China Economic Quarterly International 4 (2024) 182–211

Contents lists available at ScienceDirect

China Economic Quarterly International

journal homepage: www.keaipublishing.com/en/journals/china-economic-quarterly-international

The return of protectionism: Prospects for Sino-US trade relations in the wake of the trade war☆

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ARTICLE INFO

JEL classification:
F14
D31
F13

Keywords:
US-China trade war
Trade policy
China shock
Supply chain reconstructing

ABSTRACT

Over the past six years, the Sino-US trade war has not only reshaped the relationship between the world's two largest economies but also profoundly influenced the global economic and trade patterns. This paper reviews the background, process, and implications of the Sino-US trade war, examining its impact on China, the United States, and the broader global trade landscape across various socioeconomic dimensions. We begin by reviewing the development of Sino-US trade relations in the past 20 years. Next we detail the background and evolution of the trade war. We then discuss the economic consequences of the conflict, including the effect of tariff increases on product prices, employment, investment, consumption, and welfare. Finally, we explore the reshaping of supply chains in the aftermath of the trade conflict, and the interaction between trade policies and industrial policies within the context of the Sino-US trade war.

Existing literature indicates that the Sino-US trade war has resulted in significant welfare losses for both countries, with surprisingly little impact on employment. The tariffs have not achieved the intended outcome set by policymakers. Specifically, the additional tariffs imposed by the United States on China have neither effectively addressed trade imbalances nor brought manufacturing jobs back onshore. Our paper offers a new perspective on the complexity of the current international trade conflict.

1. Introduction

In the late 1980s and early 1990s, following the end of the Cold War, global economic integration accelerated into a period of 'hyperglobalization' (Rodrik, 2011; Goldberg, 2023). During this period, many economies undertook reforms to promote the construction of the market economy systems, reduce marginal tax rates, relax controls over the financial industry, improve business environments, and attract foreign investment. As a result, ideology and geopolitics no longer served as major barriers to global trade and cross-border investment. On the one hand, a series of transnational agreements were enacted to facilitate global trade and cross-border investment, including the signing of the North American Free Trade Agreement (NAFTA) in 1992, the upgrade of the General Agreement

☆ We thank Dandan Zhang and Xiaohan Zhong for comments and suggestions. Hong Ma thanks the financial support of the Social Science Foundation of China (Grant No.23&ZD046) and Tsinghua University Scientific Research Program (Grant No.2023TSG08102). Jingxin Ning thanks financial support from the Fundamental Research Funds for the Central Universities in UIBE (Grant No.23QD10). Contact authors: Hong Ma, School of Economics and Management, Tsinghua University, Beijing, China, email: mahong@sem.tsinghua.edu.cn; Jingxin Ning, School of International Trade and Economics, University of International Business and Economics, Beijing, China, email: ningjingxin@uibe.edu.cn.
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https://doi.org/10.1016/j.ceqi.2024.09.003
Received 24 August 2024; Received in revised form 21 September 2024; Accepted 22 September 2024
Available online 10 October 2024

on Tariffs and Trade (GATT) to the World Trade Organization (WTO) in 1995, and the establishment of the Eurozone in 1999. These measures continuously reduced trade and investment costs, expanding the multilateral trade system. On another front, reductions in shipping and air transportation costs, advances in information technology, and standardization of product production allowed production chains to be divided and reorganized among economies, making large-scale cross-border outsourcing of intermediate products increasingly profitable.

Driven by efficiency and profits, multinational companies have become the most active promoters of globalization. They sell products in the most profitable markets, source raw materials at the lowest cost, and organize production in regions with the most abundant labor. Meanwhile, they transfer substantial profits to ‘tax havens’ while waiting for the next investment opportunity. This process has provided developing countries with abundant labor but scarce capital with employment opportunities, access to overseas markets, and economic growth. China stands out among these economies, with a significant influx of foreign capital following Deng Xiaoping's famous remarks during his 1992 inspection tour of southern China.[1]By December 2001, when China formally joined the WTO, it had gradually reformed central and local regulations under the guidance of market principles and global standards, allowing China to ‘take part in international economic and technological cooperation and competition on a broader scale, in more spheres and on a higher level, and make the best use of both international and domestic markets’ (Jiang, 2002, Report to the Sixteenth National Congress of the Communist Party of China). Businessmen from Hong Kong and Taiwan, along with transnational capitals from Europe, the United States, Japan, South Korea, and other countries, converged with migrant workers from central and western China in coastal industrial development zones, generating tremendous productivity and economic vitality. In 2008, China surpassed the US to become the world's largest manufacturing producer; in 2009, it surpassed Germany to become the world's largest exporter of goods; and in 2010, it surpassed Japan to become the world's second largest economy. In 2017, China became the largest source of imports for 67 economies and the largest export market for 36 economies.[2] China's deep integration into the global production and trade system, with rapid growth in foreign trade, is undoubtedly one of the most important factors in its economic take-off.

Figs. 1 and 2, respectively, show changes in China's share of world manufacturing output, total global exports, and total global imports since 1995. For comparison, this paper also reports the share of G7 countries and the top five exporters or importers. It can be seen that since 1995, China's manufacturing output and import and export trade have increased rapidly. In2017,[3]the total manufacturing output of China reached 32% of the total global production, and it even increased to more than 35% in 2020, while the US only accounted for 12%. In fact, in 2020, China's share in total global production was more than the sum of the G7 countries. Regarding the total value of trade, even after the shock of the Sino-US trade conflict and the COVID-19 pandemic, China's total exports reached about 15% of global exports in 2020. At the same time, China has become the second largest importer after the US, with imports accounting for 11. 5% of the total world imports in 2020, only 2 percentage points lower than those of the US.

In 1994, Lee Kuan Yew, then Prime Minister of Singapore, pointed out that China has been the largest participant, and the process of China's entry into the WTO and integration into the world economy has been one of the most important events in the development of the global economy since the 1990s (Branstetter and Lardy, 2008). At that time, China had the most abundant labor resources in the world. According to the Heckscher-Ohlin model, the best development strategy is to choose labor intensive industries for specialized production (Lin et al., 1994). In fact, China has followed such a development strategy to maximize its comparative advantages. In the early 1990s, labor-intensive textiles and other light industrial goods such as textiles, clothing, shoes, and hats accounted for almost 40% of China's total exports. With the development of vertical integration in the international market, multinational companies can outsource parts and accessories with different technical levels and factor intensities to different countries and regions for production according to their comparative advantages determined by endowments and then assemble parts and accessories before entering the market. Following the law of comparative advantages, the relatively labor intensive parts of capital-intensive or technology-intensive products are outsourced to a labor-rich developing country (China) for production. Mechanical and electrical products are in line with the characteristics of global production division and offshoring of tasks, so they have gradually replaced textiles as the largest category of products exported by China. In 2020, textile, clothing, shoes and hat exports only represented 13. 9% of total Chinese exports, while exports of mechanical and electrical products accounted for 44.4%.

The aggregation of production chains in the coastal areas of China means that employment opportunities are also concentrated in these regions. Countries or regions that produce the same labor-intensive products or parts face strong competition from China. Classical trade theories (such as the factor endowment effect) and empirical studies have long recognized the distribution effect of import competition from low-income countries.[4] Most of these studies believe that under the premise of full employment and free labor mobility, the negative impact of import shock can be transformed into the impact on specific factors at the national level with cross-industry and cross-regional labor mobility. Additionally, as long as the government can compensate the groups with interest losses in trade through transfer payment or other means, trade will not only improve the net welfare, but can even achieve a Pareto

[1] According to Han et al. (2012) Fig. 1, the proportion of foreign direct investment (FDI) in China's GDP rapidly increased from just over 2% in 1992 to 6% in 1994.

[2] Calculation is based on the 2017 CEPII-BACI database.

[3] In the following figures, tables, and data descriptions, this paper chooses the year 2017 as a key time node to explain the impact of the Sino-US trade conflict. The year 2017 is the last complete year before the Sino-US trade war, which represents the global trade environment before the trade conflict and intensified de-globalization, and provides a benchmark year for the analysis in this paper.

[4] For example, in the framework of Heckscher-Ohlin's factor endowment theory, Samuelson and Stolper proved that the trade opening was beneficial to the owners of abundant factors in a country but not to the owners of scarce factors. Two classic textbooks, *International Economics* edited by Feenstra and Taylor (2011) and *International Economics* edited by Krugman et al. (2022), have discussed this issue in detail.

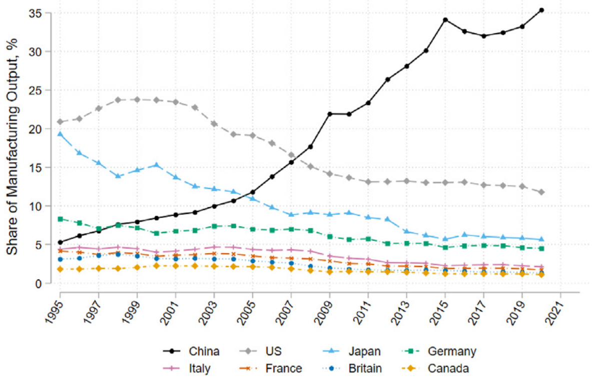
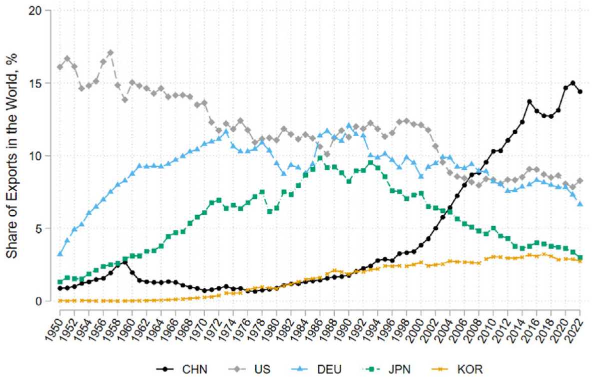
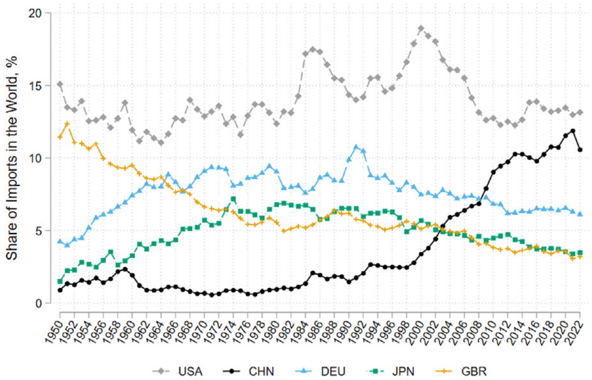


Fig. 1. The global share of total manufacturing output of China and the G7 countries.
Data source: OECD TiVA database 2023



(a) The export share of the top five exporting countries



(b) The import share of the top five importing countries

Fig. 2. The global share of imports and exports of the top five importers and exporters
Figures (a) and (b) select the top five global exporters and importers in 2017 respectively.
Data source: WTO Stats database.

improvement. However, the two premises are often not established in reality. Specific industries tend to gather in specific areas and contribute a considerable proportion of employment in these areas. Once enterprises in these industries are forced out of the market by import competition, there will be mass unemployment. Since the twenty-first century, the cross-regional mobility of the labor market in the United States has been significantly weakened compared to that in the 1980s. At the same time, government transfer payments or other relief measures have failed to meet the expected purpose. Therefore, import competition faced by specific industries (such as labor-intensive industries such as shoemaking, furniture manufacturing, etc.) from low-income countries often results in a negative impact on the regional labor market. Autor et al. (2013) found that regions facing greater import competition from China often experienced more severe manufacturing shrinkage and unemployment, which was more prominent among workers with low education levels. This phenomenon was called the ‘China syndrome’ or the ‘China shock’.

A series of follow-up studies after Autor et al. (2013) found that the labor market that was more affected by the ‘China shock’ experienced a significant decline in wages, housing prices and taxes, and a significant increase in poverty rates, divorce rates and death rates caused by alcoholism or drug abuse. Autor et al. (2016) offer a comprehensive review of the literature on the ‘China shock’, which will be further enriched in the second section of this article. It is necessary to point out that the so-called ‘China shock’ in Autor et al. (2013) should be understood as the employment and wage shock of low-income countries (‘South countries’) participating in the global trading system to the low-income groups in developed countries (‘North countries’). Due to the huge scale of China's export of manufacturing products and its high growth rates, it is difficult for wage earners in developed countries who have lost mobility to make adjustments in a short time, resulting in serious socioeconomic consequences. Autor et al. (2013) and the following studies on the US regional labor market were in line with the research of Case and Deaton (2015) on the mortality of white Americans (see *Death of Despair*) and the research of Piketty (2014) on increasing inequality in developed countries (see *Capital in the Twenty-first Century*). Unlike Deaton and Piketty, who focused on economic stratification and intensified social contradictions between ethnic groups and classes in developed countries, Autor et al. (2013) directly attributed the problem in the US labor market to China's import competition, which had a great social and political impact.

Furthermore, Autor et al. (2020) found that the ‘China Shock’ led to political polarization among different ethnic groups in a region: counties facing more intense competition from China's products were more likely to vote for Republican candidates, indicating that the ‘China Shock’ partly led to Trump's victory in the presidential election. In fact, after the 2016 US presidential election, Trump highlighted trade protectionism as soon as he took office. On his first day in office, he signed an executive order to withdraw from the Trans-Pacific Partnership (TPP). In August 2017, the US launched a Section 301 investigation into China's trade behavior. Since 2018, the United States has launched a Section 201 investigation into photovoltaic panels and washing machines and then launched a Section 232 investigation into imported steel and aluminum products for national security reasons. On April 3rd, 2018, EST, the US Trade Representative Office released a list of 1333 commodities worth USD 50 billion, claiming to impose an additional 25% punitive tariff on these commodities according to the results of Section 301 investigation. Almost at the same time, on April 4th, 2018, Beijing time, the Ministry of Commerce of China announced that it would impose an additional 25% tariff on 106 categories of American goods worth USD 50 billion exported to China, indicating the breakout of the Sino-US trade war.[5] In the following two years, China and the US continued to expand the scope of tariffs on each other, and the trade conflict escalated, even expanding to the scientific, technological, and political fields. In January 2020, after several rounds of negotiations, China and the US finally reached a Phase One Deal. However, the additional tariffs imposed by the two sides on each other remained above 20% until the date of completing this article (February 18th, 2024).

