increased from $64.044 billion in 2000 to $459.362 billion in 2014, and China and the United States have become the most important trading partners between each other. Meanwhile, the trade imbalance between China and the United States is also expanding rapidly, the US trade deficit with China expanding from $39.106 billion in 2000 to $235.26 billion in 2014. This is also the direct reason why the United States launched the trade war against China. But if in terms of trade in value-added (DVA), bilateral trade between China and the United States increased from $53.121 billion in 2000 to $378.767 billion in 2014 and the bilateral trade balance between China and the United States increased from $31.159 billion in 2000 to $190.365 billion in 2014, although the trade balance is still rising, it is not as large as total gross export trade. It can be seen that traditional gross trade overestimates the US-China trade balance.

Table 3-1

China-US Bilateral Trade Balance (Billion, $)

Year	TE			DVA		
	CHN-USA	USA-CHN	TB	CHN-USA	USA-CHN	TB
2000	51.575	12.469	39.106	42.14	10.981	31.159
2001	53.131	15.532	37.599	44.03	13.759	30.271
2002	67.661	16.394	51.267	54.612	14.601	40.011
2003	90.373	20.454	69.919	70.166	18.151	52.014
2004	122.147	29.302	92.845	91.547	25.629	65.918
2005	163.123	34.192	128.931	122.464	29.658	92.806
2006	196.93	44.843	152.087	148.480	38.525	109.955
2007	230.419	53.927	176.491	172.837	46.511	126.326
2008	244.709	63.812	180.897	187.543	54.356	133.187
2009	209.149	65.674	143.475	168.066	58.092	109.974
2010	262.703	79.548	183.155	205.858	69.145	136.712
2011	291.02	91.472	199.548	228.472	78.093	150.380
2012	315.158	98.085	217.073	251.582	72.893	178.690
2013	321.875	106.880	214.995	258.228	91.315	166.913
2014	347.311	112.051	235.260	284.566	94.201	190.365

Statistics source: calculation according to databases of UIBE GVC Index Team and WIOD

Because intermediate trade is popular in the global trade, the domestic value added (DVA) index is used to measure the trade benefits in one country. As shown in

Table 3-2, in bilateral trade between China and the United States, China's trade benefits rose from $42.14 billion in 2000 to $284.566 billion in 2014; and in the United States, trade benefits rose from $10.981 billion in 2000 to $94.201 billion in 2014. The proportion of domestic value added to total gross exports, from 2000 to 2014 the average proportion of China's domestic value added to total gross trade value was 78.61%, and the average proportion of US domestic value added to total gross trade value was 86.04%, which indicates that the profitability of the United States is much higher than that of China.

Table 3-2

China-US Trade Benefits (Billion, $)

Year	CHN-USA			USA-CHN		
	TE	DVA	Share (%)	TE	DVA	Share (%)
2000	51.575	42.14	81.71	12.469	10.981	88.07
2001	53.131	44.03	82.87	15.532	13.759	88.58
2002	67.661	54.612	80.71	16.394	14.601	89.06
2003	90.373	70.166	77.64	20.454	18.151	88.74
2004	122.147	91.547	74.95	29.302	25.629	87.47
2005	163.123	122.464	75.07	34.192	29.658	86.74
2006	196.93	148.48	75.40	44.843	38.525	85.91
2007	230.419	172.837	75.01	53.927	46.511	86.25
2008	244.709	187.543	76.64	63.812	54.356	85.18
2009	209.149	168.066	80.36	65.674	58.092	88.46

2010	262.703	205.858	78.36	79.548	69.145	86.92
2011	291.02	228.472	78.51	91.472	78.093	85.37
2012	315.158	251.582	79.83	98.085	72.893	74.32
2013	321.875	258.228	80.23	106.88	91.315	85.44
2014	347.311	284.566	81.93	112.051	94.201	84.07
Average	/	/	78.61	/	/	86.04

Statistics source: calculation according to databases of UIBE GVC Index Team and WIOD

At the industry level, the top 10 Chinese exports to the United States in 2014 shown in Figure 3-1: C17-Manufacture of computer, electronic and optical products; C06-Manufacture of textiles, wearing apparel and leather products; C18-Manufacture of electrical equipment; C19-Manufacture of machinery and equipment n.e.c.; C22-Manufacture of furniture; other manufacturing; C11-Manufacture of chemicals and chemical products; C16-Manufacture of fabricated metal products, except machinery and equipment; C20-Manufacture of motor vehicles, trailers and semi-trailers; C13-Manufacture of rubber and plastic products; C15-Manufacture of basic metals. And the top 10 the United States export to China in 2014 shown in Figure 3-2: C33-Air transport; C21-Manufacture of other transport equipment; C01-Crop and animal production, hunting and related service activities; C19-Manufacture of machinery and equipment n.e.c; C11-Manufacture of chemicals and chemical products; C20-Manufacture of motor vehicles, trailers and semi-trailers; C17-Manufacture of computer, electronic and optical products; C45-Legal and accounting activities; activities of head offices; management consultancy activities; C05-Manufacture of food products, beverages and tobacco products; C31-Land transport and transport via pipelines. According to the trade structure of China and the United States, we found that China's exports to the United States are mainly

concentrated in the low and middle manufacturing industry, while the United States exports to China are mainly concentrated in the middle and high manufacturing industry, service industry and agriculture industry.

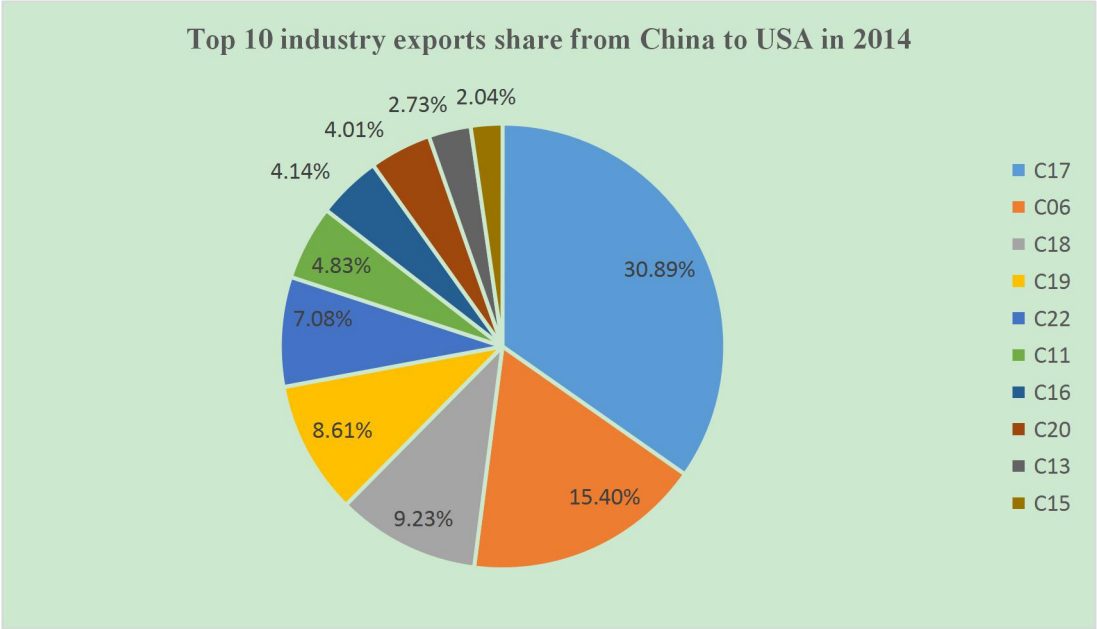

Figure 3-1 Top 10 industry exports share from China to USA in 2014

Statistics source: calculation according to databases of UIBE GVC Index Team and WIOD

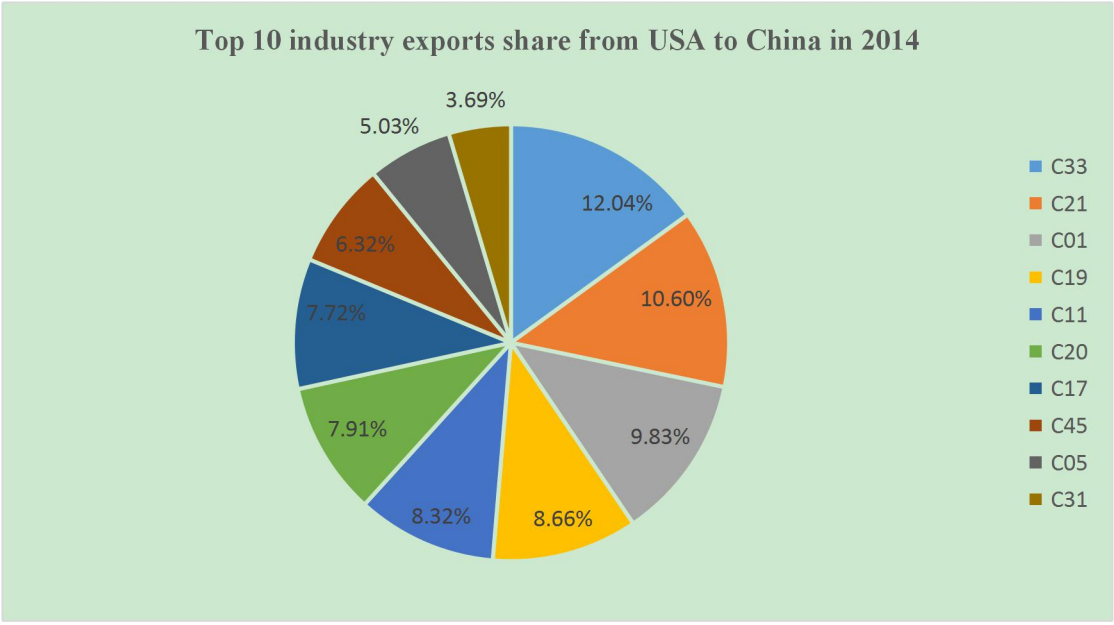

Figure 3-2 Top 10 industry exports share from USA to China in 2014

Statistics source: calculation according to databases of UIBE GVC Index Team and WIOD

And we could also make a detailed analysis of the top 10 industries in bilateral trade between China and the United States in 2014 from the perspective of trade in value added. As shown in table 3-3-1 and 3-3-2, among the top 10 industries exported by China to the United States, the domestic value added is basically between 73.63%-90.22%, with an average of 83.12%, while the foreign value added is between 9.66%-24%, with an average of 14.90%. And among the top 10 industries exported by the United States to China, the domestic value added is between 76.11%-95.45%, with an average of 86.13%, while the foreign value added is between 3.61%-23.28%, with an average of 11.86%.