The Sino-US trade war involves the two largest economies in the world, covering products worth more than USD 500 billion. It has been referred to as the ‘largest trade war’ since the Great Depression and one of the most important macroeconomic events in the international economy in recent years. In the past six years, the Sino-US trade war has not only reshaped the relationship between the two largest economies, but also profoundly affected the global economic and trade pattern. Through data analysis and literature review, this paper reviews the background, process and content of the Sino-US trade war, as well as its impact on China and the United States and the global trade pattern on various social and economic dimensions.Fajgelbaum and Khandelwal (2022) and Caliendo and Parro (2023) have conducted literature reviews on the Sino-US trade conflict and Sino-US trade relations. Compared with these two studies, on the one hand, this paper supplements some latest studies; on the other hand, it is more balanced to pay attention to research on the influence of the Sino-US trade conflict on China. In addition, to provide readers with more detailed information, this paper conducts more descriptive analyses on the structure and evolution of the Sino-US trade and tariffs. Finally, this paper discusses the global industrial restructuring and industrial policy competition triggered by the trade war.

Since the Sino-US trade conflict, especially since the Russia-Ukraine conflict, global geopolitics has seen great changes. In many cases, ideology and national security concerns have surpassed traditional economic efficiency and interests. The Sino-US trade conflict tends to spread to fields such as investment, technology, military, and ideology. Due to the theme and space limitations, this paper will not review studies on the competition and conflicts in these fields but will focus on the trade related issues. The structure of this paper is as follows. Section 2 describes the level, structure, and trend of Sino-US trade in the past 20 years; Section 3 introduces the evolution of the Sino-US trade war, and reports in detail the timeline of tariff increase and the categories of products involved; Section 4 introduces the economic consequences of the Sino-US trade war, including the tariff passthrough, and the effects of tariffs on employment, investment, consumption, and welfare; Section 5 reviews reconstruction of the supply chain caused by the trade war and the interaction between trade and industrial policies under trade disputes; Section 6 provides concluding remarks.

2. Sino-US trade: Levels, structure and trends

2.1. Development of the Sino-US trade since China's entry into the WTO

In December 2001, China officially joined the WTO, which was an important milestone in China's economic opening. China's entry

[5] Section 3 of this paper will describe in detail the timeline, process and content (including tariff lists and tariff-involved product value) of the Sino-US trade conflict.

into the WTO has had a profound impact on its foreign trade and economic growth, and on the global economic pattern, especially Sino-US trade relations. To enter the WTO, the China government took the initiative to implement a series of market-oriented reforms and trade liberalization measures in the 1990s. Ma (2019) summarized the trade liberalization measures, including: (1) In 1994, the foreign exchange system was reformed to abolish dual exchange rates and form the foreign exchange market. The RMB depreciated against the US dollar, forming a fixed exchange rate that was actually pegged to the US dollar. (2) Import tariffs, especially those on intermediate goods, were greatly reduced. The weighted average tariff dropped rapidly from 32.2% in 1992 to 15.2% in 1997, and then slowly dropped to 13.4% in 2001.[6] (3) Nontariff barriers had been greatly reduced: the share of goods requiring quotas or import licenses in total imports was greatly reduced from about 50% in 1990 to about 8.5% in 2001 (Lardy, 2002). (4) It gradually liberalized control over the participation of enterprises in foreign trade. In 1985, only 800 enterprises in China were directly engaged in international trade (Lardy, 2002), while more than 68,000 enterprises were directly engaged in export business in 2001 according to customs statistics. (5) A large number of local and central laws and regulations were abolished or revised to ensure that they conform to the WTO rules. Meanwhile, local protectionism in favor of local enterprises was greatly reduced, and the level of market integration was greatly improved.

These policy adjustments not only helped China's economy integrate into the global market but also provided a wider development space for Sino-US economic and trade exchanges. Fig. 3 shows the total annual amount of China's imports from and exports to the US at nominal prices according to data from the China General Administration of Customs. As shown in the figure, the bilateral trade volume between China and the US was only about 80 billion US dollars in 2001, and increased to 664.5 billion US dollars in 2022, with an increase of more than 7 times. With the rapid growth of trade volume, the trade surplus between China and the US has been expanding. In 2023, China exported 500.3 billion US dollars of goods to the US and imported 164.2 billion US dollars of goods from the US, with a trade surplus of 336.1 billion US dollars, reflecting the trade imbalance between them.

The growth of US imports from China in the past 20 years can be roughly divided into two stages according to the proportion of US imports from China in its total imports (see Fig. 4 (a)). The first stage is from the end of the 20th century to 2017. During this period, the proportion of US imports from China in its total imports increased rapidly. According to data from the US Bureau of Economic Analysis, the proportion of US imports from China in its total imports was 7.79% in 1998 and rose to 21.58% in 2017. The second stage is the period after the outbreak of the Sino-US trade war, with a declining share of US imports from China in its total imports. In 2023, it dropped to 13.94%, almost returning to the level before 2005. If the purpose of the US launching a trade war is to reduce its dependence on direct imports from China, the effect can be said to be remarkable. In these two stages, the share of China's imports from the United States in its total imports first declined dramatically from 12% in 1998 to just over 7% in 2011, and then recovered to slightly lower than 9% in 2015. However, after 2016, the share declined again, especially after the outbreak of the trade war, from 8.35% in 2017 to 6.42% in 2023. Fig. 4 (b) shows such a dynamic adjustment process. Compared with Fig. 4 (a) and 4 (b), it can be seen that at least before 2012, the trade imbalance between China and the US had been continuously strengthened. After the outbreak of the Sino-US trade war in 2018, there was a trend of 'economic decoupling' between China and the United States.

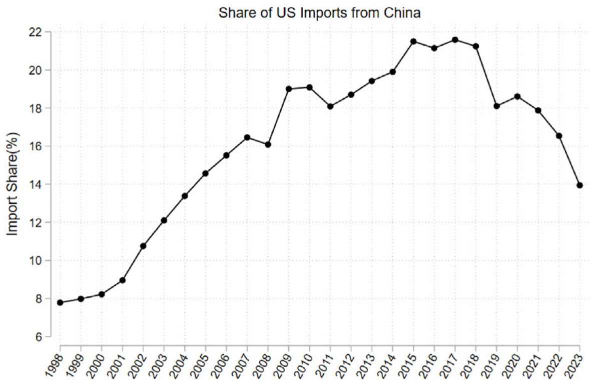
2.2. *Complementarity, competition, and imbalance of the Sino-US trade*

The rapid growth of Sino-US trade since China's entry into the WTO reflects the complementarity of the economic structures of the two countries. The complementarity arises from the differences in economic structures and industrial advantages. As the 'world factory', China has comparative advantages in manufacturing, especially in labor-intensive industries. In contrast, the US has comparative advantages in high-tech products, high-end manufacturing, and agriculture. Table 1 shows the evolution of the bilateral trade structure between China and the United States from 1998 to 2017. China's most exported products to the US include labor-intensive products such as textiles and clothing and miscellaneous products. In recent years, electronic products have gradually replaced textiles and clothing as the largest category of products exported by China to the US. China's main imported products from the United States include agricultural products, chemicals, electronic products, and mechanical products, especially high-tech products such as chips, instruments and apparatuses, and auto parts. In recent years, the proportion of agricultural products and mineral products imported by China from the United States has increased rapidly. In 2017, these two categories of products represented one fifth of China's imports from the US. In addition, the proportion of imported automobiles reached 9. 8%. However, the proportion of mechanical products and electronic products had fallen sharply.

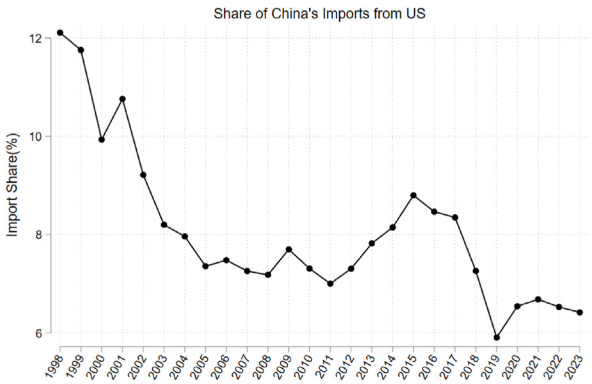
The complementarity of the trade structure between China and the US can be interpreted from the following aspects. According to the neoclassical trade theories of both Ricardo and Heckscher-Ohlin, China and the US carry out specialized production and trade exchange according to their comparative advantages, and realize trade benefits. China's comparative advantage lies in labor-intensive manufacturing. As the largest producer of industrial products, China's production has exceeded its domestic consumption by a large margin, and nearly one fifth of its exports are to the USA. For a long time, most of the surplus obtained by China's foreign trade has come from the US. The comparative advantages of the US lie in technology R&D, financial services and huge consumer market. As the largest consumer and importer in the world, the US has long been in a situation where savings are less than investments. The production of massive clothing, shoes, boots, toys, and electronic products consumed by Americans is characterized by 'labor intensive and pollution intensive', which is not in line with its own comparative advantages, so it purchases these products from countries with the lowest production cost in the world. For a long time, more than 1/3 of the US trade deficit has come from China.

[6] In fact, considering the factors such as tariff reduction and exemption in processing trade and tax evasion, the actual tariff rate is much lower than the weighted average tariff calculated according to the customs tariff description (Branstetter and Lardy, 2008; Zhai and Li, 1996).

Fig. 3. The commodity trade volume between China and U.S. from 1998 to 2022.
Data source: General Administration of Customs of China



(a) Proportion of US imports from China in its total imports



(b) Proportion of China's imports from the US in its total imports

Fig. 4. The trade share between China and the U.S. from 1998 to 2023.
Data source: UN Comtrade.

The R&D, manufacturing, and consumption constitute the core part of the industrial chain. All chains in this process are closely linked around the world, forming a complex global value chain (GVC). Finance serves the entire industrial chain process, providing financial support and risk management for transnational operations. According to GVC theory, production activities are increasingly dispersed in different regions of the world, and intermediate inputs, including raw materials, semifinished products, and parts, flow across borders in this process, linking global production and supply chains, and intermediate inputs become an important part of global trade. American consumers and manufacturers are looking for the most cost-effective industrial intermediate products on a global scale, that is, global sourcing. The trade pattern between China and the US is characterized by a vertical division of labor. From this point of

Table 1
The structure of China-U.S. Bilateral trade.

Industry	Share of China's exports to the US		Share of China's imports from the US	
	1998	2017	1998	2017
Agricultural products	1.50%	0.86%	**6.35%**	**13.09%**
Food and tobacco	0.76%	0.89%	2.22%	1.15%
Minerals	1.75%	0.38%	1.16%	5.92%
Chemicals	3.51%	3.25%	14.33%	9.47%
Plastics and rubber	4.44%	4.31%	4.92%	5.29%
Textiles and clothing	**26.40%**	**15.18%**	5.04%	2.09%
Wood and paper	1.37%	1.89%	5.89%	5.72%
Ceramic and glass	1.86%	1.71%	0.68%	0.81%
Pearls, gems, precious metals, etc.	0.79%	0.83%	0.22%	3.44%
Metal products	6.38%	5.24%	4.09%	3.55%
Mechanical products	6.01%	10.96%	**17.91%**	**10.27%**
Electronic products	**21.59%**	**35.24%**	**20.55%**	**11.73%**
Transportation (excluding automobiles)	1.15%	1.06%	9.34%	9.18%
Automobiles	2.07%	3.52%	0.77%	9.80%
Instruments and apparatus	4.07%	2.48%	5.52%	7.64%
Weapons and accessories	0.01%	0.33%	0.68%	0.48%
Miscellaneous products	16.26%	11.88%	0.34%	0.35%
Works of art	0.06%	0.01%	0.00%	0.01%
Total	100%	100%	100%	100%

Data source: China's customs data; US customs data

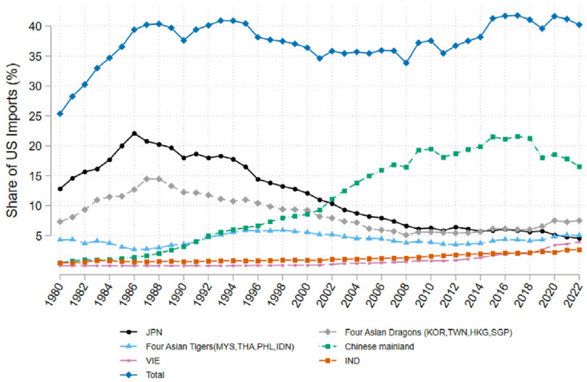


Fig. 5. The import share of U.S. from East Asia and Southeast Asia.
Data source: CICE database.

view, the changes in the export share of the electronics and machinery industries between China and the United States reflect the continuous adjustment and division of labor and reorganization of the global industrial chain of electronics and machinery products, in which multinational companies play a leading role.

According to the above theoretical system, the trade pattern between China and the US reflects the 'flying geese' pattern proposed by the Japanese scholar Kaname Akamatsu in the 1930s. From the perspective of international trade, the rapid growth of China's exports to the US is a process in which the manufacturing supply chains in East Asia and Southeast Asia have been constantly adjusted, and the manufacturing and final assembly of the downstream industries have gradually been transferred to coastal areas of China. Fig. 5 provides supporting evidence by showing the distribution and changes in the share of American imports from the major Asian economies. It can be seen that US imports from East Asia and Southeast Asia (including China, Japan, South Korea and some members of ASEAN, as well as China's Hong Kong and Taiwan) have basically stabilized at 35%–40% in the past 40 years. However, the share of US imports from different regions is characterized by a decline in one region and a rise in another region. Around 1986, the share of American imports from Japan reached its peak, accounting for about 22% of its total imports, and then gradually declined. The share was shared by four 'Asian Dragons' (South Korea, Singapore, Hong Kong, and Taiwan) and four 'Asian Tigers' (Indonesia, Malaysia, the Philippines, and Thailand). After the Southeast Asian financial crisis broke out in 1997, these emerging Asian economies were severely hit. As a result, the share of US imports from China has increased rapidly, and China's advantages of abundant labor forces and the vast hinterland market have made it quickly surpass the 'Dragons' and 'Tigers', which also adopt the export-oriented development model. In 2017, the share of US imports from China reached 21 6%, which means that more than one dollar out of every 5 dollars of goods imported by the US came from China.