The sectors C17,

C19 and C11 are on the both lists of the top 10 industries exports, but we can make a specific analysis for them: as for C17, China's domestic value added is 73.63% and foreign value added is 24%, while the US domestic value added is 90.32%, foreign value added is 7.47%; as for C19, China's domestic value added is 83.52%, foreign value added is 14.63%, while the US domestic value added is 81.70%, foreign value added is 16.09%; China's domestic value added in C11's exports to the United States is 81.58%, foreign value added is14.47%, while the domestic value added of United States in C11 is 84.71%, and foreign value added is 10.45%. All these show that the actual profit level of the United States is higher than that of China in its bilateral trade.

Table 3-3-1

Top 10 industry exports from China to USA in 2014

CHN-USA	TE	DVA		FVA	
Sector No.	Value(Bil,$)	Value(Bil,$)	Share	Value(Bil,$)	share

C17	107.298	79	73.63%	25.759	24%
C06	53.479	48.25	90.22%	5.168	9.66%
C18	32.069	26.13	81.48%	5.434	16.94%
C19	29.903	24.975	83.52%	4.375	14.63%
C22	24.6	21.956	89.25%	2.604	10.59%
C11	16.771	13.681	81.58%	2.428	14.47%
C16	14.367	11.985	83.42%	2.075	14.44%
C20	13.937	11.885	85.27%	1.732	12.43%
C13	9.509	7.940	83.50%	1.396	14.69%
C15	7.073	5.609	79.31%	1.213	17.15%

Statistics source: calculation according to databases of UIBE GVC Index Team and WIOD

Table 3-3-2

Top 10 industry exports from USA to China in 2014

USA-CHN	TE	DVA		FVA	
Sector No.	Value (Bn, $)	Value (Bn, $)	Share	Value (Bn, $)	Share
C33	13.491	11.668	86.48%	1.411	10.46%
C21	11.881	9.597	80.78%	2.223	18.71%
C01	11.019	9.754	88.52%	9.965	9.04%
C19	9.703	7.927	81.70%	1.561	16.09%

C11	9.331	7.904	84.71%	9.749	10.45%
C20	8.858	6.742	76.11%	2.062	23.28%
C17	8.654	7.817	90.32%	0.647	7.47%
C45	7.085	6.763	95.45%	0.256	3.61%
C05	5.635	4.975	88.29%	0.582	10.32%
C31	4.134	3.678	88.95%	0.377	9.12%

Statistics source: calculation according to databases of UIBE GVC Index Team and WIOD

There is no denying that China-United States trade accounts for more than 50% of the total US trade deficit, regardless of the statistical method. Trump argued that the trade deficit would hurt U.S. interests, and that the U.S. trade deficit with China was due to the Chinese government's export subsidies to businesses and high taxes, but this is not the case. According to the Global Value Chains, China is generally in the low and middle position, while the United States, relying on its advantage in the field of high technology and marketing services, occupies the high-end position in the Global Value Chains. This trade imbalance caused by the division of Global Value Chains, although China is in the position of trade surplus, the actual benefit surplus belong to United States, China only gets less processing fees, and the United States can make more profits by exporting core parts. Take iPhone for example, from which China earns limited processing fees, while the United States can make more profit by providing core components. Thus, the trade imbalance is only the direct cause of US-China trade war, not the root cause.

3.2.2 The root cause of US-China trade war

In this US-China trade war, U.S.'s tariffs on China focused on high-technology-intensive products such as medical machinery, biomedicine, new

materials, high-speed rail equipment and information technology and space equipment, pointing to "made in China 2025"[5], with the fundamental aim of maintaining the U.S. at the top position of the global value chains, while blocking China's technological advances and the development of high-tech industries, and its strategy of keeping China at the low end of the global value chains for a long time.

Table 3-4 shows the GVC_participation indexes of Chinese and US's overall industry from 2000 to 2014. The overall GVC_participation indexes of China and the United States both reached their highest points on around of the global financial crisis. Since the 2008 financial crisis, the GVC_ participation indexes of China and the United States has shown a certain downward trend and the overall participation indexes of China and the United States are roughly equal. According to the composition of the GVC_participation indexes, China's forward participation index is far lower than the backward participation index, indicating that China is still at the low end of the global value chains; but China's forward participation index has risen rapidly from the lowest 2.55% to 4.67% in 2014, and then the backward participation index has decreased from the highest 23.88% to 16.35% in 2014, indicating that China's position in the global value chains is gradually moving from the low to the middle and high position. The forward participation index of the United States as a whole is roughly equal to backward participation index, indicating a more balanced division of US participation in GVCs, but the US's forward participation index has declined from the highest 16 % to 9.8 % in 2014 and the backward participation index has risen from the lowest 8.72% to 12.22 % in 2014, while the gap between the forward participation index between China and the United States gradually narrowed from the highest 14.54% to 5.13% in 2014, indicating that the US's position at the top of the GVCs is challenged by China.

Table 3-4

GVC_ participation indexes of Chinese and US's overall industries (%), 2000 to

[5] Made in China 2025. URL- http://www.gov.cn/zhuanti/2016/MadeinChina2025-plan/index.htm

2014

Year	CHN			USA		
	GP	IV/E	FV/E	GP	IV/E	FV/E
2000	20.72	3.4	17.32	18.76	8.97	9.79
2001	19.42	3.12	16.3	17.76	8.32	9.44
2002	21.21	2.79	18.42	18.65	9.73	8.92
2003	23.92	2.55	21.37	21.13	12.41	8.72
2004	26.54	2.66	23.88	23.87	14.55	9.32
2005	26.39	2.68	23.71	24.3	14.53	9.77
2006	26.27	3.03	23.24	26.15	15.94	10.21
2007	26.75	3.18	23.57	27.46	17.72	9.74
2008	25.68	3.83	21.85	27.71	16.96	10.75
2009	21.64	2.95	18.69	22.15	13.01	9.14
2010	23.63	3.21	20.42	23.12	12.76	10.36
2011	23.81	3.73	20.08	23.63	11.83	11.8
2012	22.55	3.66	18.89	22.59	10.58	12.01
2013	22.62	4.37	18.25	22.32	10.17	12.15
2014	21.02	4.67	16.35	22.02	9.8	12.22

Note: GP- GVC-Participation index; IV/E-forward participation index; and FV/E-backward participation index.

Statistics source: calculation according to databases of UIBE GVC Index Team and WIOD

Figure 3-3 is a comparative analysis for the GVC_position indexes of Chinese and US's overall and MTI-HTI industries from 2000 to2014. The GVC_position index of China's whole industry from 2000 to 2014 is less than 0, indicating that China is at a disadvantage in the international division of labor in global value chains at the present stage, but the GVC_position index of China's whole industry shows an upward trend, rising from -0.13 in 2000 to -0.1 in 2014, which means that China's position in the global value chains is gradually rising to a favorable position. And the GVC_position indexes of China's medium and high technology industries from 2000 to 2014 is less than 0, indicating that China's medium and high technology industries are at a disadvantage in the global value chains, but the GVC_position index of China's middle and high technology industries is on the rise, especially its GVC_position index has reached -0.08 in 2014, indicating that China's middle and high technology industries are gradually moving from end to the middle and high end of the global value chains. Meanwhile, the GVC_position indexes of the U.S. overall industry and middle and high-tech industries showed a downward trend from 2000 to 2014, but still greater than 0 in general, indicating that the U.S. overall industry and middle and high-tech industries are in a favorable position in the global value chains, and located upstream of the global value chains. The comparison between China and the United States shows that during 2000~2014, the GVC_position indexes of the United States in the whole industry and in the middle and high technology industries were higher than that of China, indicating that China was more disadvantaged in the global value chains than the United States; however, the gap between China and the United States was gradually narrowing in both the overall and the middle and high technology industries, and China as a whole began to move from the low to the middle and high end in the global value chains.

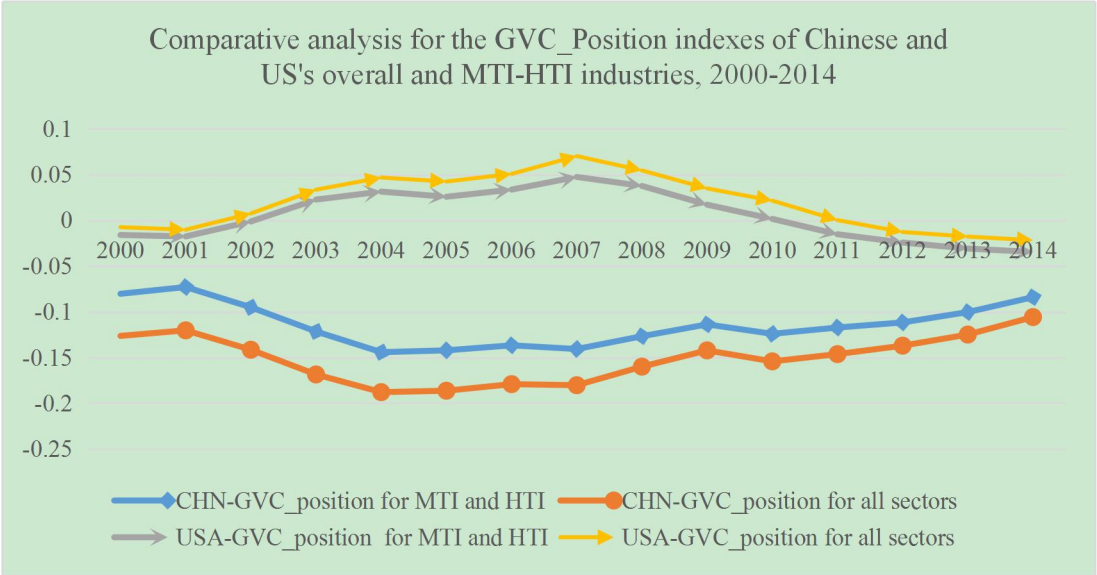

Figure 3-3 Comparative analysis for the GVC_Position indexes of Chinese and US's overall and MTI-HTI industries, 2000-2014

Statistics source: calculation according to databases of UIBE GVC Index Team and WIOD

Overall, through the calculation and analysis of the GVC_ participation index and the GVC_position index of China and the United States, we find that the United States is in the upstream position of the global value chains as a whole, and the advantage of the middle and high technology industries is obvious; while China is currently in the downstream position of the global value chains as a whole, and the middle and high technology industries is still in a disadvantageous position. The gap between China and the United States in the forward participation index, the GVC_position index of overall industry and the GVC_position index of middle and high technology industries is narrowing, and China is showing a clear upward trend in the global value chains, and is gradually getting rid of the dilemma of being "locked in the low position" by the United States and moving towards the middle and high position in the global value chains. And the United States realizes China's development trend in the global value chains and predicts that the position between China and the United States in the global value chains is constantly approaching, so it attempts to block the development process of China's high-tech industry through a

"trade war", forcing China to remain at the "low position" in the global value chains, which also verifies the root cause of the US-China trade war described above.

3.3 The impacts of the US-China trade war

In the context of GVCs becoming the dominant feature of current global trade, an increasing number of economies integrate into its division system and become important links in the GVCs. Both the United States and China actively participate in the GVCs, so the US-China trade war will inevitably lead to a negative impact on GVCs, whether on China and the United States, and on the global trade.

3.3.1 Analysis of tariff lists imposed by both sides

From the US side, the first round tariff list worth of approximately $50 billion published by USTR included two groups: the first group contained 818 tariff subheadings, with an approximate annual trade value of $34 billion[6]; the second group contained 279 tariff subheadings, with an annual trade value of approximately $16 billion[7].

Figure 3-4 shows the specific industrial sectors distribution of tariff list that US imposed on China on the first round. The industry sectors with a large number of items subject to the HS2017 are Chapter 84(Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof); Chapter 85 (Electrical machinery and equipment and parts thereof; sound recorders and reproducers; television image and sound recorders and reproducers, parts and accessories of such articles); Chapter 39 (Plastics and articles thereof) and Chapter 90 (Optical, photographic, cinematographic, measuring, checking, medical or surgical instruments and apparatus; parts and

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[6] China Section 301-Tariff Actions and Exclusion Process: $34 Billion Trade Action (List 1).

URL-https://ustr.gov/issue-areas/enforcement/section-301-investigations/section-301-china/34-billion-trade-action

[7] China Section 301-Tariff Actions and Exclusion Process: $16 Billion Trade Action (List 2).
URL-https://ustr.gov/issue-areas/enforcement/section-301-investigations/section-301-china/16-billion-trade-action

accessories). The numbers of items in the tariff list are 454, 222, 146 and 145 respectively, accounting for 88.1% of the total tariffed commodities. In addition to the above industries, vehicles, railways and electric locomotives, aircraft and ships are also the main industries in the tariff lists. Overall, the tariff lists worth of $50 billion focused mainly on the high-tech manufacturing sector related to China's "Made in China 2025" industrial policy program, rather than middle and low-end manufacturing, where china has a higher comparative advantage.

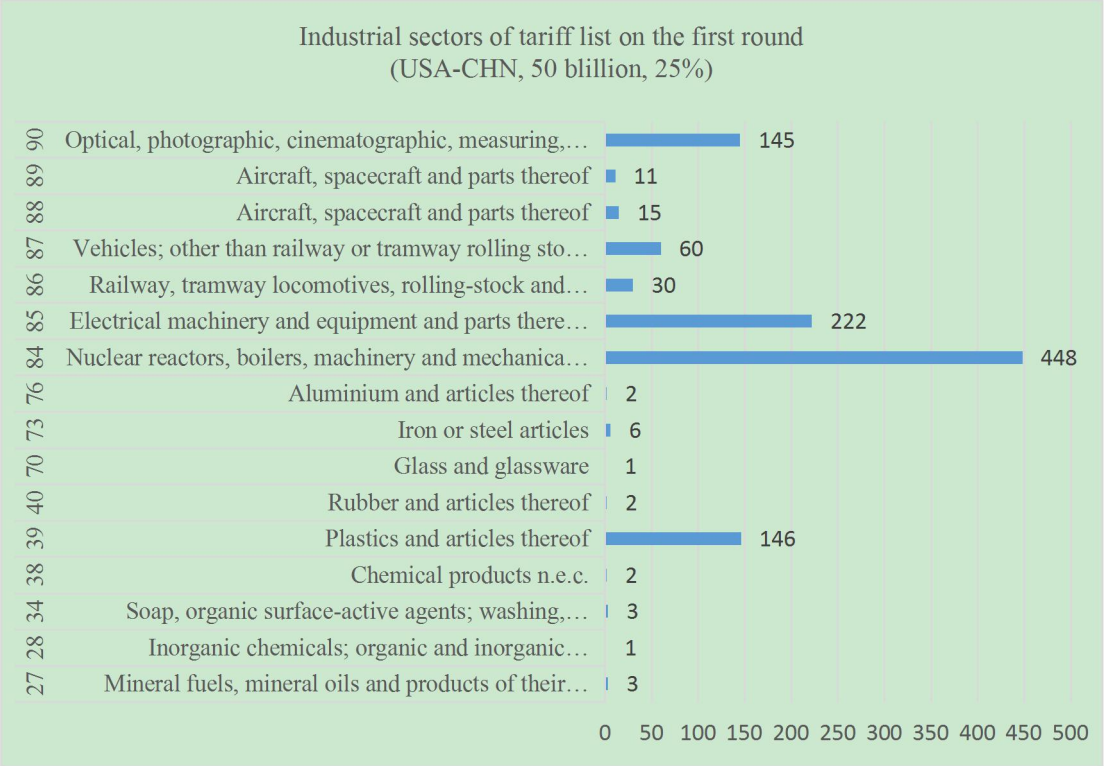

Figure 3-4 Industrial sectors of tariff list on the first round (USA-CHN, 50 billion, 25%)

Source: Offcie of the United States Trade Representative

The second round tariff list worth of approximately $200 billion published by USTR, contained 6125 tariff subheadings[8]. Figure 3-5 shows the distribution of the top 20 tariffed commodities on the second round, accounting for the total number of

[8] China Section 301-Tariff Actions and Exclusion Process:$200 Billion Trade Action (List 3). URL-https://ustr.gov/issue-areas/enforcement/section-301-investigations/section-301-china/200-billion-trade-action

tariffed items 64.78%. From the HS2017, among which the industry sectors with a large number of tariffed commodity items are organic compounds, animal and vegetable oils and their decomposition products, organic and inorganic chemicals, cotton, fish, paper and paperboard products, electrical equipment and other industries. Unlike the high concentration of the industry on the first round of tariff lists, the second round of tariff lists involves a wide range of industries, most of which are hit by the trade war.

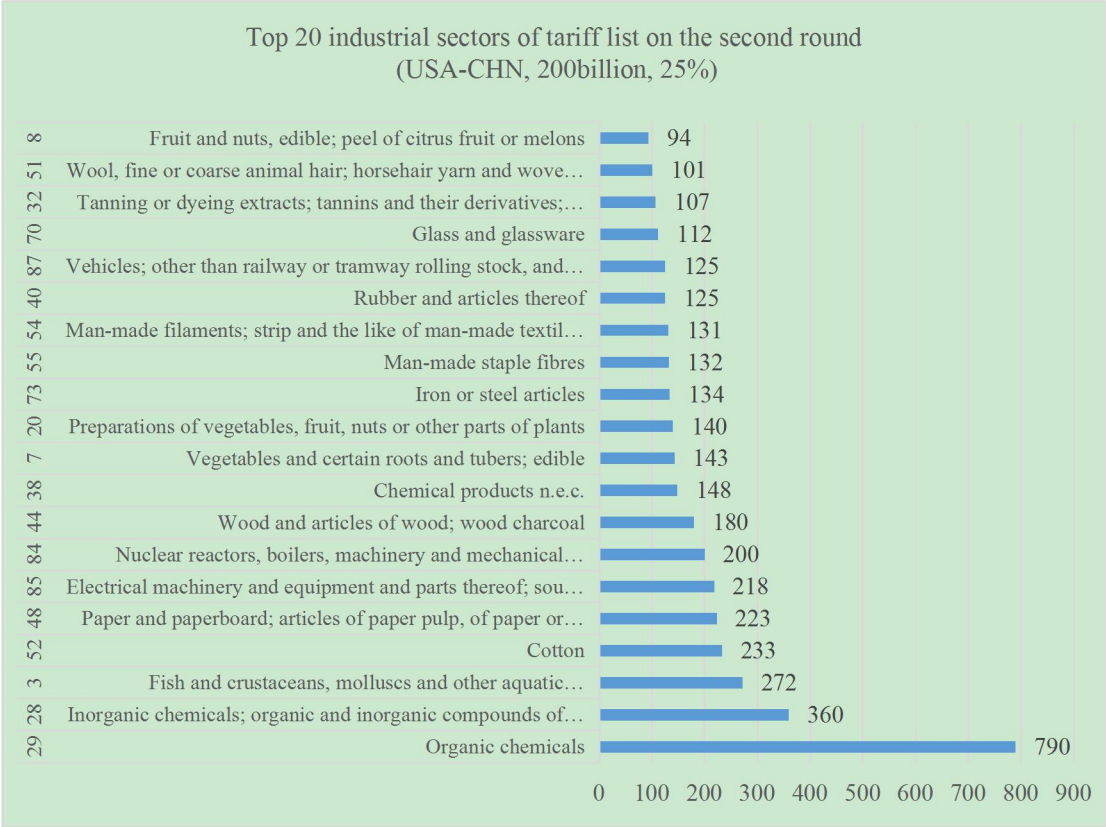

Figure 3-5 Top 20 industrial sectors of tariff list on the second round (USA-CHN, 200 billion, 25%)

Source: Office of the United States Trade Representative

The Chinese government has chosen to respond to the U.S. first round action by imposing equivalent tariff measures on U.S. commodities. China's announcement sets out two lists. The first list contains 545 tariff subheadings that supposedly corresponds

to the initial U.S. $34 billion action[9]. The second list contains 333 tariff subheadings that supposedly corresponds to the additional proposed $16 billion U.S. action[10].

Figure 3-6 shows the industrial sectors distribution of tariff list that China imposed on US on the first round. The industry sectors with a large number of items subject to the HS2017 are Chapter 87 (Vehicles; other than railway or tramway rolling stock, and parts and accessories thereof); Chapter 3 (Fish and crustaceans, mollusks and other aquatic invertebrates); Chapter 7(Vegetables and certain roots and tubers; edible); Chapter 8(Fruit and nuts, edible; peel of citrus fruit or melons); Chapter27 (Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes) and Chapter 2 (Meat and edible meat offal). The numbers of items in the tariff list are 206, 182, 93, 86, 64 and 48 respectively, accounting for 77.33 % of the total tariffed commodities. Compared with the United States, China basically focused on agricultural products (vegetables, fruits, meat), vehicles and some fossil fuels.