However, the trend was reversed by the Sino-US trade war in 2018, and the share of US imports from China began to decline rapidly. In 2022, the share dropped to 16.5%. However, the share of US imports from the four 'Asian Dragons' and the four 'Asian Tigers'

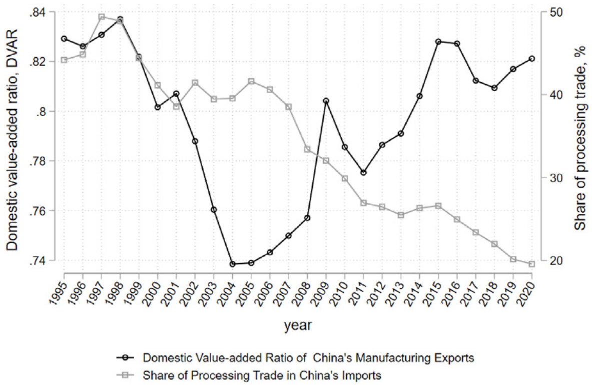


Fig. 6. The DVAR of China's exports and the import share of China's processing trade.
Data source: OECD-TIVA database 2023; China's customs data.

increased from 10. 3% in 2017 to 12.6% in 2022. The share of US imports from Vietnam increased rapidly from 2% in 2017 to 4% in 2022.

Koo (2022) described the changing pattern of production and trade among the above-mentioned economies as a 'pursued era'. According to his definition, from the 1970s to the 1990s, European and American economies were pursued by Japan, and after the 1990s, Japan was pursued by emerging Asian economies (four Asian dragons, four Asian Tigers and the Chinese mainland). After the Asian financial crisis in 1997, especially after China's accession to the WTO in 2001, the Chinese mainland began to rely on its large size to pursue the four Asian dragons, four Asian tigers, and even developed countries in Europe and America. In this 'pursued era by China', the production of labor-intensive products from the US, Europe, Japan, and South Korea was transferred to the Chinese mainland due to their rising labor costs, while their comparative advantages in capital-intensive and even technology-intensive manufacturing industries were gradually lost due to the free flow of capital and technology. Therefore, the domestic value added of China's exports has gradually increased since China's entry into the WTO (Ma et al., 2015; Kee and Tang, 2016), while Chor et al. (2021) found that the upstreamness of China's imports had been increasing. Fig. 6, according to the OECD-TIVA data, shows the changing trend of the domestic value added rate (DVAR) of China's exports (left), indicating that the DVAR of Chinese mainland exports has increased rapidly since 2004. Fig. 6 also shows the proportion of processing trade in China's total imports (right), indicating that the proportion of conventional processing trade in China's imports has dropped rapidly.

In the following two pictures, this paper tries to illustrate the increasing competition between Chinese and American products. Fig. 7 shows the changes in the export share of Chinese and American products in the world market (4-digit HS code). The scattered points are more concentrated in the upper left corner (the second quadrant). For the HS-4 products in this quadrant, the share of the US in world exports decreased from 2000 to 2017, while the share of China increased. The econometric regression also shows such a correlation: for products in which the share of the US in world exports decreased, the share of China increased.

Fig. 8 shows that revealed comparative advantages (RCA) of China's export had been improved in 2000–2017 in the HS-4 products in which the US used to have revealed comparative advantages.

These observations show that with the rapid development and industrial upgrading of China's economy, competition in Sino-US trade relations has gradually increased, especially in the high-tech field. The United States has long been a global leader in technological innovation, high-end manufacturing, biotechnology, and aerospace. In recent years, China has developed rapidly in the fields of artificial intelligence (AI), 5G, new energy vehicles (NEVs), electronic manufacturing, etc. by large-scale investment, relevant industrial policies, and the scale advantage of its domestic market, narrowing the gap with the US. Competition between China and the US in key technical fields has constantly increased (Schneider-Petsinger et al., 2019; Ju et al., 2024; Huang, 2022).

Under the above-mentioned pattern of division of labor, the proportion of domestic manufacturing production in the US has been decreasing. The closer the products are to the industrial downstream (the larger the total trade volume), the more likely their production is transferred to developing countries with lower labor and land costs. For the balance of foreign trade of the US, it presents an increasing deficit in commodity trade. Fig. 9 shows that in the past two decades, the US deficit in commodity trade has been increasing and maintained on the scale of 600–800 billion US dollars for a long time after 2009. The US deficit in commodity trade with China has been increasing, accounting for nearly 50% of its total trade deficit in 2015. Fig. 9 shows that this trend reversed quickly after the outbreak of the Sino-US trade conflict in 2018. In 2023, although the US trade deficit soared to nearly USD 1.3 trillion, China's share in it has decreased to approximately 24%.

Ma and Qin (2021) made a detailed analysis on the trade imbalance between China and the United States. They found that China's surplus in commodity trade with the US was significantly overestimated due to factors such as the pricing method, the entrepot trade, the trade mark-up, and differences in the division of labor between China and the United States in the GVC. According to the China Ministry of Commerce GVC Research Group,[7] in 2017, China's domestic added value driven by China's exports to the US was 285.8

[7] see https://images.mofcom.gov.cn/www/201412/20141223154610238.pdf.

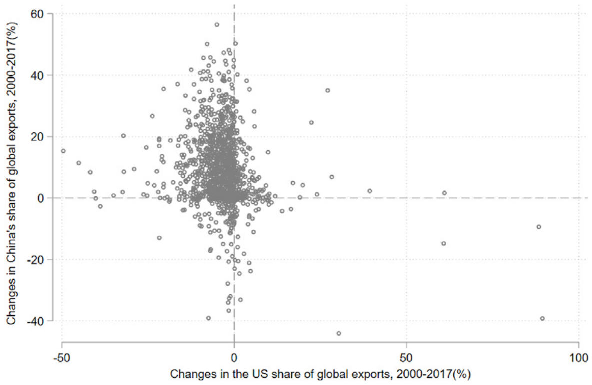


Fig. 7. The change in export share of China's and U.S. products in the global market
Notes: each scatter point in the figure represents a HS-4 product.

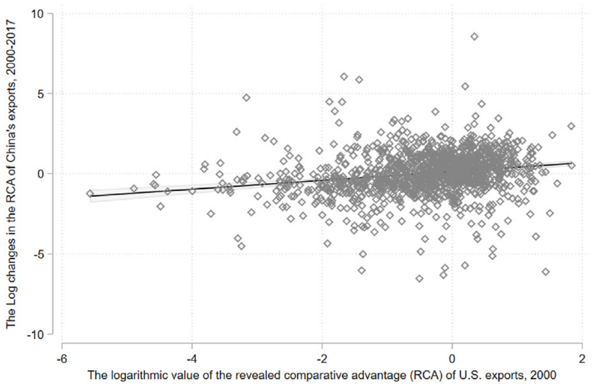


Fig. 8. Changes in revealed comparative advantage of China's export products (2000–2017)
Notes: each scatter point in the figure represents a HS-4 product.

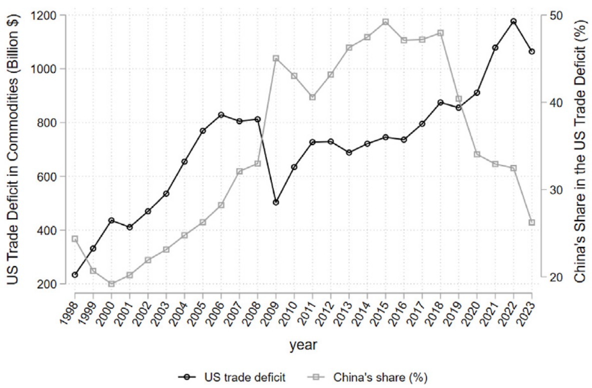


Fig. 9. The U.S. deficit in commodity trade and China's share (2000–2023).
Data source: US Customs data.

billion US dollars, while that driven by China's imports from the US was USD 127.4 billion. China's surplus in commodity trade with the US based on trade added value statistics was only 158.4 billion US dollars, which was 43% lower than the accounting based on the total value of goods.

In addition, since 2015, the US has been the largest source country of China's deficit in service trade, and China's deficit in service trade with the US has been rising. According to the statistics of the US Bureau of Economic Analysis, between 2006 and 2019, US service trade exports to China increased from 10 billion to 56.5 billion dollars, with an increase of 465%. In 2019, the US surplus in service trade with China was USD 36.4 billion, about 30 times that of 2006.

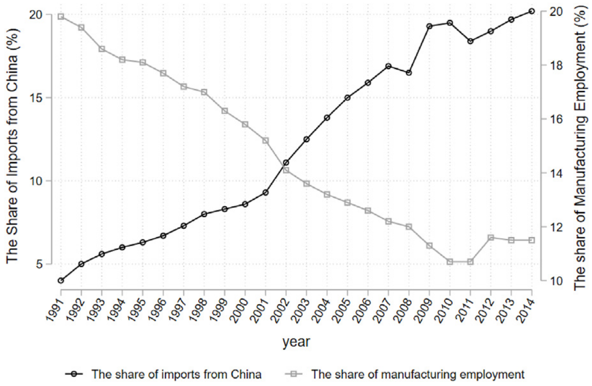


Fig. 10. U.S. manufacturing employment and U.S. imports from China.

In addition to the export of goods and services, a country can provide goods and services to another country by establishing local subsidiaries or joint ventures by means of foreign direct investment (FDI) and selling products and services directly to the local market. There are great differences in the optimal "going global" paths chosen by Chinese and American companies: for the products and services provided by American companies to the China market, approximately 70% are sold locally in the China market through American-funded companies in China and only approximately 30% are exported to China. However, China's enterprises mainly provide goods and services to the US market through exports. If the volume of local sales in the form of FDI is considered, the US realized a 'sales surplus' of approximately 34 billion dollars to China in 2017. It should be noted that the benefits from local FDI are mainly shared by the capital that can flow freely across borders, local labor forces, and local suppliers, while the blue-collar workers in the source countries of capital are excluded from this wealth creation process. In the next section, we will focus on reviewing the literature on the economic and social consequences of the 'China shock'.

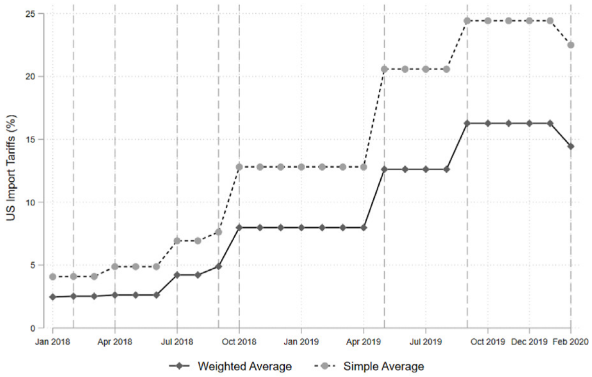
2.3. Impact of "China shock" on the US economy and society

Since the mid-1990s, the number of manufacturing employees in the US has been declining (Pierce and Schott, 2016), and the proportion of manufacturing employment in the whole society has also been declining. This coincides with China's accession to the WTO and integration into the world economic and trade system. As shown in Fig. 10, in 1991, China accounted for 4% of the total value of goods imported by the US, and this proportion exceeded 20% in 2014. During the same period, the proportion of manufacturing employment in total employment in the United States dropped from almost 20%–11%. Therefore, rapid growth in imports from China is considered as the causes of the domestic economic imbalance and employment problem in the US, especially the significant impact on the economic structure and labor market in the US. Autor et al. (2013) and their review of the literature in 2016 called this phenomenon 'China Syndrome' or 'China shock'.

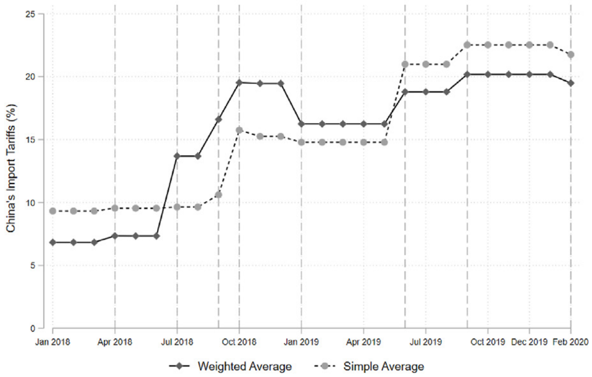
Autor et al. (2013) have aroused great social repercussions and widespread concern, and spawned a lot of follow-up studies. These studies show that import competition from China has significantly affected the US labor market, including manufacturing and non-manufacturing fields, leading to an increase in unemployment rates and a decrease in wages. Pierce and Schott (2016) used different levels of decreased uncertainty of different industries exporting to the US after China's accession to the WTO[8] to construct a difference-in-differences (DID) method, and found that these industries with high uncertainty in the past suffered greater employment losses after the uncertainty is eliminated: comparing two industries with uncertainty in the 25th percentile (low uncertainty) and the 75th percentile (high uncertainty), respectively, the latter is 0.08 log points higher than the former. Autor et al. (2013) focused on the differences in import competition in different commute zones in the US to construct a Bartik index to measure the exposure of different areas to import shocks from China. Their regression analysis showed that an increase of 1000 US dollars (unit worker) in imports from China during 2000–2007 led to a decrease of nearly 0.6 percentage points in the proportion of manufacturing employment among the working-age population. Since the US imported 1839 dollars per unit worker from China during 2000–2007, the estimated impact range estimated by Autor et al. (2013) means that the 'China Shock' caused the proportion of manufacturing employment in the US to drop by 1.1 percentage points, that is, 55% of the actual decline in manufacturing employment in the same period.

The impact of 'China shock' on the US labor market has extended to the level of social structure. Autor et al. (2014, 2019, 2020,

[8] Before China and the US reached an agreement on China's accession to the WTO, the US Congress would consider whether to continue granting China the Normal Trade Relationship (NTR) next year. If denied, China's exporters would face tariffs much higher than those of other exporting countries with NTR treatment.Handley and Limão (2017) believed that this led to different export uncertainties for China's products in different industries. At the end of 1999, China and the US reached an agreement in Beijing that the US supported China's accession to the WTO, and then the US Senate agreed to grant China the Permanent Normal Trade Partnership (PNTR) treatment, thus eliminating the tariff uncertainty faced by China's exports to the US. Handley and Limão (2017) found that one third of China's exports growth to the US came from the elimination of this uncertainty. Furthermore, Liu and Ma (2020) found that the elimination of export uncertainty promoted the R&D and investment in fixed assets of Chinese companies, which could partly explain the rapid increase in TFP of Chinese companies after China's entry into the WTO.



(a) U.S. import tariffs against China



(b) China's retaliatory tariffs against the U.S.