[9] Notification-Tariffs Commission on imports of $50 billion from the United States.
URL-http://gss.mof.gov.cn/gzdt/zhengcefabu/201806/t20180616_2930325.htm

[10] Notification-Tariffs Commission on imports of $16 billion from the United States.

URL-http://gss.mof.gov.cn/gzdt/zhengcefabu/201808/t20180808_2983770.htm

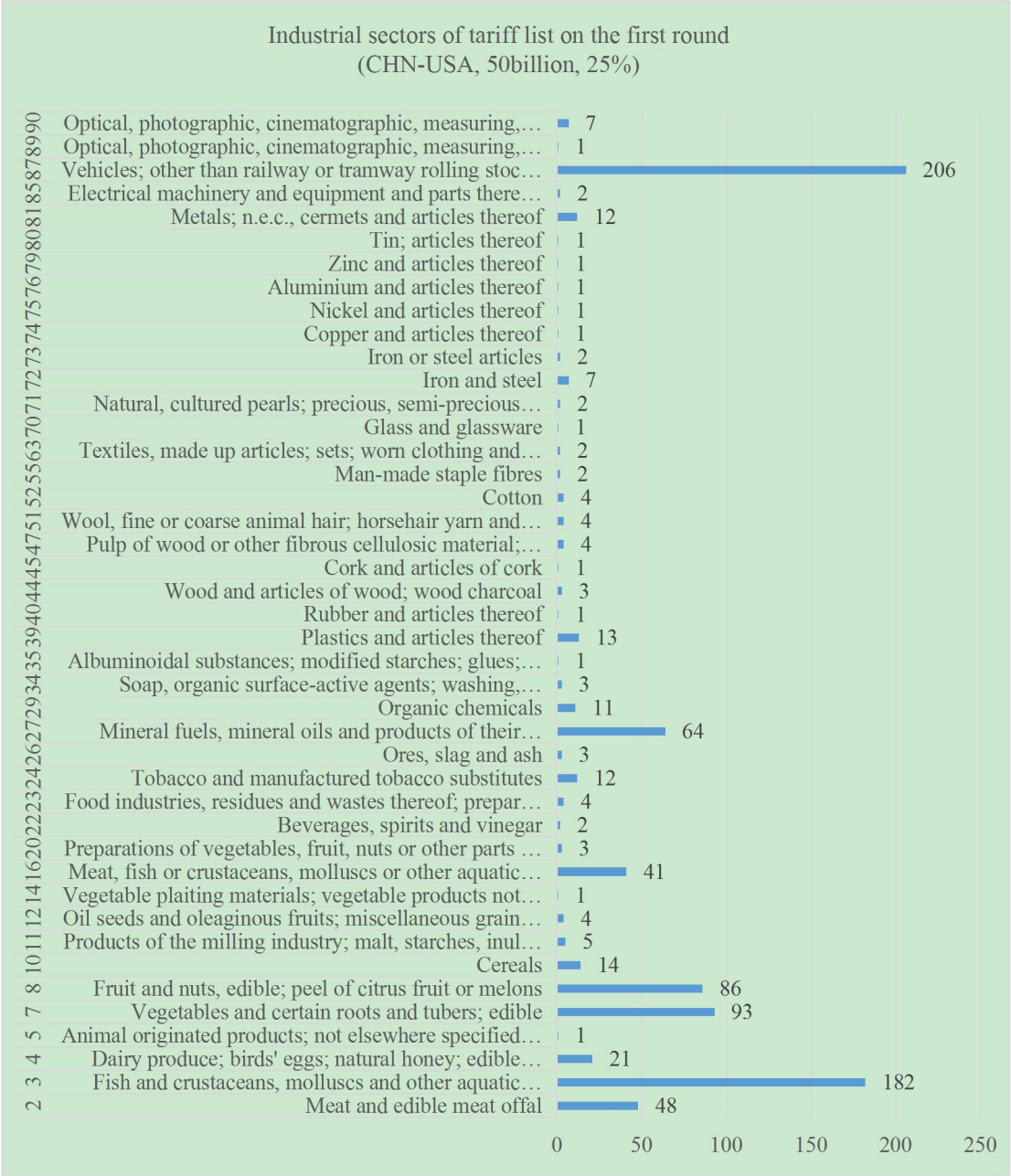

Figure 3-6 Industrial sectors of tariff list on the first round (CHN-USA, 50 billion, 25%)

Source: Ministry of Finance of The People's Republic of China

The second round tariff lists worth of approximately $600 billion published by Chinese government are complicated, it divided into four parts: 595 tariff subheadings worth of $20 billion, 974 subheadings worth of $16 billion, 1078 subheadings worth

of $13 billion, and 2493 subheadings worth of $11 billion.[11] Figure 3-7-1 shows the distribution of the top 20 tariffed commodities on the second round, that China imposed 5% tariff on US commodities worth of $20 billion. From the HS2017, among which the industry sectors with a large number of tariffed commodity items are Chapter 29 (Organic chemicals), Chapter 84(Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof), Chapter 85(Electrical machinery and equipment and parts thereof; sound recorders and reproducers; television image and sound recorders and reproducers, parts and accessories of such articles);Chapter 28 (Inorganic chemicals; organic and inorganic compounds of precious metals; of rare earth metals, of radio-active elements and of isotopes). Figure3-7-2 shows the distribution of the top 20 tariffed commodities on the second round, that China imposed 10% tariff on US commodities worth of $16 billion. From the HS2017, among which the industry sectors with a large number of tariffed commodity items are also Chapter84, Chapter 29, Chapter 85 and Chapter 90(Optical, photographic, cinematographic, measuring, checking, medical or surgical instruments and apparatus; parts and accessories). Figure3-7-3 shows the distribution of the top 20 tariffed commodities on the second round, that China imposed 20% tariff on US commodities worth of $13 billion. From the HS2017, among which the industry sectors with a large number of tariffed commodity items are also Chapter84, Chapter 85, Chapter 29 and Chapter 48 (Paper and paperboard; articles of paper pulp, of paper or paperboard). Figure3-7-4 shows the distribution of the top 20 tariffed commodities on the second round, that China imposed 25% tariff on US commodities worth of $11 billion. From the HS2017, among which the industry sectors with a large number of tariffed commodity items are also Chapter 84, Chapter 85, Chapter 29 and Chapter72 (Iron and steel). Different from the high concentration on agricultural products on the first round, the second round involves a wide range of industries covered almost all sectors, which focused on organic chemicals, nuclear reactors, electrical equipment.

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[11] Notification-Tariffs Commission on imports of $200 billion from the United States.

URL-http://gss.mof.gov.cn/gzdt/zhengcefabu/201905/t20190513_3256788.htm

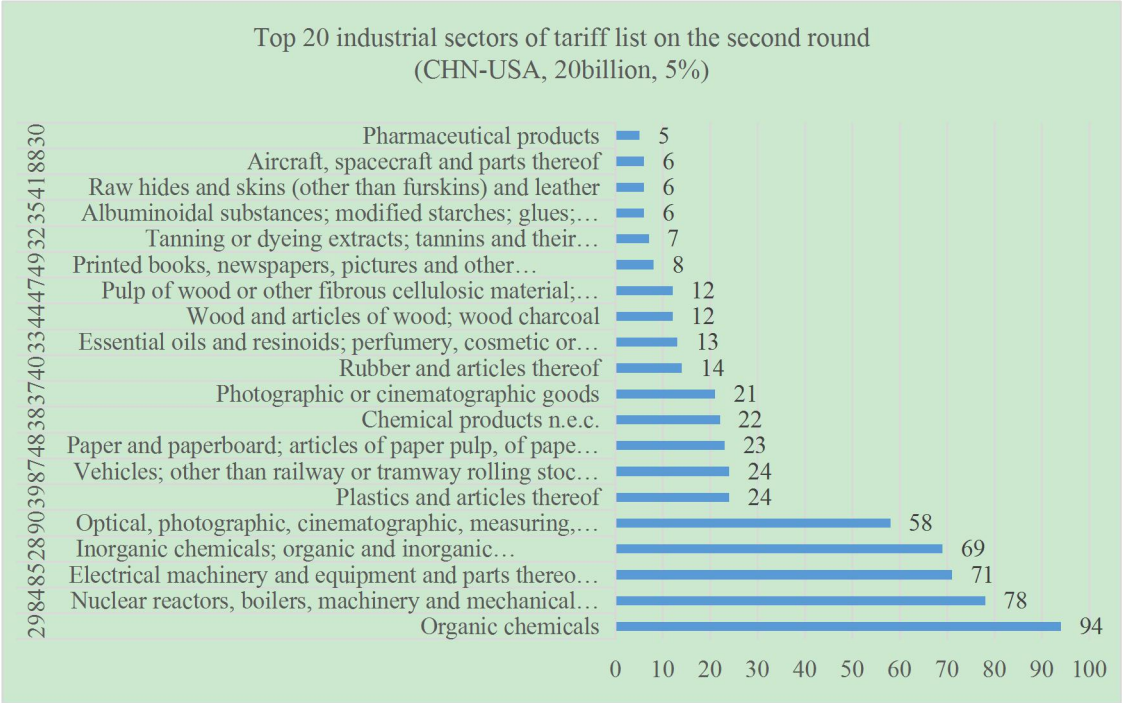

Figure 3-7-1 Top 20 industrial sectors of tariff list on the second round (CHN-USA, 20 billion, 5%)

Source: Ministry of Finance of The People's Republic of China

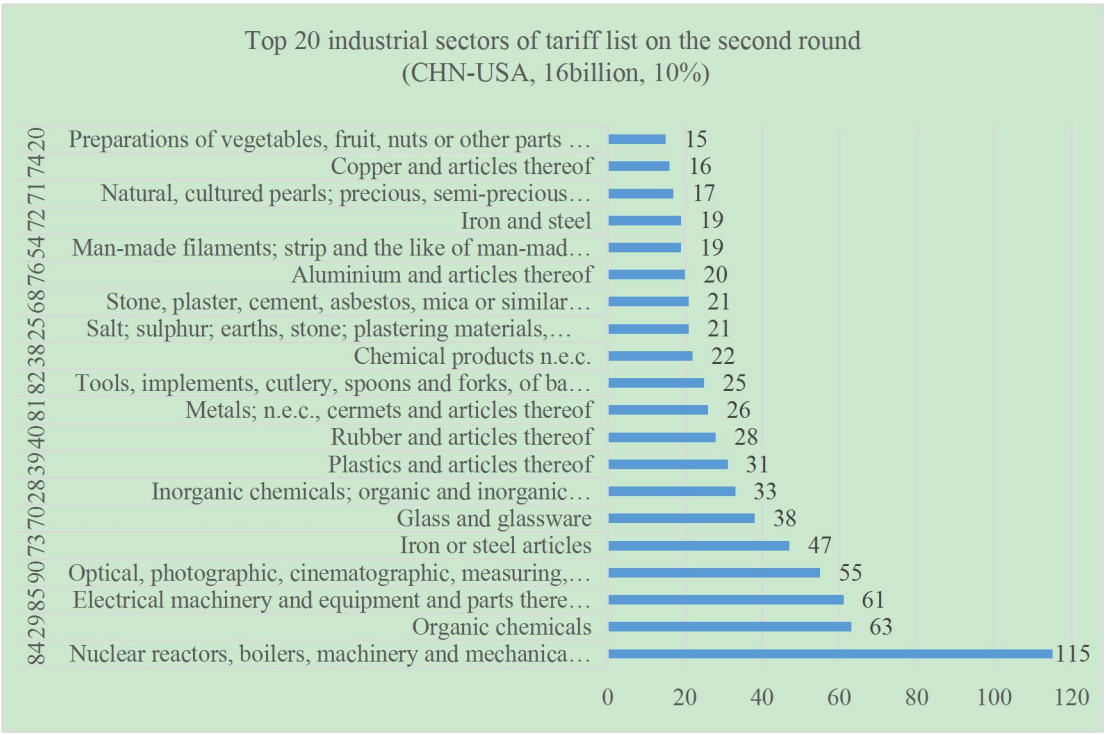

Figure 3-7-2 Top 20 industrial sectors of tariff list on the second round (CHN-USA,

16 billion, 10%)

Source: Ministry of Finance of The People's Republic of China

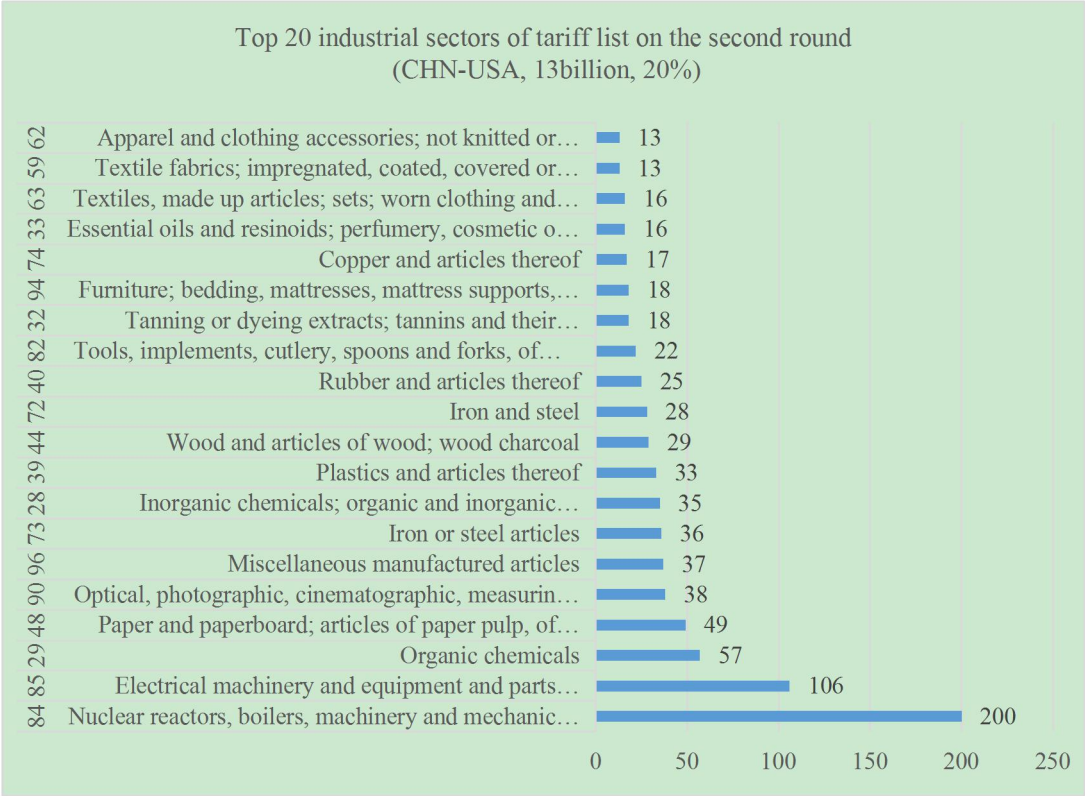

Figure 3-7-3 Top 20 industrial sectors of tariff list on the second round (CHN-USA, 13 billion, 20%)

Source: Ministry of Finance of The People's Republic of China

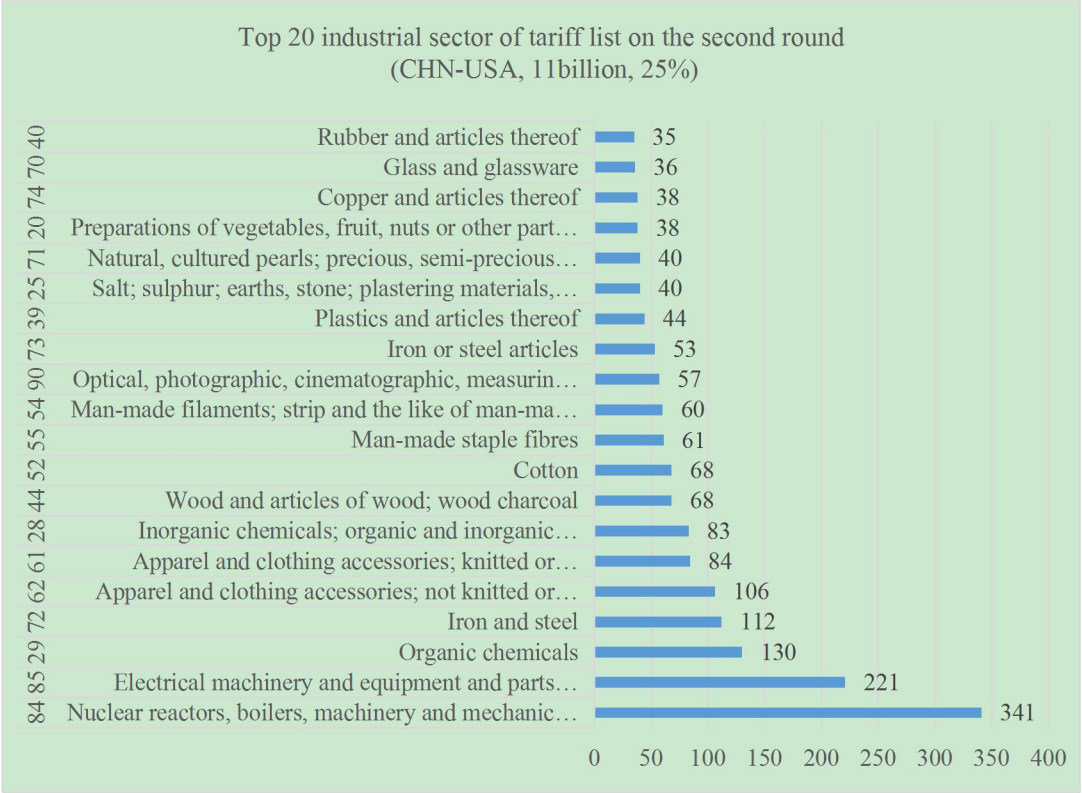

Figure 3-7-4 Top 20 industrial sectors of tariff list on the second round (CHN-USA, 11 billion, 25%)

Source: Ministry of Finance of The People's Republic of China

On the whole, the tariffs imposed by the United States on China are mainly concentrated in the middle and high-end manufacturing industry, while the tariffs imposed by China on the United States are mainly concentrated in agricultural and manufacturing sectors. Compared to the two rounds of tariff lists, both the United States and China show that the second round is more extensive than the first one, and can affect the vital interests of producers and consumers.

3.3.2 The impact on the trade of both countries

Given the two rounds of tariffs imposed by China and the United States, which mainly focus on manufacturing and agriculture industries, this section will focus on the two industries. Now we will analyze the trade impact of these two industries on China and the United States from the perspective of GVCs.

If we analyze the value added decomposition of China's manufacturing exports to the United States (as shown in the Table 3-5), we will find from 2000 to 2014, the gross exports value (TE) increased from $48.013 billion to $333.61 billion. Among them, the Chinese domestic value added (DVA) has increased faster, from $38.973 billion in 2000 to $272.717 billion in 2014, and its share occupied the manufacturing industry's total exports value is relatively stable, with an average ratio of 78.25%; and although the corresponding value added in the United States also has increased from $0.782 billion in 2000 to $3.68 billion in 2014, but its share has decreased from 1.63% in 2000 to 1.1% in 2014, and its average share is 1.61%. So, it proves that if USA imposes tariffs on Chinese manufacturing industry, China will be affected by approximately 78.25%, the United States itself by approximately 1.61%.

Table 3-5

Value-added decomposition of Chinese manufacturing exports					
Year	TE	DVA		MVA	
	$ Billion	$ Billion	Share %	$ Billion	Share %
2000	48.013	38.973	81.17	0.782	1.63
2001	49.129	40.476	82.39	0.729	1.48
2002	63.568	51.003	80.23	1.077	1.69
2003	85.759	66.183	77.17	1.567	1.83
2004	116.784	87.041	74.53	2.342	2.01
2005	156.174	116.699	74.72	2.887	1.85
2006	188.722	141.704	75.09	3.645	1.93
2007	221.219	165.278	74.71	4.329	1.96
2008	232.063	177.07	76.3	4.075	1.75
2009	197.391	157.971	80.03	3.04	1.54

2010	249.261	194.54	78.05	3.826	1.53
2011	275.14	215.243	78.23	3.748	1.36
2012	298.448	237.434	79.56	3.843	1.29
2013	311.176	248.323	79.8	3.721	1.2
2014	333.61	272.717	81.75	3.68	1.1
Average	/	/	78.25	/	1.61

Statistics source: calculation according to databases of UIBE GVC Index Team and WIOD

As for the manufacturing industry as shown in the Table 3-6-1, we can see that from 2000 to 2014, the manufacturing products exported by the United States to China increased from $10.327 billion to $70.143 billion; Among them, although the domestic value added of The United States has increased from $8.975 billion in 2000 to $56.63 billion in 2014, but its share occupied the manufacturing industry's total exports value has decreased from 86.91% in 2000 to 80.74% in 2014. And the corresponding Chinese value added has increased from $0.037 billion in 2000 to $1,387 billion in 2014 and its share also has increased from 0.36% in 2000 to 1.98% in 2014. It shows that if China imposes tariffs on American manufacturing products, the United States will be affected by approximately 85.3%, China itself will be affected by approximately 0.938%.