Fig. 11. Changes in U.S. tariff increases and China's retaliatory tariffs
Notes: The weighted average tariff rate in Figure (a) calculated using U.S. import data from China in 2017 as weights; the weighted average tariff rate in Figure (b) calculated using China's ordinary import data from U.S. in 2017 as weights.
Data Source: USITC; Tariff Policy Commission of the State Council of China; WITS.

2021) explored the impact of 'China Shock' on US households and enterprises from multiple perspectives. For example, it would affect the wage, inequality and family stability, reduce marriage and fertility rates, and inhibit R&D investment and innovation activities of enterprises. In addition, Feler and Senses (2017) pointed out that high import competition from China put pressure on local finance in the US, leading to a decrease in the supply of public goods and housing prices. McManus and Schaur (2016) focused on the impact of US imports from China on the health of US manufacturing workers and found that in small companies the risk of work-related injuries and diseases increased, which was equivalent to a 1%–2% drop in wages. Chen et al. (2022) found that import competition from China leads to increased tax avoidance by US manufacturing enterprises. Autor et al. (2021) found that although the 'China Shock' reached its peak around 2010, its negative impact on the US labor market will persist for a long time.

There are also controversies about the negative impact of the 'China Shock' in academia. Feenstra et al. (2019) point out that trade had always included imports and exports, and the "net employment loss" of US participation in globalization would be greatly reduced if the employment created by US exports were considered. Xu et al. (2023) note that the fluctuation of the real estate market in the US amplified the impact of the 'China Shock'. Wang et al. (2018), from the perspective of supply chains, find that the US downstream industries, especially the service industries, used a lot of intermediate input from China; for these industries, the employment effect of the China Shock was actually positive. Caliendo et al. (2019) used the dynamic general equilibrium model to estimate that the China Shock reduced manufacturing employment in the US, but overall welfare in the US increased by 0.2%. The latest literature review of Caliendo and Parro (2023) found that 'China Shock' was not the main reason for the decline in manufacturing employment in the United States. In addition to the US, the so-called China Shock also had an impact on other developed countries and some developing countries.[9] However, in other countries, we have not seen the rise of trade protectionism or conservatism on the same scale as the US.

As mentioned above, the impact of US imports from China on the US labor market is mainly concentrated in labor-intensive

[9] For example, Balsvik et al. (2015) find that the China import shock made low-skilled Norwegian workers unemployed or left the labor market. Medina (2024) and Mansour et al. (2022) find that in the face of competition from China products, the quality of export products of Peruvian enterprises had improved, but female workers faced greater pressure from import competition and their interests were relatively damaged.

industries, and these industries (such as textiles and furniture) are often concentrated in specific areas. In the short term, it is difficult for labor to move between regions and industries, so the import competition faced by specific industries is reflected in the negative impact in specific areas. This leads to the political and ideological polarization of ethnic groups. Autor et al. (2020) find that the import competition from China led to an increasing ideological polarization in some areas and a right-wing tilt in politics in some areas. Specifically, the constituencies that suffered more from China's import competition have shown a right-wing tilt in media viewing habits and political beliefs, the ideological orientation of campaign donors has become more polarized, and the number of conservative Republican representatives has increased. Che et al. (2022) find that the import competition from China made the presidential candidates of democratic parties more popular, and voters in areas greatly affected by the import competition turned to supporting political parties that pursued trade policies consistent with their economic interests, that is, democratic parties that were more likely to advocate protectionism and oppose free trade. Colantone and Stanig (2018) find that globalization, especially economic and trade relations with China, contributed to the rise of populism. Rodrik (2021), from the perspective of political economy, analyze the promoting effect of intensified import competition from China on the populist movement and its political outcomes.

Table 2 summarizes the related literature on ‘China Shock’. A more comprehensive literature review on the impact of ‘China Shock’ is available in Autor et al. (2016).

In summary, with the expansion of the trade scale between China and the United States, trade frictions and disputes have gradually increased. The Sino-US trade conflict appears to be the result of the unbalanced goods trade between China and the US, but is essentially “the manifestation of the intensified contradiction in the distribution of interests between the major countries under globalization” (Ma, 2018). The import competition from China has had important impacts on the American labor market, enterprises, social structure, and even political governance. Furthermore, with the improvement of China's comprehensive strength, the competition between China and the US in the technical field and global governance has also intensified. A series of economic and trade policies of the US since the Trump administration not only reflect its short-term internal pressures in finance, social distribution, and elections, but also reflect the reality that the world trade system is facing major changes. In fact, since the global financial crisis, the growth of global trade in goods has slowed significantly. Relative data shows that during 2012–2019, the growth rate of global trade in goods was almost the same as that of global GDP, hovering around 2.3%. In contrast, before the global financial crisis, the growth rate of global trade in goods had remained more than twice that of global GDP for a long time. Stagnated growth in the competitive environment means changed trade structures and the intensified contradiction of interest distribution. Against this background, the trade war launched by the US is not only the response of the frontrunners to competitive pressure from the pursuers but also encompasses the long-term strategic intention of deconstructing and reshaping the global economic and trade system.

3. Overview of the development and main policies of the Sino-US trade war

After the Trump administration came to power in 2016, the US government's trade policies tended to be conservative. In 2017, the US Department of Commerce initiated 82 antidumping and countervailing investigations, an increase of 58% compared to 2016. The Sino-US trade conflict has also escalated. It should be noted that the US has been using antidumping, countervailing, and Section 337 investigations against China.[10]They are trade measures aimed at specific industries or products, but have been upgraded after the 2008 financial crisis. In August 2017, the US launched a Section 301 investigation into China's trade behavior. In November 2017, the US formally submitted a document to the WTO, opposing the grant of the China market economy status, which means that the US would continue to use surrogate country prices in antidumping investigations of Chinese companies.

Since 2018, Sino-US economic and trade relations have become increasingly tense. On April 3, 2018, the US Trade Representative Office (USTR) initiated Section 301 investigation into China's acts, policies, and practices related to technology transfer, intellectual property, and innovation (hereinafter referred to as Section 301 investigation), announcing that an additional 25% tariff would be imposed on some imported goods from China. On April 4, Beijing time, China announced countermeasures. Since then, at least 12 rounds of formal negotiations have been held between China and the United States, and the leaders of the two countries have also held face-to-face talks. However, the trade conflict has been escalating, in which we can see that the US has put ‘extreme pressure’ to test the bottom line of China and China adopted a ‘tit-for-tat’ strategy. The rest of this section will introduce the measures, evolution, and specific content of the Sino-US trade conflict in detail.[11]

3.1. Timeline and tariff rate changes of the tariff increase between China and the US

On January 22, 2018, the Trump administration announced that it would impose import tariffs on imported solar products and washing machines based on Section 201. On February 5, the China Ministry of Commerce launched antidumping and countervailing investigations into American sorghum. On March 23, the Trump administration decided to impose additional tariffs of 25% and 10% on imported steel and aluminum products on the grounds of ‘threating national security’ in Section 232 of the 1962 Trade Expansion Act. In response, on March 23, China announced an increase in import tariffs on products such as pork, fresh fruit, and recycled aluminum. It

[10] Section 337 authorizes the US government to impose sanctions on the imported goods for infringing the intellectual property rights of US enterprises. In the Strategic Thinking of the Sino-US Trade Friction Escalation: From the Perspective of Japanese Experience (Ma et al., 2018), the authors predicted and analyzed the trade protection measures that the Trump administration could take after taking office.

[11] Bown and Kolb tracked and recorded in detail the trade protection measures taken by the Trump administration.See https://www.piie.com/blogs/trade-and-investment-policy-watch/2018/trumps-trade-war-timeline-date-guide.

Table 2
Related literature on the "China shock".

Research topic	Related literature	Conclusion
Labour market	Autor et al. (2013, 2014, 2016, 2019, 2020, 2021)	The increase in imports led to an increase in unemployment rates, a decrease in labor participation rates, and a decrease in wages in local labor market where the manufacturing industries competing with import products were located.
	Acemoglu et al. (2016)	During the decade of China Shock (2000–2011), industries that were more vulnerable to China's import competition experienced greater employment losses.
	Pierce and Schott (2016)	The US granting China Permanent Normal Trade Relations (PNTR) status led to a 0.47 increase in the reduction of employment in industries with high trade uncertainty compared to those with low trade uncertainty
Welfare and distribution effects	Caliendo et al. (2019)	The overall welfare of the US increased by 0.2%; manufacturing employment declined, and labor shifted to service industries.
	Kim and Vogel (2020)	The US granting China Permanent Normal Trade Relations status resulted in a 3.1 percentage point decrease in welfare in U.S. commute zones that were 90% exposed to the China shock compared to those that were 10% exposed
Supply of public goods; housing price	Feler and Senses (2017)	The decline in the supply of local public goods and the decline in housing prices in the US.
Workers' health	McManus and Schaur (2016)	The growth of Chinese imports gatively impacted the health of U.S. manufacturing workers, with the increased risk of injury and illness in small enterprises equivalent to a 1%–2% reduction in workers' wages
Firms	Chen et al. (2022)	US manufacturing firms increased tax avoidance activities
Election campaign	Autor et al., (2020)	Counties suffering higher import competition from China's were more likely to vote for Republican candidates.
	Che et al. (2022)	Import competition from China made the democratic presidential candidates more popular.

should be noted that the above two investigations were not only aimed at China. For example, Section 201 investigation on the grounds of damaging industries was aimed at all countries except Canada and Mexico. On April 3, the USTR Office announced Section 301 investigation of China's acts, policies, and practices related to technology transfer, intellectual property, and innovation, announcing the list of imported products from China subject to an additional 25% tariff, indicating the escalated trade conflict between the two largest economies in the world. Wright Heze, then USTR, explained the composition of the first list of products of Section 301 investigation, following the following principles to select China commodities to enter the list: (1) products supported by "Made in China (2025)"; (2) Exclude those believed by experts to have an adverse impact on the US economy or have been restricted by laws and regulations; (3) those with high substitution from third countries; (4) those with small negative impact on SMEs and consumers. In view of every tariff increase imposed by the US, China has taken countermeasures.

Fig. 11 (a) shows the dynamics of tariffs imposed by the United States on Chinese goods.[12] The weighted average tariff increased from 2.53% in January 2018 to 16.53% in December 2019. Fig. 11 (b) shows the dynamics of China's imposition of additional tariffs on US goods. The weighted average tariff increased from 6.83% in January 2018 to 20.18% in December 2019. It should be noted that in January 2019, China suspended additional import tariffs imposed on automobiles and parts from the US, so the average tariff rate in January 2019 decreased. Under the guidance of the "all-round opening up" strategy, China launched a new round of tariff concessions in 2017, reducing the most-favored nation (MFN) tariffs on daily chemical products, clothing, shoes, hats, automobiles, and parts.[13] With the signing of the Phase One Deal between China and the US, they have reduced the tariffs imposed on some products. In February 2020, the average additional tariff imposed by the US on Chinese products was 14.45%, and the average additional tariff imposed by China on US products was 19.49%.

3.1.1. US section 201 tariffs

Solar panels and washing machines: In February 2018, the US imposed additional tariffs on imported solar panels and washing machines: 30% tariff on solar panels and 20%–50% tariff on washing machines, which involved about 10 billion dollars of US imports, including about 1 billion USD from China. China did not take countermeasures against it.

[12] When calculating the weighted average tariff, the proportion of imports of HS-6 goods from the counterpart to the total imports is used as the weight (for China's imports, this paper uses the proportion in general trade imports to calculate the weight), while Bown (2019) used the ratio of exports from exporting countries to the world exports of HS-6 goods as weight to calculate the weighted average tariff. The method adopted by Bown (2019) can avoid the endogeneity problem between tariffs and imports to some extent, but the structure of goods exported by the US to the world is quite different from that exported to China, thus overestimating the tariff level of China.

[13] Qin and Ma (2023) study the tariff reform in 2017–2019. They found that at the product-country level, the weighted tariff rate of imported consumer goods in China dropped from 7.2% in 2017 to 4.9% in 2019, with a decrease of 32%. Furthermore, from 1 July 2018, the automobile tariff was reduced to 15%, and the tariff on auto parts was reduced to 6%. Since MFN tariffs are applicable to all WTO members (including the US), the adjusted MFN tariffs should be multiplied by the additional tariff rates imposed by China on related goods from the US to calculate China's import tariffs from the US.

3.1.2. US section 232 tariffs

Steel and aluminum products: On March 8, 2018, according to the results of Section 232 investigation disclosed by the US Department of Commerce, US President Trump signed an announcement and decided to impose additional tariffs on USD 18 billion of aluminum and steel products imported from China from March 23, 2018, including an additional 10% import tariff on aluminum products and an additional 25% import tariff on steel products. As a response, China announced on March 23, 2018 that it would impose retaliatory tariffs on products (about 3 billion dollars) imported from the United States. It was formally implemented on April 2, 2018, including an additional 25% tariff on eight imported products (HS-8) such as pork and recycled aluminum, and an additional 15% tariff on 120 imported products such as fresh fruit and wine.

3.1.3. US section 301 tariffs

In August 2017, US President Trump signed a memo to launch a Section 301 investigation into China; On March 23, 2018, the USTR Office released the results of Section 301 investigation. Based on the results, the USTR Office announced on April 3, 2018 (US time) that it would impose additional tariffs on products (about USD 50 billion) imported from China. The products that will be imposed additional tariffs were mainly those that benefit from China's industrial policies, such as the aerospace and information and communication industries.

The first batch of Section 301 tariffs: On April 3, 2018 (US time), the USTR Office announced imposing an additional 25% tariff on imported products (about 50 billion dollars, 1333 HS-8 products) from China. The list was adjusted on June 15, and the first batch of the list covered 818 HS-8 products (mainly products in high-tech industries such as aerospace, information technology, and auto parts), about 34 billion dollars. It was officially implemented on July 6.

As a response to Section 301 tariffs implemented by the US on July 6, 2018, China imposed the same retaliatory tariffs on products of the same size imported from the US, imposing an additional 25% tariff on 545 HS-8 products (about 34 billion dollars). It came into effect on July 6, mainly covering agricultural products, automobiles, aquatic products, etc.

The second batch of Section 301 tariffs: On June 15, 2018, the US adjusted the list of tariffs imposed in April for China's products benefiting from "Made in China (2025)" and other industrial policies. The second list imposed an additional 25% tariff on products of about 16 billion dollars, which came into effect on August 23.

In response to it, China also made a counterattack of the same scale, imposing an additional 25% tariff on about 16 billion dollars of American products, which also came into effect on August 23. The list mainly included 114 products, such as chemical products, medical equipment, and some energy products.