Table 3-6-1

Value-added decomposition of U.S. manufacturing exports					
Year	TE	DVA		MVA	
	$ billion	$ billion	Share %	$ billion	Share %
2000	10.327	8.975	86.91	0.037	0.36
2001	13.207	11.57	87.61	0.049	0.37

2002	13.831	12.192	88.15	0.059	0.43
2003	17.079	15.027	87.99	0.079	0.46
2004	23.712	20.483	86.38	0.137	0.58
2005	27.569	23.596	85.59	0.19	0.69
2006	36.065	30.589	84.82	0.294	0.82
2007	40.945	34.741	84.85	0.348	0.85
2008	45.431	38.008	83.66	0.466	1.03
2009	44.413	38.735	87.22	0.398	0.9
2010	53.142	45.435	85.5	0.588	1.11
2011	58.153	48.505	83.41	0.781	1.34
2012	60.837	50.816	83.53	0.857	1.41
2013	68.924	57.317	83.16	1.196	1.74
2014	70.143	56.63	80.74	1.387	1.98
Average	/	/	85.3	/	0.938

Statistics source: calculation according to databases of UIBE GVC Index Team and WIOD

Comparing Table 3-5 and Table 3-6-1, we can see that both China and the United States impose tariffs on manufacturing industry will cause certain losses. Among them, if the United States impose tariffs on Chinese manufacturing, which will affect China by 78.25%, the United States itself by 1.61%; if China impose tariffs on American manufacturing, it will affect the United States by 85.3%, China itself by 0.938%. In any case, manufacturing on both sides will be affected, with a slightly greater impact on the US than on China. Maybe that's why the Trump administration set the policy of "Made in America, Again".

From Table 3-6-2, we can see that from 2000 to 2014, the agricultural exports by

the United States to China have increased from $0.519 billion to $11.379 billion, increasing nearly 23 times; Among them, the domestic value added of the United States has increased very fast from $0.469 billion in 2000 to $10.09 billion, nearly 21.5 times, and its share occupied the agricultural industry's total exports value is relatively stable, with an average ratio of 88.914%, and the corresponding Chinese added value shows an upward trend, from 0.17% in 2000 to 0.65% in 2014. It shows that if China imposes tariffs on American agricultural products, the United States will be affected by 88.914%, China itself will be affected by 0.388%.

Table 3-6-2

Value-added decomposition of U.S. agricultural exports					
Year	TE	DVA		MVA	
	$ billion	$ billion	Share %	$ billion	Share %
2000	0.519	0.469	90.37	0.000869	0.17
2001	0.546	0.497	91.03	0.000954	0.17
2002	0.575	0.523	90.96	0.001199	0.21
2003	1.676	1.523	90.87	0.003592	0.21
2004	2.932	2.663	90.83	0.00667	0.23
2005	2.685	2.385	88.83	0.007822	0.29
2006	3.487	3.066	87.93	0.011805	0.34
2007	4.664	4.095	87.8	0.018061	0.39
2008	6.414	5.535	86.3	0.033635	0.52
2009	7.542	6.665	88.37	0.034321	0.46
2010	11.054	9.739	88.1	0.053614	0.49
2011	12.06	10.551	87.49	0.062691	0.52

2012	13.782	11.998	87.06	0.084304	0.61
2013	12.372	11.024	89.1	0.068717	0.56
2014	11.379	10.09	88.67	0.074108	0.65
Average	/	/	88.914	/	0.388

Statistics source: calculation according to databases of UIBE GVC Index Team and WIOD

Compared with the Tables 3-6-1 and 3-6-2, the impact that China imposed tariffs on US agricultural products on the United States is 88.914%, which is higher than that China imposed tariffs on US manufacturing on the United States (85.3%); the impact that China imposed tariffs on US agricultural products on China's itself is 0.388%, which is lower than that of manufacturing industry (0.938%), so it also confirms why China firstly imposed tariffs on American agricultural industry.

In general, the additional tariffs on manufacturing and agricultural industries imposed by both countries will cause losses for both sides. As for the manufacturing industry, the negative impacts on U.S. greater than on China, and as for the agricultural industry, the negative impact on U.S. is significant.

3.3.3 The impact on the global trade

Now let's analyze the impact of additional tariffs imposed by U.S. and China on the rest of the world. From the Table 3-7, we will find that China's manufacturing exports has increased, its share of domestic value added (DVA) remained stable, the share of value added in the United States has decreased, while the share of value added in the rest of the world presented upward trend, from the lowest 15.31% to the highest 22.23%, and an average of 18.81%. This means that if the United States impose tariffs on Chinese manufacturing products, the other countries in the world will be affected by 18.81%.

Table 3-7

Value-added decomposition of Chinese manufacturing exports

Year	TE	DVA	MVA	OVA
	$ Billion	Share %	Share %	Share %
2000	48.013	81.17	1.63	16.23
2001	49.129	82.39	1.48	15.31
2002	63.568	80.23	1.69	15.79
2003	85.759	77.17	1.83	20.02
2004	116.784	74.53	2.01	22.3
2005	156.174	74.72	1.85	22.23
2006	188.722	75.09	1.93	21.63
2007	221.219	74.71	1.96	21.93
2008	232.063	76.3	1.75	20.44
2009	197.391	80.03	1.54	17.5
2010	249.261	78.05	1.53	19.22
2011	275.14	78.23	1.36	19.01
2012	298.448	79.56	1.29	17.89
2013	311.176	79.8	1.2	17.19
2014	333.61	81.75	1.1	15.42
Average	/	78.25	1.61	18.81

Statistics source: calculation according to databases of UIBE GVC Index Team and WIOD

From the Table 3-8-1, we will find that U.S. manufacturing exports also has increased, its share of domestic value added (DVA) remained stable, the share of Chinese value added has increased from 0.36% in 2000 to 1.98% in 2014, but the

share of value added in the rest of the world was stable with an average of 10.57%. This means that if the China imposes tariffs on manufacturing indusrty on U.S., the other countries in the world will be affected by 10.57%.

Table 3-8-1

Value-added decomposition of U.S. manufacturing exports

Year	TE	DVA	MVA	OVA
	$ billion	%	%	%
2000	10.327	86.91	0.36	10.38
2001	13.207	87.61	0.37	9.89
2002	13.831	88.15	0.43	9.24
2003	17.079	87.99	0.46	8.82
2004	23.712	86.38	0.58	9.51
2005	27.569	85.59	0.69	9.94
2006	36.065	84.82	0.82	10.2
2007	40.945	84.85	0.85	9.86
2008	45.431	83.66	1.03	10.8
2009	44.413	87.22	0.9	9.32
2010	53.142	85.5	1.11	10.56
2011	58.153	83.41	1.34	12.29
2012	60.837	83.53	1.41	12.51
2013	68.924	83.16	1.74	12.59
2014	70.143	80.74	1.98	12.69
Average	/	85.3	0.938	10.57

Statistics source: calculation according to databases of UIBE GVC Index Team and

WIOD

Comparing Table 3-7 and Table 3-8-1, we can observe that both China and the United States impose tariffs on manufacturing industry will cause losses for the other countries in the world. If the United States imposes tariffs on Chinese manufacturing, the other countries in the world will be affected by 18.81%; if China impose tariffs on American manufacturing, the other countries in the world will be affected by 10.57%. By contrast, the impact on the rest of the world that the United States imposed additional tariffs on Chinese manufacturing industry than the impact on the rest of the world that China imposed additional tariffs on American manufacturing industry.

As shown in the Table 3-8-2, from 2000 to 2014, the share of the domestic value added of the United States has presented very stable, the corresponding Chinese value added shows an upward trend, and the share of value added in the rest of the world also has increased with an average of 8.11%. This shows that if China imposes tariffs on American agricultural products, the other countries in the world will be affected by 8.11%.

Table 3-8-2

Value-added decomposition of U.S. agricultural exports

Year	TE	DVA	MVA	OVA
	$ billion	Share %	Share %	Share %
2000	0.519	90.37	0.17	7.77
2001	0.546	91.03	0.17	7.17
2002	0.575	90.96	0.21	7.4
2003	1.676	90.87	0.21	6.89
2004	2.932	90.83	0.23	6.69
2005	2.685	88.83	0.29	7.82

2006	3.487	87.93	0.34	8.16
2007	4.664	87.80	0.39	8.16
2008	6.414	86.3	0.52	9.53
2009	7.542	88.37	0.46	8.45
2010	11.054	88.10	0.49	8.55
2011	12.060	87.49	0.52	9.16
2012	13.782	87.06	0.61	9.58
2013	12.372	89.1	0.56	8.05
2014	11.379	88.67	0.65	8.27
Average	/	88.914	0.388	8.11

Statistics source: calculation according to databases of UIBE GVC Index Team and WIOD

Compared with Tables 3-8-1 and 3-8-2, the impact that China imposed tariffs on US manufacturing industry on the rest of the world is 10.57%, which is higher than that China imposed tariffs on US agricultural industry on the rest of the world (8.11%).

In general, the additional tariffs imposed by both countries will cause certain losses in world trade. The impact that the United States imposed tariffs on Chinese manufacturing industry on the world manufacturing trade (18.81%) is greater than that China imposed tariffs on U.S. manufacturing industry on the world manufacturing trade (10.57%). From the agricultural aspect, if China impose tariffs on U.S. agriculture industry, it will have an impact of 8.11% on world agricultural trade.

3.4 The development trend of the US-China trade war

The US-China trade dispute is the largest trade war in economic history, which seriously endangers the security of GVCs, causes the turbulence of global market,

reshapes the world economic and financial pattern, and delays the pace of global economic recovery. Actually, the trade war is not a mere trade activity between China and the United States. Trump hopes to curb China's rise by raising tariffs to force the chinese Yuan to appreciate and guide high-technical manufacturing back to the United States, thereby hindering China's high-tech development and industrial upgrading. While China's trade response is to have bargaining chips in exchange for china's time to deepen reform, and step-by-step solutions to the superbubble in real estate and local government debt. Since neither of China nor the United States intends to trade itself, the probability of continuing a large-scale trade war is low, the next problematic area will be dealing with another issue, and because the fundamental contradiction between China and the United States has not been resolved, the main battlefield in the future between the United States and China will shift from trade to technology and foreign exchange issues.