The third batch of Section 301 tariffs: On July 10, 2018, the USTR Office released a list of goods (about 200 billion dollars) imported from China, and would impose an additional 10% tariff on the listed products on September 24. The list mainly included intermediate products such as electronic products and auto parts, as well as consumer goods such as mobile phones, computers, furniture, and table lamps. Compared with the first two batches of Section 301 tariffs, the products covered by this list were larger in scale and contained more consumer goods.

In response to this, on August 3, 2018, China announced that it would impose additional 5%–25% retaliatory tariffs on 60 billion dollars of imported goods from the United States. This list contained a large number of intermediate goods, followed by capital goods and consumer goods. The retaliatory tariffs came into effect on September 24. It included four sub-lists, covering 2493, 1078, 974 and 662 HS-8 products, respectively. The additional tariff imposed on the first two sub-lists was 10%, and that imposed on the last two sub-lists was 5%.

The fourth batch of Section 301 tariffs: After a period of negotiations, on May 10, 2019, the Trump administration decided to impose another 15% tariffs on the 200 billion dollars of China's products. Subsequently, China also further raised tariffs on the third batch of products (about 60 billion dollars). Specifically, an additional 15% tariff was imposed on 2493 HS-8 products in the first sub-list, 10% on 1078 HS-8 products in the second sub-list, 5% on 974 HS-8 products in the third sub-list, and no additional tariff was imposed on 595 HS-8 products in the fourth sub-list. This batch of additional retaliatory tariffs came into effect on June 1, 2019.

The fifth batch of Section 301 tariffs: On August 1, 2019, Trump announced that the US planned to impose additional tariffs on about 300 billion dollars of products imported from China, covering almost all the remaining products imported from China. On August 13, 2019, the US announced that it would postpone the imposition of additional tariffs on some products in the list, and announced two sub-lists, which brought about great uncertainty. The first sub-list came into effect on September 1, 2019, imposing an additional 15% tariff on products (about 125 billion dollars) imported from China, mainly covering products such as tools, equipment, clothes, and shoes. The second sub-list came into effect on December 15, mainly covering products such as toys, electronics, and other consumer goods, but it was cancelled on December 13.

In response, on August 23, 2019, the Customs Tariff Commission of the State Council of China issued a notice to impose an additional 5% or 10% retaliatory tariff on products (about USD 75 billion) imported from the United States, which was divided into two sublists, the first of which took effect on September 1, 2019, and the second of which came into effect on December 15, 2019. In addition, China announced that it would resume the additional 5% or 25% tariff imposed on auto parts originating in the United States on December 15, 2019.

The Phase One Deal between China and the US: As China and the US reached the Phase One Deal on December 13, 2019, the additional tariffs determined to be imposed by the US on December 15 were cancelled; and for about 125 billion dollars of imported goods subject to additional tariffs that took effect on September 1, 2019, the additional tariff rate was reduced to 7.5%. The retaliatory tariffs determined to be imposed by China on December 15, 2019 were also cancelled. In addition, China continued to suspend the tariff increase on automobiles and parts originating in the US. On January 15, 2020,[14] the Phase One Deal was formally signed. Subsequently, both China and the US issued announcements to reduce the tariffs previously imposed. The USTR Office issued an announcement, deciding that from February 14, 2020, the US would reduce the additional tariff on the first part (about 120 billion dollars) of the USD 300 billion products from China from 15% to 7.5%. At the same time, the Customs Tariff Commission of the State Council of China issued an announcement that from February 14, 2020, it would adjust the additional tariffs for about 75 billion dollars of imported goods originating in the US. For the products imposed with an additional 10% tariff as a response to the fifth batch of Section 301 tariffs, the additional tariff rate was reduced from 10% to 5%; for products that were originally subject to an additional 5% tariff, the tariff rate was reduced from 5% to 2.5%.

In the above analyses, we have described the timeline for the increase in tariffs between China and the US in 2018–2019. Table 3 reports the changes in the additional tariff rates imposed by China and the US since the trade conflict, as well as the changes in the final tariff rates, including the MFN tariffs. To show the tariffs of each batch more concisely, we have sorted out the announcement time, entry-into-force time, tariff rates, and product categories of each batch of tariff increase and retaliatory tariffs. As shown in Table 4, the tariff increase between China and the US has gradually escalated, from the initial tariff increase for a small number of products to the tariff increase for large-scale products in September 2018. Among the products imported by the US from China, 1269 HS-8 products were not subject to additional tariffs, accounting for 34.5% of the US imports from China in 2017. Among products imported from the US, 1917 HS-8 products were not subject to retaliatory tariffs, accounting for 29.12% of China's imports from the US in 2017.

There are two other channels for bilateral tariff changes during the Sino-US trade war. One is the list of product exclusions; and the other is trade remedy measures such as antidumping and countervailing. Bown (2021) analyzed these other channels.

(1) List of product exclusions

During the Sino-US trade war, both the US and China exempted some products subject to additional tariffs through the list of product exclusions. On July 6, 2018, the USTR Office released Section 301 Tariff Exclusion Process: US importers, end customers, trade associations, and other stakeholders with interests related to related products could submit exclusion applications on the website of the US federal government. When the USTR Office handled the exclusion applications, its decision to accept or reject the applications reflected the complicated political and economic considerations, including the substitutability of products, that is, whether they can be easily purchased from third countries; whether the products may cause serious economic damage to the US; the strategic importance of the products, that is, whether they benefit from 'Made in China (2025)′ or other industrial plans.[15] The US government announced the first batch of exclusions from Section 301 tariffs on December 28, 2018. By the end of Trump's administration, the US had issued more than 50 product exclusion announcements.[16] However, since the list of product exclusions involved the description of specific product variety, that is, only more specific products under the HTS-10 code could be exempted from tariffs, rather than all products, it is difficult to directly calculate the exclusion ratio of tariff increase through the lists. Based on the ratio of the tariff revenue to the import value in 2018–2020, Bown (2021) estimated that products in the list of product exclusions accounted for 4% of the products subject to Section 301 tariffs imposed by the US on China.

Similarly, on May 13, 2019, China issued an announcement to exclude products subject to additional tariffs imposed on US products. On September 11, 2019, China announced the first batch of exclusion list of products subject to additional tariffs imposed on US products, and the tariff increase was suspended after September 17, 2019. The list covered 16 commodities (HTS-8), of which additional tariffs for 12 products were refunded. By 2023, China has released four lists of exclusions for products and 13 lists with extension of the exclusion. The criteria for the exclusion applications focus mainly on three aspects: (1) the substitutability of products, that is, whether it is easy to find alternative sources of goods; (2) whether the tariff increase brings serious economic damage to the applicants; (3) whether the tariff increase has a significantly negative impact on related industries or causes serious social consequences. However, due to the lack of tariff rebate data by product, it is impossible to know whether the products under each HS-8 in the list are excluded from additional tariffs. Assuming that the tariff exemption covers all products under each HS-8 in the list of product exclusions, Bown (2021) estimated that during 2019–2020, 16% of products subject to retaliatory tariffs were exempted from additional tariffs.

(2) Trade remedy measures such as antidumping and countervailing Trade remedy measures such as anti-dumping and countervailing are another channel that affects bilateral tariffs between China and the US during the trade friction. Compared to Section 301 tariffs, antidumping and countervailing investigations are usually targeted at specific commodities and need a stricter investigation process. However, after the outbreak of the Sino-US trade war, antidumping and countervailing investigations initiated by the two sides have become more frequent. Bown (2021) pointed out that before the trade war, more than 7% of US imports from China were subject to antidumping and countervailing duties, which increased to 10.3% at the end of 2020.

In addition, the policy measures taken during the Sino-US trade conflict were not limited to additional tariffs. Trade policies such as the entity list, export control, negative list of foreign investment, technology transfer restrictions, and investment review also had a long-

[14] It is the USA Eastern Standard Time.

[15] The exclusion procedure of the US required applicants to provide detailed information on the key factors, so that the USTR could comprehensively evaluate the impact and importance of each application when making decisions.

[16] Yao et al. (2020) summarized the exclusion and extension of additional tariffs imposed by the US on China.

Table 3
Cumulative tariff rates imposed by China and the U.S. from January 2018 to February 2020.

Year	Month	Additional tariffs imposed by China on the US				Additional tariffs imposed by the US on China			
		Additional tariff (AT)		Additional tariff including MFN (AT + MFN)		Additional tariff (AT)		Additional tariff including MFN (AT + MFN)	
		Weighted average	Simple average	Weighted average	Simple average	Weighted average	Simple average	Weighted average	Simple average
2018	1	0.00	0.00	6.83	9.32	0.00	0.00	2.46	4.07
2018	2	0.00	0.00	6.83	9.32	0.06	0.02	2.52	4.09
2018	3	0.00	0.00	6.83	9.32	0.06	0.02	2.52	4.09
2018	4	0.51	0.23	7.35	9.55	0.15	0.71	2.62	4.87
2018	5	0.51	0.23	7.34	9.55	0.15	0.71	2.62	4.87
2018	6	0.51	0.23	7.34	9.55	0.15	0.71	2.62	4.87
2018	7	8.31	1.83	13.70	9.64	1.75	2.53	4.21	6.93
2018	8	8.31	1.83	13.70	9.64	1.75	2.53	4.21	6.93
2018	9	11.21	2.80	16.60	10.61	2.43	3.16	4.89	7.62
2018	10	14.13	7.94	19.52	15.75	5.60	8.13	7.98	12.81
2018	11	14.13	7.94	19.46	15.25	5.60	8.13	7.98	12.81
2018	12	14.13	7.94	19.46	15.25	5.60	8.13	7.98	12.81
2019	1	10.91	7.48	16.24	14.78	5.60	8.13	7.98	12.81
2019	2	10.91	7.48	16.24	14.78	5.60	8.13	7.98	12.81
2019	3	10.91	7.48	16.24	14.78	5.60	8.13	7.98	12.81
2019	4	10.91	7.48	16.24	14.78	5.60	8.13	7.98	12.81
2019	5	10.91	7.48	16.24	14.78	10.36	15.60	12.62	20.58
2019	6	13.47	13.69	18.79	20.99	10.36	15.60	12.62	20.58
2019	7	13.47	13.69	18.79	20.99	10.36	15.60	12.62	20.58
2019	8	13.47	13.69	18.79	20.99	10.36	15.60	12.62	20.58
2019	9	14.86	15.22	20.18	22.53	14.06	19.95	16.28	24.43
2019	10	14.86	15.22	20.18	22.53	14.06	19.95	16.28	24.43
2019	11	14.86	15.22	20.18	22.53	14.06	19.95	16.28	24.43
2019	12	14.86	15.22	20.18	22.53	14.06	19.95	16.28	24.43
2020	1	14.86	15.22	20.18	22.53	14.06	19.95	16.28	24.43
2020	2	14.16	14.46	19.49	21.76	12.21	17.77	14.45	22.51

Notes: a. Additional tariffs imposed after 15th of a month are included in the following month. For example, additional tariffs imposed on September 24, 2018 are included in October 2018.
b.The weighted average tariff imposed by China on the US uses China's ordinary trade imports from the US in 2017 as the weight.
c. The additional tariffs imposed by the US on China use the US imports from China in 2017 as the weight.

term important impact on the economy of China and the US, and even the global economic and trade pattern. Research on the impact of these non-tariff measures is rare. According to the estimation of Chen et al. (2022), non-tariff barriers could explain 50% of the decline in China's imports from the US during the trade war. They also found that the welfare loss caused by non-tariff barriers (NTBs) was far greater than that caused by tariff barriers.

Finally, we present a timeline of the development of the Sino-US trade war during 2018–2023 (Fig. 12), including the fierce tariff war in 2018–2019 and the tariff exemption and export control after 2020. Referring to Bown,[17] this paper divides the Sino-US trade war in 2018–2023 into five stages. (1) From January to June 2018: the tariffs increased moderately, and the tariff levels of both sides were relatively moderate. (2) From July 2018 to September 2018: the tariffs between the two sides increased sharply and trade friction intensified significantly. (3) From October 2018 to May 2019: the tariffs were relatively stable and the two countries did not increase the tariffs further. (4) From June to September 2019: both sides continued to raise the tariff level against each other. (5) 2020–2022: although China and the US reached the Phase One Deal, the high tariff level persisted, forming a 'new normal'. At the same time, non-tariff barriers such as tariff exemption, export control, and entity list were adopted frequently, increasing the complexity of the trade friction.

3.2. Product categories and industries subject to tariff increase

In the previous section, the timeline of tariff increase was reported in detail, covering the value of imports, the share of imports and the number of product categories. To better understand the products covered by the increase in tariffs, this section provides descriptive statistics on the industries and product categories covered by the additional tariffs.

Fig. 13 (a) shows the changes in the additional tariffs imposed by the US on China's goods in different industries. Section 201 tariffs imposed by the US were mainly aimed at solar panels and washing machines, and Section 232 tariffs were mainly aimed at steel and aluminum products. The first two batches of Section 301 tariffs mainly covered high-tech industries such as aerospace, information technology, and auto parts. As shown in Fig. 13 (a), the first batch of Section 301 tariffs imposed by the US mainly covered products in

[17] https://www.piie.com/research/piie-charts/us-china-trade-war-tariffs-date-chart.

Table 4
Timeline and content of tariff increase.