On August 13, 2018, US President Donald Trump signed “The National Defense Authorization Act (NDAA) for fiscal year 2019”[12], which includes promoting the decoupling of high-tech sectors between China and the United States. “Foreign Investment Risk Review Modernization Act (FIRRMA) of 2018”[13], aims to strengthen the competence of the Committee on Foreign Investment in the United States (CFIUS) and strengthen the examination of foreign enterprises investing in the United States. “The Export Control Reform Act (ECRA)”[14], which strengthens export control, includes countermeasures to prevent the flow of important technologies from the United States to overseas, and "emerging and basic technologies" will also be

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[12] The National Defense Authorization Act (NDAA) for fiscal year 2019.
URL-https://www.congress.gov/115/crpt/hrpt676/CRPT-115hrpt676.pdf

[13] Foreign Investment Risk Review Modernization Act (FIRRMA) of 2018.
URL-https://home.treasury.gov/sites/default/files/2018-08/The-Foreign-Investment-Risk-Review-Modernization-Act-of-2018-FIRRMA_0.pdf

[14] The Export Control Reform Act (ECRA).

URL-https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/644187/EPRS_BRI(2019)644187_EN.pdf

brought under their jurisdiction in the future, covering 14 areas that overlap most of the "Made in China 2025" plan and banning the United States government from purchasing communications equipment from five Chinese enterprises. Under these rules, the United States has tightened restrictions on Chinese companies' investment in the United States, export control, and restrictions on government procurement of Chinese communications equipment. Restrictions are imposed on foreign investment in American companies with key technologies and infrastructure. As the United States stepped up its offensive against China, China also began to fight back. First of all, in addition to retaliating against tariffs on imports from the United States, China announced on May 31, 2019 that it would establish a "list of unreliable entities"[15]. on June 9, 2019, “People's Daily” reported that the Chinese government, in order to effectively prevent and resolve national security risks, strengthen restrictions on technology exports, and establish a "National Technology Security Management list system"[16]. On May 20, 2019, Chinese chairman Xi Jinping, accompanied by the person in charge of trade negotiations between China and the United States, inspected rare earth-related enterprises. Judging from the confrontation between China and the United States, the impact of the science and technology war is brewing.

The escalating US-China trade war has had a great negative impact not only on the economies of China and the United States, but also on the world economy. Foreign companies in China are speeding up the transfer of production overseas because of heavy restrictions on trade with the United States. Moreover, as the United States tightens restrictions on foreign direct investment, Chinese companies and investment funds are struggling to acquire and invest in American companies, especially high-tech companies. Chinese direct investment in the United States fell

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[15] China is establishing an ‘unreliable entities’ list that will include companies and people.

URL-https://www.cnbc.com/2019/05/31/china-is-establishing-an-unreliable-entities-list-that-will-include-companies-and-people.html

[16] China to establish national technological security management list system.

URL-https://www.chinadaily.com.cn/a/201906/08/WS5cfb89c5a310176577230124.html

again, from $46 billion in 2016 to $29 billion in 2017 and sharply to $4.8 billion in 2018. As the U. S. government tightens restrictions on Chinese companies acquiring high-tech companies in the United States, it will become more and more difficult for China to obtain technology from the United States. For China, the introduction of technology from abroad at low cost is one of the keys to supporting high growth. If China loses this advantage before it becomes a developed country, its medium-and long-term economic development will be largely constrained.

The United States will also pay a huge price while promoting decoupling policies. China is the second largest economy in the world, and many American enterprises invest in China. China is the center of the global industrial supply chain, there are a amount of products produced by American companies in China, including final and many intermediate products and components. If economic relations between China and the United States are further delinked, many American companies will have to leave China to shift investment to countries with higher costs than China and import products from those countries. In the end, the United States will not only lose the Chinese market, but also bear the consequences of rising import prices and declining industrial competitiveness. Amid these concerns, prominent U.S. high-tech companies such as HP, Dell, Microsoft, Intel and Apple issued statements against tariff increases during the fourth round of tariff increases, which began on June 17, 2019.

If China and the United States further strengthen restrictions on the flow of talent, materials, funds, and technology, and further decoupling economic relations, the world economy may split. As a result, the supply chain of many industries has been cut off, and multinational enterprises can’t optimize the allocation of resources through the layout of the GVCs. World trade, direct investment and economic growth will all stagnate, and their impact will far outweigh Brexit.

On August 5, 2019, Chinese Yuan broke 7 against the US dollar, and the United States immediately declared China as a currency manipulator. It is no accident that the United States declared China as a currency manipulator at this time. Trump promised

in the 2016 presidential election that if elected, he would immediately identify China as a currency manipulator. So it can be said that Trump fulfilled his original promise. In this trade war, raising tariffs has become the most important means for the United States to suppress China. The United States is trying to curb China's negative impact on exports to the United States by devaluing Chinese Yuan.

Moreover, the US government worries that the appreciation of US dollar could widen its trade deficit and current-account deficit. According to “Macroeconomic and Foreign Exchange Policies of Major Trading Partners of the United States”[17], issued by the U.S. Department of the Treasury Office of International Affairs in May 2019, the Chinese Yuan depreciated by 3.8% against the dollar during the second half of 2018 and is down 8 percent over the past year to 6.92 Yuan to the dollar. In his tweeter on 8th August, 2019, President Trump pointed out that the Fed’s higher interest-rate policy, which kept the dollar strong, made it difficult for US companies such as Boeing to compete on an equal footing internationally, and asked the Fed to cut interest rates to guide the dollar’s depreciation. The United States cannot tolerate the depreciation of Chinese Yuan against US dollar and its possible negative impact on the American economy.

Although the outbreak of pandemic COVID-19 in the world, this does not mean that the United States takes a new or completely different approach to Chinese trade. Indeed, when asked recently whether the United States might relax tariffs on China in order to stimulate the economy and address the COVID-19 outbreak, White House trade adviser Peter Navarro flatly said "no" and characterized any suggestions to the contrary as "absurd." The tariffs imposed by the Trump administration on China have forced many businesses to rethink their supply chains based in China. In short, the exigencies of the COVID-19 outbreak may force the United States to relax certain tariffs on certain products with an "eye" to fighting the virus, but we do not expect the

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[17] Macroeconomic and Foreign Exchange Policies of Major Trading Partners of the United States.

URL- https://home.treasury.gov/system/files/206/2019-05-28-May-2019-FX-Report.pdf

White House to "chart a new course" with respect to China, especially in the long term".[18]

Although China and the United States signed the "Economic and Trade Agreement between the United States of America and the People's Republic of China" at the begining of 2020, and the outbreak of pandemic COVID-19 in the world, the fundamental contradiction between the two sides has not been resolved, because it is impossible for China to give in on issues of principle and make trade in its future development. Nor will the United States easily give up its position as an economic leader.

[18] The Impact of COVID-19 on the US-China Trade Relationship. URL-https://www.mayerbrown.com/en/perspectives-events/publications/2020/03/the-impact-of-covid-19-on-the-us-china-trade-relationship?utm_source=Mondaq&utm_medium=syndication&utm_campaign=LinkedIn-integration

Conclusion

The United States and China are the world's two largest national economies, China is the world's largest exporter and the United States is the world's largest importer. They have so far been important pillars for the global economy. While the total amount of trade expanded when China joined the WTO in 2001, China maintained a long trade surplus with the United States, and the trade imbalance gradually increased, the United States launched a trade war against China on this basis in 2018, but actually the root cause is the escalation of GVCs' competition. As for the impacts of US-China trade war, it will inevitably lead to a negative impact on GVCs, whether on China and the United States, and on the global trade.

As for the negative impact on China's trade, the Chinese government should take positive measures to deal with it.

1) Consultation and cooperation

There is a strong economic complementarity between China and the United States, win-win cooperation is the only right choice for both sides. In the face of differences and frictions in the field of trade, China and the United States should adhere to the principles of equality, reciprocity, resolve differences through consultation, expand the interests of both sides, and jointly safeguard global stability and development. As the two largest economies in the world, the differences between China and the United States are inevitable in economic and trade cooperation. Consultation and cooperation are the best choice to solve the problem. However, in the course of the consultation, China and the United States should have an equal negotiating position, seek common interests between the two sides, and cooperate in good faith so as to achieve win-win results.

2) Scientific and technological innovation

Although China's position in the GVCs is rising, it is still at the low end of the GVCs. In particular, the United States attempt to curb china's gradual increasing to the

top of the GVCs by blocking Chinese technological progress. Improving the key technological innovation ability is the only choice for China to enhance its position in the GVCs and prevent the blocking of technology.

3) Deepening reform

Chinese government should strengthen intellectual property protection and create an open, transparent and equally competitive business environment. It is necessary to improve the legislation of intellectual property rights, strengthen the protection of legitimate rights and interests for foreign investors, encourage the development of new forms of trade, such as digital trade, and promote the integration of small and medium-sized enterprises into GVCs to enhance China's pattern and position in GVCs.

4) Broadening the Market

In order to solve the dilemma, China should actively advocate free trade on a global scale, uphold the multilateral trading system, and continuously enhance China's competitiveness and international position in the GVCs. China should improve the regional structure of foreign trade, open up diversified trade markets, further promote the construction of “Belt and Road”, actively seek cooperation with other countries and regions, and reduce dependence on the United States market.

Specially, the Chinese government needs to fully consider cooperation with Russia in the face of the US-China trade war. It is worth noting that in recent years the export of intermediate goods from Russia to China has been growing rapidly for years, exceeding the growth rates of both Russian exports and Chinese imports the corresponding product in General. This clearly demonstrates the strengthening of the Russian-Chinese trade cooperation is not only broad based on the growth of trade turnover, but also and deeper, increasing the degree of cooperation between States.

Strengthen trade complementarity between China and Russia. In addition to the energy trade between two countries, China and Russia need to expand cooperation in

the field of food. China has always been the main export destination of American soybeans, and about 60% of American soybeans were exported to the Chinese market in 2017, accounting for 58% of the total agricultural products exported by the United States to China, and 11% of the total US exports to China. But China's imports of soybeans from the U.S. have fallen sharply amid ongoing trade war. In the long term, it is necessary and possible to diversify China's grain import channels as soon as possible. Russia has great potential as a substitute for American soybeans. In recent years, China-Russia agricultural trade has developed rapidly. China's imports of grain from Russia reached 712.4 thousand tons in 2017, and 4.5 tmes increased from 2014, with a growing variety of imports, including grains, soybeans, flaxseed and rapeseed. To that end, with a sharp reduction in imports of agricultural products such as soybeans from the United States, China could cooperate with Russia on agricultural products. And also China and Russia can re-position consumption patterns, produce capital-intensive and technology-intensive products, strengthen cooperation in the field of services, and expanded the development of high-tech services.