Batch\variable	(1) Announced time	(2) Effective time	(3) Number of product (HS-8)	(4) Imports from China/US in 2017 (USD 100 million)	(5) Proportion of imports in total imports in 2017	(6) Tariff rates	(7) Cumulative tariff rates
(a) Additional tariffs imposed by the US							
Section 201 tariffs	2018-01-22	2018-02-07	8	10.49	0.21%	30%; 20%	0.06%
Section 232 tariffs	2018-03-08	2018-03-23	330	33.48	0.66%	10%; 25%	0.15%
The first batch of Section 301 tariffs	2018-04-04	2018-07-06	812	322.62	6.38%	25%	1.75%
The second batch of Section 301 tariffs	2018-04-04	2018-08-23	278	136.85	2.71%	25%	2.43%
The third batch of Section 301 tariffs	2018-07-10	2018-09-24	5538	1603.13	31.72%	10%	5.60%
The fourth batch of Section 301 tariffs	2018-09-18	2019-05-10	5538	1603.13	31.72%	15%	10.36%
The fifth batch of Section 301 tariffs	2019-08-13	2019-09-01	3232	1248.75	24.70%	15%	14.06%
No additional tariff imposed			1269	1743.42	34.50%		
Tariffs reduced after reaching the Phase One Deal	2020-01-15	2020-02-14	3232	1248.75	24.70%	−7.5%	12.21%
(b) Counter-tariffs imposed by China							
Retaliation-Section 232 tariffs	2018-03-23	2018-04-02	128	29.69	1.93%	15%; 25%	0.51%
Retaliation -the first batch of Section 301 tariffs	2018-04-04	2018-07-06	545	338.18	21.97%	25%	8.31%
Retaliation -the second batch of Section 301 tariffs	2018-04-04	2018-08-23	333	141.38	9.18%	25%	11.21%
Retaliation -the third batch of Section 301 tariffs	2018-08-03	2018-09-24	5207	579.53	37.65%	5%; 10%	14.13%
Retaliation -the fourth batch of Section 301 tariffs	2019-05-13	2019-06-01	4545	400.27	26.00%	5%; 10%; 15%	13.47%
Retaliation -the fifth batch of Section 301 tariffs	2019-08-23	2019-09-01	1717	284.73	18.50%	5%; 10%	14.86%
No additional tariff imposed			1917	448.37	29.12%		
Tariffs reduced after reaching the Phase One Deal	2020-02-06	2020-02-14	1717	284.73	18.50%	−5%; −2.5%	14.16%

Notes: Table (a) uses the data of US imports from China in 2017. The US imports from China in 2017 amounted to $505.47 billion. Due to the overlap of products subject to additional tariffs in different batches, the total import share of all batches in 2017 was greater than 1. Table (b) uses the data of China's imports from the US in 2017. China's imports from the US in 2017 were USD 153.95 billion. Due to the overlap of products subject to additional tariffs in different batches, the total import share of all batches in 2017 was greater than 1.
Data source: Chin's customs data, U.S. customs data, tariff data.

transportation, mechanical and electrical products, and appliance; the second batch of Section 301 tariffs mainly covered industries such as plastics, rubber, and mechanical and electrical equipment. With the escalating trade conflict between China and the US, the scale of the third batch of Section 301 tariffs imposed by the US expanded, covering products in most industries, including not only upstream intermediate industries such as chemical products, plastics and rubber, but also downstream consumer goods such as animal and plant products, food, beverage, textiles, and clothing. The fourth batch of Section 301 tariffs imposed by the US covered the same products in the third batch, involving products in most industries. The fifth batch of Section 301 tariffs imposed by the US also covered most industries, especially precious metals, textiles, and clothing, which were severely affected by the fifth batch of Section 301 tariffs, with additional tariffs of 11.74% and 9.11%, respectively. In summary, Section 301 tariffs imposed by the US were initially concentrated in Made in China (2025) related industries such as aerospace, information technology and automotive parts, and then gradually expanded to more industries, including not only high-tech products but also mid-low-end manufacturing industries such as textiles, clothing, plastics and rubber.

Fig. 13 (b) describes the retaliatory tariffs imposed by China on imported products in various US industries. For Section 201 tariffs imposed by the US, China did not impose the retaliatory tariff; China imposed retaliatory tariffs on base metals and animal and plant

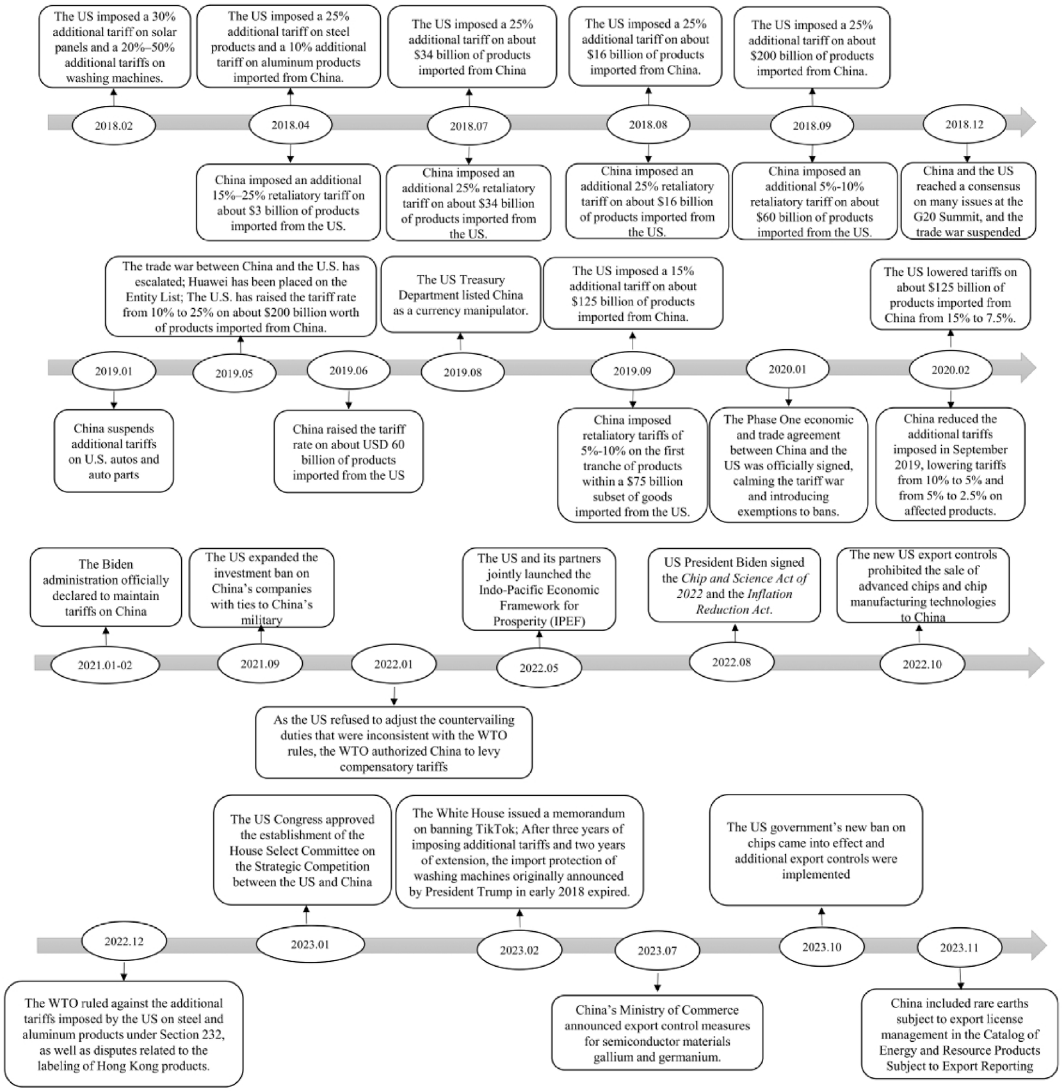
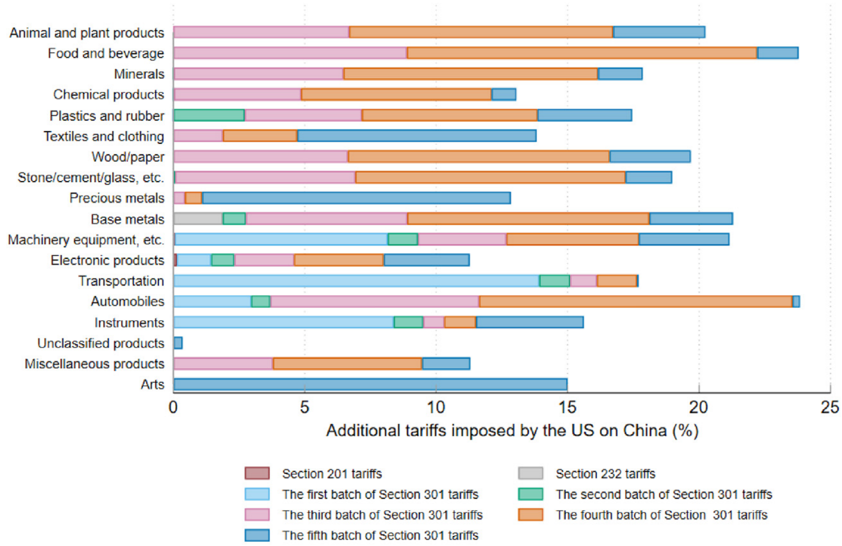


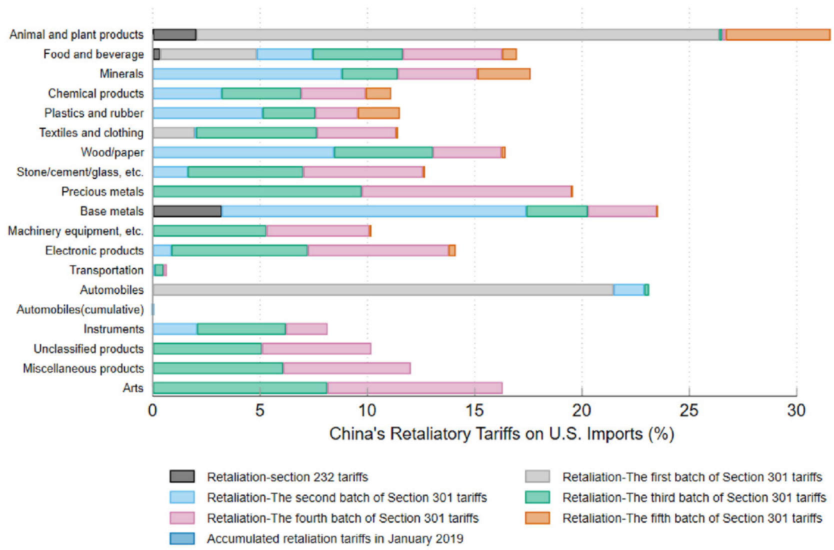
Fig. 12. Timeline of China-U.S. trade frictions (2018–2023).
Source: The Ministry of Commerce of China, the USTR Office, the WTO, and the International Monetary Fund (IMF).

products imported from the US in response to Section 232 tariffs imposed by the US. For the five batches of Section 301 tariffs imposed by the US, China also imposed retaliatory tariffs. The first batch mainly involved imported animal and plant products, food, and beverage; the second batch of retaliatory tariffs mainly covered metals, mineral products, wood, paper, plastics, and rubber. With the escalation of the Sino-US trade war, the third batch of retaliatory tariffs imposed by China covered products of most industries. The products covered by the fourth batch of retaliatory tariffs were basically the same as those covered by the third batch. The fifth batch of retaliatory tariffs imposed by China in September 2019 covered mainly animal and plant products, mineral products, plastics and rubber. In summary, China's retaliatory tariffs gradually expanded from industries such as animal and plant products and base metals to most industries. At the end of 2019, the average tariff on animal and plant products exceeded 30%, followed by base metals, with the retaliatory tariff exceeding 20%.

By analyzing the timeline of the Sino-US trade conflict since 2018, the product categories involved and the additional tariff rates, we find that the list of products subject to the tariff increase has the following characteristics: (1) From the perspective of products covered by the tariff increase, in general, the list of products subject to the US tariff increases is scattered, while the list of products subject to China's tariffs is relatively concentrated. The first two batches of Section 301 tariffs imposed by the US focused on products such as aerospace, optical medical equipment, rail transit, mechanical equipment, and other high-tech industries, especially the manufacturing products that are highlighted in the Made in China (2025). China's countermeasure list focused on soybeans, airplanes, automobiles, etc. These are US goods with traditional advantages exported to China and are highly dependent on the China market. (2) From the perspective of China's counter-strategy, China has retaliated on the same scale against the first two batches of Section 301 tariffs.



(a) Additional tariffs imposed by the U.S. on China



(b) Retaliatory tariffs imposed by China on U.S.

Fig. 13. Changes in U.S. tariff increases and China's retaliatory tariffs
Notes: Figure (a) calculates the weighted average tariff by using the US imports from China in 2017 as weights. Figure (b) calculates the weighted average tariff by using China's ordinary imports from the US in 2017 as weights. Since the retaliatory tariffs imposed on automobiles and auto parts were suspended in January 2019, the accumulated additional tariff imposed on automobiles and auto parts dropped to almost zero after January 2019.
Data Source: USITC; Tariff Policy Commission of the State Council of China.

Starting from the third batch of Section 301 tariffs, China adopted retaliation in the same proportion (Yu et al., 2022). (3) From the perspective of tariff rates, the range of tariff increases for the same batch (Section 301 tariffs) of the US is the same, with the tariff increase of different batches ranging from 10% to 25%. In response to Section 301 tariffs of the United States, China imposed different tariff rates on different products in the same batch. For example, in the third batch of retaliatory tariffs, China imposed an additional 5% or 10% tariff on different products.

Academia has conducted research on the choice of products subject to additional tariffs imposed by China and the US. Ju et al. (2024) argued that the first batch of additional tariffs imposed by the US was mainly aimed at China's industrial policies, especially *Made in*

China (*2025*) and subsidies to industries with external economies of scale. There are several papers discussing the motives of China and the US to increase tariffs from the perspective of the political economy. Fetzer and Schwarz (2021) believed that the retaliatory tariffs imposed by China were consciously aimed at the constituents that voted for Trump in the 2016 presidential election. Fajgelbaum et al. (2020) found that China's retaliatory tariffs were more targeted at counties that were more inclined to the Republican Party, and swing counties (for example, those counties where the Democratic Party and the Republican Party receive equal votes) were more likely to be protected by import tariffs. Ma et al. (2022) expanded the model of Bombardini (2008) on the protection of sale with heterogeneous firms, and empirically found that industries with more large companies had a certain political influence and had the ability to affect the distribution and level of tariffs. In short, the scope, size, rationality and differences of the additional tariffs and retaliatory tariffs are worthy of further study.

4. Economic consequences of the Sino-US trade war

4.1. Impact of the tariff increase on the trade volume and price

4.1.1. Theoretical basis and the estimation of trade elasticity

In the framework of the neoclassical partial equilibrium theory, the welfare impact of the import tariff increase depends on: (1) the welfare loss caused by imports reduction; (2) the improvement of terms of trade caused by the decrease of import (pre-tariff) prices. If an importing country is a ‘small country’, that is, the country's additional tariffs on imports do not affect the world price. At this time, the import (pre-tariff) prices remain unchanged, and the additional tariffs will be completely transmitted to the post-tariff import price of the country. As a result, the increase in tariffs leads to a net loss of welfare. In Fig. 14 (a), it is observed as a perfectly elastic export supply curve. Assuming that the pre-tariff import price is p_0, the ad valorem tax τ is added, the foreign export supply curve shifts upward by τ unit, and the post-tariff import price becomes $p_0\ (1+\tau)$. To evaluate the overall impact of trade policies, the key is to estimate the pass-through effect of tariffs on prices. If the importing country is a large country, that is, changes in its demand can affect the world price. As shown in Fig. 14 (b), the importing country faces an upward inclined export supply curve. The increase in tariffs leads to a decrease in import demand, and foreign exporters are forced to lower prices, so the tariffs will not be fully transmitted to import prices, that is p_1/p_0

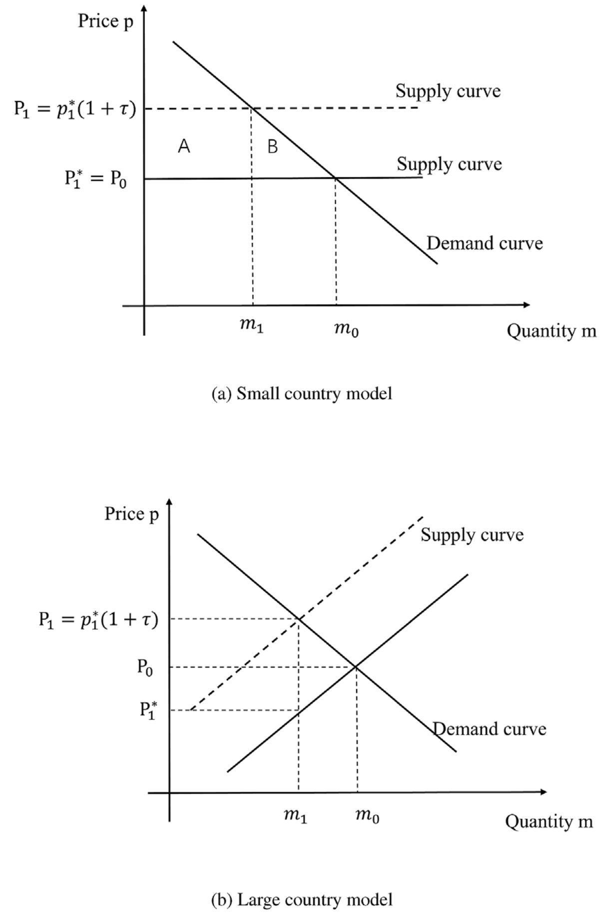


Fig. 14. Tariff passthrough under perfect competition.

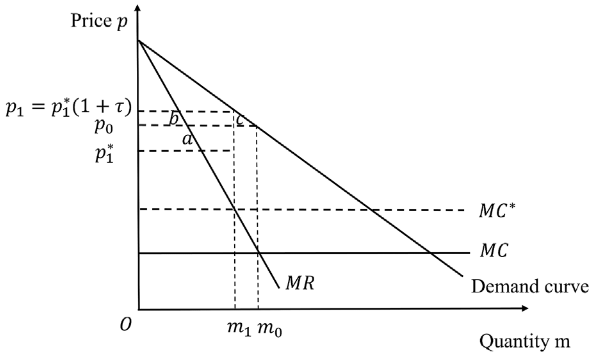


Fig. 15. Tariff passthrough under foreign monopoly.

$< 1 + \tau$. As can be seen in the figure, the lower the elasticity of export supply, the more limited the passthrough of tariffs to import prices. Therefore, for a large country, increasing tariffs will improve its terms of trade. If the benefits from the improvement of terms of trade outweigh the welfare losses caused by the reduced imports, the overall welfare of the country will increase.

The tariff passthrough is defined as $PT = (p_1 - p_0)/\tau$, that is, the proportion of the increase in tariffs that has been transmitted to post-tariff prices of the importing country. Fig. 14 (b) shows that PT depends on the elasticity of the export supply curve and the elasticity of the import demand curve. More generally, the tariff passthrough is denoted as $PT = 1/(1 + \omega\sigma)$, where σ is the elasticity of import demand and ω is the reciprocal of the elasticity of export supply. Obviously, when σ or ω is close to zero, that is, when the import demand is inelastic or the export supply is perfectly elastic, PT is close to 1, that is, the tariff will be completely transmitted to the import price. However, when the import demand is perfectly elastic or the export supply is inelastic, the PT is close to 0, that is, the tariff will be fully borne by the exporter.

The above classical model assumes that the market structure is perfectly competitive. In an imperfect competitive market, the imposition of additional tariffs can cause monopoly companies to lower producer prices, leading to incomplete passthrough of tariffs (Katrak, 1977; Brander and Spencer, 1984). In this case, a country may not only improve the terms of trade by imposing additional tariffs but also change the profits of monopoly manufacturers, thus realizing profit shifting. Fig. 15 assumes the simplest scenario, that is, there is only the monopoly of foreign manufacturers. In this case, the increase in tariffs makes the price of products exported by monopoly manufacturers increase from p_0 to p_1, and the pre-tariff price of manufacturers' exports will drop from p_0 to p_1^*, so the increase in tariffs will not be completely transmitted to the import price. At this time, due to the decline in the pretariff price of imports, the terms of trade are improved. The trade conflict between Japan and the US in the 1980s gave birth to a number of studies on strategic trade policy, which are summarized in Brander (1995). Few studies discuss the gains and losses of the Sino-US trade conflict under imperfect competition, which deserves further exploration.

The above analyses show that, in a perfectly competitive partial equilibrium framework, to estimate the welfare changes brought by tariffs, we need to measure the changes in the value of imports and import prices (that is, the tariff pass-through PT). We can empirically estimate the changes in the value of imports and the import volume, as well as the price passthrough effect of tariffs through the trade data at the country-product level. Specifically, the following regression is used to estimate the impact of tariffs on import value, volume, and price.

$$\Delta \ln y_{ijt} = \beta \Delta \ln(1 + Tariff_{ijt}) + controls + \epsilon_{ijt} \quad (1)$$

where i denotes the product, j denotes the country, t denotes time, Δ denotes difference before and after the increase in tariff and $Tariff_{ijt}$ denotes the additional tariff imposed on the product i exported by the country j. The dependent variable $\ln y_{ijt}$ represents the log of import values, quantities, and prices. When the dependent variable is the log of import price, the estimated tariff passthrough is $PT = 1 + \beta$.[18] If the estimated price elasticity is $\beta = 0$, the increase in tariff is almost completely transmitted to the price of imported goods, and the cost of tariff is borne primarily by the importer (see Fig. 14 (a)). If the estimated price elasticity is $\beta < 0$, the tariff is not completely transmitted to the importer, and the exporter also bears part of the tariff cost by lowering the price (see Fig. 14 (b)).

4.1.2. Further discussions

A large number of studies have examined the tariff passthrough effect of the import tariff reduction in different countries during trade liberalization, which supports the incomplete passthrough of tariffs on prices (Kreinin, 1961; Feenstra, 1989; Mallick and Marques, 2008; Marchand, 2012; De Loecker et al., 2016; Ludema and Yu, 2016; Han et al., 2016; Sun et al., 2019, 2021).[19] However, most studies on the Sino-US trade war found that the additional tariffs imposed in the Sino-US trade war were almost completely transmitted to the import price, that is, the cost of the tariff increase was entirely borne by the importer (see Table 5). Existing research mainly estimates

[18] It can be seen from this formula that we can also calculate the tariff passthrough by estimating the elasticity of demand and supply.

[19] Other studies also explored the incomplete passthrough of exchange rate changes to import prices (e.g. Campa and Goldberg (2005); Berman et al. (2012); Li et al. (2015)).

Table 5
Tariff pass-through during the U.S.-China trade war.

Literature	Importing country	Tariff pass-through coefficient (pre-tariff price)
Amiti et al. (2019)	US	−0.003
Amiti et al. (2020)	US	0.00
		For iron and steel products, the initial tariff passthrough coefficient was 100%, and reduced to 50% one year later.
Fajgelbaum et al. (2020)	US	0.00
Flaaen et al. (2020)	US	1.25–2.25
Cavallo et al. (2021)	US	−0.018
		0.044 (retail price)
Jiao et al. (2022)	US	0.003
Jiang et al. (2023)	US	−0.0047
Ma and Meng (2023)	US	−0.262 (The first batch of Section 301 tariffs)
		0.223 (The second batch of Section 301 tariffs)
		−0.997 (The third batch of Section 301 tariffs)
Ma et al. (2021)	CHN	0.065
Yu et al. (2022)	CHN	−0.021

Notes: In the regression estimates used in Ma and Meng (2023), the dependent variable is the post-tariff price. The estimated coefficient for the first wave of Section 301 tariffs is 0.738; the estimated coefficient for the second wave of Section 301 tariffs is 1.223; and the estimated coefficient for the third wave of Section 301 tariffs is 0.003. The pre-tariff price estimated coefficients calculated are the post-tariff price estimated coefficients minus 1.

the impact of the tariff increase of the US on the value of imports, the import volume and import prices. Amiti et al. (2019) found that the tariff increase of the US made the value of imports and import volume drop significantly. The estimated results showed that for every 1% increase in the tariffs imposed by the US, the value of US imports decreased by about 6.4% and the import volume decreased by 5.9%. However, the tariff increase had no significant effect on the pre-tariff import prices, and the tariff increase imposed by the US was completely transmitted to the import prices of the US, that is, the tariff cost was completely borne by the importer. By the end of 2018, it had caused a cumulative net welfare loss of USD 8.2 billion in the US. The price passthrough of tariffs has heterogeneity in different sectors. In the steel industry, the increase in tariffs led to a sharp drop in the export prices of foreign exporters (Amiti et al., 2020). Similarly, Fajgelbaum et al. (2020) found that the increase in import tariffs of the US led to a sharp decline in the value of imports and import volume, but had no significant impact on the pre-tariff import prices, that is, tariffs were completely transmitted to the import prices. Different from Amiti et al. (2019, 2020) and Fajgelbaum et al. (2020) who used customs data for analyses, Cavallo et al. (2021) used more detailed retailer data for analyses and found that the tariff increase of the US was completely transmitted to the import prices, but the passthrough to the retail price was incomplete, indicating that retailers might bear part of the price increase by reducing their profit rates. Flaaen et al. (2020) studied the impact of US tariff increases on washing machines from the perspective of industrial transfer and found that imposing tariffs on products from some countries may lead to transnational transfer of production, thus alleviating the impact of trade policies on domestic consumer prices. Different from the complete tariff passthrough found in existing studies, Ma and Meng (2023) used the products in the list of exclusions as the control group, and studied the impact of tariffs imposed by the US on different batches of imported products from China. The results showed that the tariffs reduced US imports from China by 4.5%, the tariffs imposed on the first two batches of USD 50 billion of imported products were completely transmitted to the import prices, while the passthrough of tariffs imposed on the third batch of USD 200 billion of imported products was very limited.

Studies using China's export data also find a similar result. Jiang et al. (2023) use product-level export data and find that the tariff increase of the US caused China's exports to the US to decrease by 16.47%, and the tariff increase was completely transmitted to export prices; In addition, those products with comparative advantages were more affected by tariff changes. Jiao et al. (2022) use the export data of an enterprise in Zhejiang Province to study the Jiao et al. (2022) passthrough of tariffs. Similarly, they find that the increase in the import tariff of the US substantially reduced the exports of Chinese firms to the US, and the tariffs were completely transmitted to the import prices of the US, but the exporter did not reduce the pre-tariff prices.

In addition, there are also studies exploring the price passthrough effect of China's imposition of retaliatory tariffs during the Sino-US trade war. The increase in tariffs had greatly reduced the value and volume of imports from the United States, and the tariffs had completely shifted to the import prices (Ma et al., 2021; Yu et al., 2022).

The classic trade models assume that both China and the US are large countries and their economic scale is large enough to affect world prices, so the imposition of additional tariffs will lead to incomplete tariff passthrough. However, most recent empirical studies on the Sino-US trade war have found complete tariff passthrough to prices, which does not mean that the US and China are small open countries. The equilibrium price is determined by both the supply curve and the demand curve, and the tariff passthrough to prices depends on supply elasticity, demand elasticity, market structure, etc. Fajgelbaum and Khandelwal (2022) summarized several possible mechanisms. First, the tariff increase may lead to demand shifters, for example, when enterprises expect to face higher tariff restrictions in the future, they may make inventory adjustments.[20] In this case, the import demand of firms in the current period increases and the demand curve moves upward, so the equilibrium import price does not decline. Second, the tariff increase may lead to supply shifters,

[20] Inventory adjustment is a short-term behavior. Leibovici and Dunn (2023) found that when the uncertainty of economic policy increased, firms can increase their inventories from foreign countries to mitigate potential trade shocks.

for example, government subsidies to firms offset the impact of tariffs; tariffs can also be transmitted along the supply chain, increasing the cost of exporters. The third mechanism is the price stickiness, that is, due to existing contracts, even after the implementation of the tariff increase, enterprises cannot adjust prices immediately, resulting in the complete passthrough of tariffs. Jiao et al. (2022) investigated 600 Chinese companies to understand how tariffs affect their export prices, and 21% of them said that they lacked the flexibility to adjust prices due to contractual agreements (Table 6); and 72.2% of the firms said that the profit margin is too low to further reduce prices. Therefore, price stickiness may be more significant in processing trade and internal transactions of foreign-funded enterprises, as China's enterprises can rely more on the cost structure and pricing strategies of external suppliers or parent companies than on the supply-demand relationship in the market. In industries where the cost is easy to determine, the cost structure is clearer and it is easier for enterprises to adopt the “cost plus” pricing strategy, that is, to set the price based on cost accounting and certain profits. At this time, the tariff increase will also be completely transmitted to the import prices.

These price changes may have a larger impact on more vulnerable groups. Using disaggregated household expenditure data, Ma et al. (2024) provide novel evidence on how the US-China trade war has differentially affected US households in different income groups. They document a 0.9 percentage point smaller increase in the cost of living for the top 20% income households relative to the bottom 20%. This differential effect is attributed to wealthier households’ greater ability to adjust their expenditure shares across products and to face a smaller reduction in product variety.

4.2. Welfare impact of the Sino-US trade war

4.2.1. Research method

The existing literature used various methods to quantitatively estimate the welfare loss of the Sino-US trade war.