Strengthen and promote "Belt and Road" and Eurasian Economic Union construction. How to better realize the connection between the "Silk Road Economic Belt" and the construction of the Eurasian Economic Union and promote the economic and trade cooperation between China and Russia and the members of the Eurasian Economic Union is a strategic subject of great practical significance. China has strong economic complementarity with the member countries of the Eurasian Economic Union, and has great potential for trade and investment cooperation. The bilateral trade volume reached $109.4 billion in 2017. Guided by “Research on the silk road economic belt and the Eurasian Economic Union” signed by China and Russia in 2015, China and the representatives of the Eurasian Economic Commission and the States members of the Eurasian Economic Union jointly signed the “Agreement on trade and economic cooperation between the Eurasian Economic Union (EAEU) and the People's Republic of China (PRC)” in May of 2018, which covers a wide range of areas, including intellectual property rights, customs

cooperation and trade facilitation, government procurement and sectoral cooperation, as well as new issues, including competition and electronic commerce. The two sides intend to strengthen cooperation and further simplify customs clearance procedures through the exchange of information and experience, reduce the cost of goods trade, further reduce non-tariff barriers to trade, improve the level of trade facilitation, and create a good environment for industrial development. This is the first important institutional arrangement reached between China and the Eurasian Economic Union in the field of economic and trade cooperation, marking the beginning of the new stage of economic and trade cooperation between the two sides from the project-driven to the system-led, and has a milestone significance in promoting the construction of the "Silk Road Economic Belt" and the construction of the Eurasian Economic Union.

Although China and the United States signed the "Economic and Trade Agreement between the United States of America and the People's Republic of China" at the beginning of 2020, and the outbreak of pandemic COVID-19 in the world may force the United States to relax certain tariffs on certain products from China, but we do not expect the White House to "chart a new course" with respect to China, especially in the long term, because the fundamental contradiction between the two sides has not been resolved. Now, the US Presidential Administration accuses China of hiding information about the appearance of COVID-19 and threatens with new financial and trade sanctions. The probability of continuing a large-scale trade war is low, the main battlefield in the future between the United States and China will shift from trade to technology and foreign exchange issues. For Chinese government, it should take positive measures to deal with the negative impacts of trade war, strengthen the cooperation with other countries and regions, especially with Russia. If the trade war can be solved by win-win way, it will undoubtedly be a happy ending.

Reference:

Monographs

1. Gereffi G, Korzeniewicz M. Commodity chains and global capitalism[M]. London: Praeger, 1994.

2. Gereffi G. A Commodity Chains Framework for Analyzing Global Industries[M]. Working Paper for IDS, 1999b.

3. Krugman P. R., Maurice Obstfeld, Marc J. Melitz. International Economics Theory & Policy[M]. PEARSON, 2012: 21-110.

4. Porter M E. Competitive Advantage: Creating and Sustaining Superior Performance [M]. NewYork: Free Press, 1985 :25-29.

5. Ricardo D. Principles of political economy and taxation[M]. Batoche books: Kitchener, 2001.

6. Smith A. The Wealth of Nations[M]. Industrial Systems Research, 2015.

7. Sutyrin Sergei F., Olga Y. Trofimenko and Alexandra G. Koval. Russian trade policy-Achievements, Challenges and Prospects[M]. Routledge, 2019.

Journals Articles

8. Baldwin, Richard & Javier Lopez-Gonzalez. Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses[J]. NBER Working Papers 18957, 2013.

9. Deardorff A.V. Fragmentation in simple trade models[J]. North American Journal of Economics and Finance, 2001(12):121-137.

10. Ernst D, Guerrieri P. International production networks and changing trade patterns in East Asia: The case of the electronics industry[J]. Oxford Development Studies, 1998, 26(2): 191-212.

11. Gereffi G, Humphrey J, Sturgeon T. The Governance of global value chains[J]. Forth coming in Review of International Political Economy, 2003, 11(4):5-11.

12. Humphrey J, Schmitz H. Governance in global value chains[J]. IDS Bulletin, 2001, 32(3):19 -29.

13. Hummels D., Ishii J., Yi K.M. The Nature and Growth of Vertical Specialization in World Trade[J]. Journal of International Economics, 2001(54):75-96.

14. Krugman P. R. Increasing Returns, Monopolistic Competition and International Trade[J]. Journal of International Economic, 1979(9), 469-479.

15. Krugman P. R. The theory of interstellar trade[J]. Economic Inquiry, 2010, 48(4): 1119-1123.

16. Koopman R., Wang Z., Wei S.J. How Much of Chinese Exports is Really Made in China? Assessing Domestic Value-added When Processing Trade is Pervasive[J]. NBER Working Paper No.14109, 2008.

17. Koopman R., Powers W., Wang Z.,Wei S.J. Give Credit Where Credit is Due: Tracing Value-added in Global Production Chains[J]. NBER Working Paper No.16426, 2010.

18. Koopman R, Wang Z, Wei S J. Estimating domestic content in exports when processing trade is pervasive[J]. Journal of development economics, 2012, 99(1): 178-189.

19. Koopman R., Wang Z., Wei S.J. Tracing Value-added and Double Counting in Gross Exports[J]. American Economic Review, 2014, 104(2):459-494.

20. Kogut, B. Designing global strategies: comparative and competitive value-added chains[J]. Sloan Management Review, 1985, 26(4):15 -28.

21. Los Bart, Erik Dietzenbacher, Robert Stehrer, Marcel Timmer and Gaaitzen de Vries. Trade Performance in Internationally Fragmented Production Networks:

Concepts and Measures[J]. WIOD Working Paper No.11, 2012.

22. Lan Qingxin, Dou Kai. An Analysis of the Sino-US Trade Friction from the Perspective of the Global Value Chain[J]. Comparative Economic & Social Systems, 2019, 05-0067-11.

23. Li Feng. Analysis of Sino-US Trade Friction from the Perspective of Division of Labor in Global Value Chain[J]. Southern economy, 2019, 07- 001-15.

24. Lv Yue, Ma Jialin, Tian Lin. The Impact of Sino－US Trade Friction on the reconstruction of Global Value Chain and China's Plan[J]. International trade, No. 8, 2019.

25. Ouyang Xiangying, Jia Zhongzheng. Strategy, structure and space: Economic Complementarity between China and Russia - the Context of US-China Trade war[J]. Eurasian Economy, No.1, 2019.

26. Popova Liudmila V., Zhou Weidi. Russia’s trade with China in the face of sanctions a search for new market opportunities[J]. Russia trade policy, 2019:171-197.

27. Srholec M. High-tech exports from developing countries: A symptom of technology spurts or statistical illusion?[J]. Review of World Economics, 2007, 143(2): 227-255.

28. Stehrer R.. Trade in value added and the valued added in trade[J].WIOD Working Paper No. 8, 2012.

29. Stehrer R., Neil Foster, Gaaitzen de Vries. Value Added and Factors in Trade: A Comprehensive Approach[J]. WIOD Working Paper No.7, 2012.

30. Timmer M P., Bart Los, Robert Stehrer, Gaaitzen J. de Vries. Fragmentation, Incomes and Jobs: an analysis of European competitiveness[J]. WIOD Working Paper No.9, 2012.

31. Tan Jingrong, Guo junliang, Yu bin. Analysis of China-US Manufacturing Bilateral Trade Structure Base on Global Value Chain[J]. Science and Economy, No. 32, 2019.

32. Wang Z, Powers W, Wei S J. Value chains in East Asian production networks: An international input-output model based analysis[J]. Offcie of Economics Working Paper, 2009.

33. Wang Z., S. Wei, X. Yu, and K. Zhu. Measures of Participation in Global Value Chain and Global Business Cycles[J]. NBER Working Paper No. 23222, 2017a.

34. Wang Z., S. Wei, X. Yu, and K. Zhu. Characterizing Global Value Chains: Production Length and Upstreamness[J]. NBER Working Paper No. 23261, 2017b.

35. Yu Yongding. Deep Root and Future Trend of Sino-US Trade War[J]. Research on Financial and Economic Issues, 2019,(8): 3-12.

36. Yu Zhen, Zhou binghui, Xie xubin, Wang zinan. Participation in the Reconstruction of the GVCs and Sino-U.S. Trade Frictions[J]. China's Industrial Economy, 2018, 07-0024-19.

37. Zhang Ziming, Yue Qiu. Sino-US Trade Friction Based on the Perspective of Global Value Chain[J]. Journal of South China Normal University (Social Science Edition), No.2, 2019.

38. Wang Wuqing, Su Qingyi, Zhao Xincheng. The Cause, Measure and Benefit Analysis of Sino-US Trade Imbalance from the Perspective of Global Value Chain[J]. Statistics and Information Forum, Vol. 35, No.2, 2019.

Reports

39. Gereffi G., Humphrey J., Kaplinsky R., Sturgeon T. Introduction: Globalization, Value Chains and Development[R]. IDS Bulletin, 2001(32):1-8.

40. Helpman E. Trade, FDI and the Organization of Firms [R]. NBER working Paper

No.12091, 2006.

41. Koval Alexandra G., Navrotskaya Natalia A., Prospects for the development of global value chains in China and Russia[R]. Saint-Petersburg State University, April 22, 2020.

42. Sirkin Harold L, Michael Zinser, Douglas Hohner. Made in America, Again: why manufacturing will return to the U.S.[R]. The Boston Consulting Group, August 25, 2011.

43. Timmer M P, Erumban A A, Gouma R, et al. The world input-output database (WIOD): contents, sources and methods[R]. Institue for International and Development Economics, 2012.

44. UNIDO's industrial development 2002/2003[R] . Vienna, 2002:107 -116.

45. United Nations Industrial Development Organization. Competing through Innovation and Learning-the Focus of UNIDO's Industrial Development 2002/2003[R]. Vienna, 2002:107-116.

46. Wang Z, Wei S J, Zhu K. Quantifying international production sharing at the bilateral and sector levels[R]. National Bureau of Economic Research, 2013.

Internet resources and electronic databases

47. Ministry of Finance of the People's Republic of China, http://www.mof.gov.cn/index.htm, and http://gss.mof.gov.cn/

48. Office of the United States Trade Representative, https://ustr.gov/

49. RIGVC UIBE, 2016, UIBE GVC Index, http://rigvc.uibe.edu.cn/english/D_E/database_database/index.htm.

50. U.S. DEPARTMENT OF THE TREASURY, https://home.treasury.gov/

51. World Input-Output Database, http://www.wiod.org/database/wiots16

52. World Bank database, https://wits.worldbank.org/CountryProfile/en/Country/USA/Year/2017/Summary/