Some studies used the framework of partial equilibrium to estimate the overall welfare impact of the Sino-US trade war. First, we can estimate the impact of tariff changes on the price and volume of imports through the regression model. As shown in the previous section, the main finding of the existing literature is that the tariff increase has been completely transmitted to the import prices, and the welfare loss of the tariff increase is mainly borne by the importer. As shown in Fig. 14(a), in the case of a perfectly elastic export supply, the increase in tariffs reduces the export volume from m_0 to m_1, and the import price increases from p_0 to p_1. At this time, the tariff revenue is $\tau \times m_1$, that is, the area of A in Fig. 14(a); loss of consumer welfare is the area of $A + B$; and dead weight loss (DWL) caused by the tariff increase is the area of B. To quantify welfare loss, the estimation coefficient can be used to approximate the DWL. Assuming that the market is perfectly competitive, the slope of the import demand curve is approximately constant, and the area of B in Fig. 14(a) is approximately a triangular area, which can be expressed as $\frac{1}{2} \times {p_1}^{*}\tau(m_0 - m_1) = \frac{\frac{1}{2}({p_1}^{*}m_1)\tau(m_0-m_1)}{m_1}$, where ${p_1}^{*}m_1$ is the value of imports after the tariff increase,τ is the additional tariff, and $\frac{m_0-m_1}{m_1}$ is the change of import quantity caused by the tariff increase. Based on the estimated elasticity β, changes in the quantity of imports caused by the increase in tariffs can be calculated, that is, $-\beta \ln(\frac{1+\tau_t}{1+\tau_{t-12}}) = -ln(\frac{m_1}{m_0}) \approx \frac{m_0-m_1}{m_1}$. The DWL of the tariff increase can be calculated by the value of imports, the increase of the tariff, and the estimated elasticity, i.e., $DWL = -\frac{1}{2}(p_1^{*}m_1)\tau\beta\ln(\frac{1+\tau_t}{1+\tau_{t-12}})$. This rough calculation is based on the trade elasticity estimated by regression. Using the partial equilibrium analysis, it only considers partial market clearing, but ignores the indirect influence of other variables in the economy, more reflecting the short-term direct effect of the trade friction.

Other studies use general equilibrium analysis to quantitatively estimate the overall welfare loss of trade friction. The general equilibrium analysis framework incorporates the links between different markets and industries, which can simulate the long-term and indirect effects of trade friction. The computable general equilibrium model calculates the equilibrium solution by calibrating parameters and adding data. However, the calculation is relatively complicated, requiring a lot of parameters to be calibrated; and the rough division of industries makes it impossible to analyze specific industries or products. In contrast, the quantitative analysis framework of the structural model has a more solid micro-foundation. The model framework is constructed based on economic theories, and the influence of trade policies is quantitatively analyzed by calibrating core parameters. Compared with the computable general equilibrium model, the mechanism behind the economic phenomena can be studied more clearly using propper models (Caliendo and Parro, 2015; Balistreri et al., 2018).

4.2.2. Further discussions

Partial equilibrium method: Based on the estimated complete tariff passthrough coefficient, Amiti et al. (2019) calculated that by the end of 2018, the welfare loss of US tariff increases was about 0.044% of its GDP; Fajgelbaum et al. (2020) estimated that the welfare loss of the US was 0.059% of its GDP in 2018, and it increased to 0.17% after considering the tariff increase in 2019. Ni et al. (2018) estimated the price effect of tariffs from the perspective of GVC and calculated the welfare loss caused by US additional tariffs on USD 50 billion of imported products to be USD 4.792 billion. Ma et al. (2021) used China's import data and estimated that by May 2019, the accumulated welfare loss in China was USD 1.5 billion. Compared with the accumulated welfare loss of the US by 2018 calculated by Amiti et al. (2019), and the welfare loss in China was much smaller. This may be due to that the proportion of China's imports from the US is much smaller than that of US imports from China. It should be noted that the partial equilibrium analysis is based on the trade elasticity and price elasticity for regression, and does not consider the impact of retaliatory tariffs on the overall welfare and the indirect impact of other variables in the economy, that is, it ignores the impact of general equilibrium.

General equilibrium method: Ossa (2014) quantitatively analyze the non-cooperative and cooperative trade policies based on the multi-country, multi-sector general equilibrium model, and discussed the optimal tariff rates, trade war and trade negotiations in detail. Ossa (2014)'s results are based on long-term equilibrium, ignoring the cost in the equilibrium change, so it may underestimate the

Table 6
Survey results: Impediments to firms' adjustments of export prices and sales in different markets.

	Fraction
Panel (A): Impediments to the Adjustments of Export Prices (choose only one option)	
Profit margin is too low to further reduce prices	72.2%
Lack of price adjustment flexibility due to contractual agreements	21.1%
If prices fall, worry about anti-dumping investigations	3.8%
Control the pricing power, thus no need to reduce prices	2.8%
Panel (B): Impediments to Expanding Alternative Foreign Markets (can choose more than one option)	
Different product specifications and standards	22.9%
Lack of sales channels and sales network	59.3%
Lack of brand awareness	25.3%
Concern of a low collection rate	25.0%
Market size is not big enough	25.3%
Panel (C): Impediments to Diverting Sales to the Domestic Market (can choose more than one option)	
Different product specifications and standards	28.3%
Lack of sales channels and sales network	46.6%
Lack of brand awareness	23.2%
Concern of a low collection rate	28.9%
Market size is not big enough	27.2%

Notes: The table is from Jiao et al. (2022)

impact of the trade war. For the quantitative analysis of the Sino-US trade conflict, Fajgelbaum et al. (2020) adopt the general equilibrium for the quantitative estimation. It assumes that labor forces did not flow between regions, and find that the trade friction caused massive welfare redistribution, and the consumer prices increased, while the wages of workers in some industries increased. On the whole, the overall welfare loss caused by the Sino-US trade war was small, and the welfare loss in 2018 only accounted for 0.05% of its GDP, which increased to 0.13% when the tariff increase in 2019 was considered. Chang et al. (2021) use the same method to estimate the welfare loss in China, and found that the overall welfare loss in China was 0.29% of its GDP. Fan et al. (2020) evaluate the welfare effect of the Sino-US trade war based on the multi-country, multi-sector general equilibrium model, and found that the welfare loss of both China and the US was less than 1% of their GDP.

All of the above studies calculated the short-term welfare loss while the labor force can flow between industries or regions in the long run. Reyes-Heroles et al. (2020) use a multi-country dynamic general equilibrium model to quantify the long-term welfare loss. They find that the GDP of China and the US decreased by about 1%. This is similar to the welfare loss estimated by Costinot and Rodríguez-Clare (2014) using the same general equilibrium framework and based on standardized parameters, namely, an additional 100% tariff from the United States would reduce its welfare by about 0.3%. Caliendo and Parro (2022) use a dynamic general equilibrium model to perform a quantitative estimation and find that the trade friction reduced the welfare of American consumers by about 0.1%, and there was an obvious spatial distribution effect. Finally, there are also studies using the computable general equilibrium (CGE) model to quantitatively estimate the welfare loss effect of the Sino-US trade war. Some researchers use the global trade analysis project (GTAP) to estimate the welfare loss caused by the Sino-US trade war (Bollen and Rojas-Romagosa, 2018; Ciuriak and Xiao, 2018; Bellora and Fontagné, 2020; Carvalho et al., 2019; Freund et al., 2020; Gentile et al., 2020; Li and Whalley, 2021; Li et al., 2018), for example, Ciuriak and Xiao (2018) calculate the welfare loss caused by the additional tariffs imposed by the US on imported steel and aluminum products based on the GTAP model; Carvalho et al. (2019) use the GTAP model to estimate the welfare loss caused by the US's imposition of additional import tariffs on 50 billion USD products from China and conduct a counterfactual analysis on China's retaliatory duties. In addition, some scholars use the dynamic stochastic general equilibrium model for quantitative estimation. For example, Georgiadis et al. (2021) use the DSGE model to calculate the welfare loss effect of the Sino-US trade war, and found that the output of the US fell by 0.1% and the output of China fell by 0.25%.

Researchers have employed different methods to estimate the welfare loss of the Sino-US trade war quantitatively, and most studies have found that the Sino-US trade war had caused small welfare losses to the United States or China. The above-mentioned quantitative estimations ignored factors such as unemployment and non-tariff barriers, and did not consider the exit or transfer of production by enterprises, as well as the impact of uncertainties brought about by trade conflicts on the long-term investment and technology R&D, so the welfare effect of trade frictions may be underestimated. Chen et al. (2022) study the influence of non-tariff barriers in the recent Sino-US trade war and find that more than 90% of Chinese consumers' welfare loss was caused by non-tariff barriers. In addition, the model setting may have a significant impact on the estimated welfare loss, for example, different market structures, utility functions, production technologies, etc. may affect the welfare estimation of trade policies. Most of the existing models are based on a perfectly competitive market structure, where producers and consumers are price takers and cannot influence market prices. This ignores the existence of market and monopoly powers. In the model of imperfect competition, trade policies can affect the product pricing of enterprises, thus affecting the estimation of welfare losses.

Different utility functions may also affect the welfare estimation. Most studies used the Cobb-Douglas (CD) utility function or a constant elasticity of substitution (CES) utility function. The former assumes that the elasticity of substitution of different commodities is 1, and the proportion of consumer expenditures on various commodities is constant. The latter is more flexible, assuming that the elasticity of substitution between different commodities is constant, but in the real world, the elasticity of substitution between commodities may change with the price and consumption quantity. The above two utility functions simplify the welfare analysis. In addition, the above two homothetic utility functions do not consider the differences in consumption choices of consumers with different income levels. In the non-homothetic utility function, the income levels of consumers can affect the structure of their consumption choices, and changes in trade policies may lead to different welfare changes for different income groups, thus revealing complex distribution effects. Different assumptions about production technologies and cost structures may also affect the estimated welfare loss. For example, if production technologies are assumed to have economies of scale, the strengthened trade barriers may lead to the reduction of production efficiency in the domestic market and thus increase welfare losses.

4.3. Impact on consumption, employment, and enterprise operation

In addition to the tariff passthrough effect, there are also studies that focus on the impact of the Sino-US trade conflict on employment, investment, and consumption. Some studies estimated the impact of trade friction on the US. For example, Flaaen and Pierce (2019) find that the additional tariffs imposed by the US and its trading partners reduced manufacturing employment in the US and increased producer prices. Amiti et al. (2021) find that the Sino-US trade war disturbed the investment of American listed companies and led to the decline of their share prices. Huang et al. (2023) found that the Sino-US trade war had a negative impact on the financial performance and stock returns of American enterprises. Handley et al. (2020) find that the Sino-US trade war significantly inhibited American exports through the supply chain spillover. Waugh (2019) studies the influence of the trade war on automobile consumption and finds that China's retaliatory duties suppressed the growth of new vehicle consumption in American counties. He finds that export and employment of counties affected by China's retaliatory tariffs declined, thus affecting consumption.

Other studies focus on the impact of the Sino-US trade war on China. Chor et al. (2021) use high-frequency nighttime light data and found that for every 1% increase in tariff exposure in the US, the grid nighttime light intensity would decrease by 0.6%. In addition, it focuses on 2. 5% of the population most affected by tariffs, and finds that per capita income decreased by 2.52% and manufacturing employment decreased by 1.62%. Benguria et al. (2022) find that during the Sino-US trade war, the investment, R&D expenditures, and profits of companies decreased by 2. 3%, 2. 3%, and 11. 5%, respectively, for every standard deviation increase in trade uncertainty. Cui and Li, (2021) find that the Sino-US trade war had a negative impact on firm entry in China, especially in industries that were more dependent on American exports. In terms of employment, He et al. (2021) used an online recruitment dataset to study the influence of trade friction on the labor demand of enterprises, and found that enterprises that were greatly impacted by the US tariff increases would reduce job vacancies and provide lower wages. Similarly, Ding and Liu (2023) found that China's exporters did not lay off employees on a large scale, but reduced labor costs by reducing working hours, resulting in a decrease in wages and non-cash income. He et al. (2023) studied the influence of trade friction on non-standard jobs and found that non-standard jobs could play a role of employment buffer; cities that were severely affected by American tariffs would reduce the demand and wages of standard jobs, but the demand for and wages of non-standard jobs did not change significantly.

5. Trade diversion and global supply chain restructuring

The Sino-US trade war has not only affected China and the US, but also affected third countries. Fajgelbaum et al. (2024) analyze the impact of additional tariffs imposed by China and the United States on the exports of third countries. They find that on average other countries reduced their exports to China and increased their exports to the US and other regions of the world, leading to the conclusion that most countries' export products were complementary to those of the US and substitutive to those of China. The Sino-US trade war would bring about a global redistribution effect and Vietnam, Thailand, South Korea, and Mexico became the biggest export winners. Choi and Nguyen (2023) found that although the Sino-US trade war led to a decline in US imports from China, US imports from Vietnam increased, indicating a trade diversion effect.

Recently, some studies have paid attention to the impact of the Sino-US trade war on the global supply chain. Grossman et al. (2024) analyze in a search-and-matching framework that the US imposition of high tariffs may cause American enterprises to turn to countries with exemption for new suppliers. Alfaro and Chor (2023) find that after the outbreak of the Sino-US trade conflict, the US GVC position changed significantly: the US reduced imports from China and shifted its focus of the import market to other low-cost producing countries, especially Vietnam and Mexico. In addition, the position of the US in the production chain became more upstream, indicating that its manufacturing industry had a tendency to onshoring. Similarly, Utar et al. (2023) find that the trade friction between China and the United States in 2018–2019 made the US adjust its value chain and choose nearshoring to Mexico. Unlike studies that pay more attention to face value, Baldwin et al. (2023) emphasize the importance of intermediate goods and found that the dependence of the American supply chain on China measured by global input-output data was almost four times that measured by conventional trade data. Therefore, if Vietnam's exports to the US depend on intermediate goods from China, simply importing more products from Vietnam instead of China may not reduce its dependence on China. Similarly, Freund et al. (2023) point out that US tariff increases against China led to a decline in its imports from China, but the supply chain links between new suppliers and China remained close, indicating that the geographical reorganization of the supply chain did not mean complete economic decoupling. At the same time, although the US supply chain has been restructured, China is still its main trading partner. In addition, some studies have paid attention to the supply chain distribution of multinational corporations. Zeng et al. (2023) investigate the subsidiaries of multinational corporations in China and found that enterprises with a low dependence on local procurement were more likely to transfer their production outside of China to reduce the impact of trade barriers.

Ma et al. (2023) paid attention to how the Sino-US trade war changed the Asia-Pacific supply chain from the perspective of China. The Asia-Pacific regional trade value chain, with the United States as the demand (consumption) center and China as the supply (production) center, forms the most important and efficient value chain in the world. The economies in the region account for 1/3 of the global population, more than 60% of the global economy, and nearly half of global trade. Since the end of the Second World War, the West has continuously outsourced the production of labor intensive and low value-added products, and the Asia-Pacific region has formed a dynamic growth pattern with Japan (1960s–1970s), the Four Asian Tigers (South Korea, Singapore, Hong Kong, and Taiwan in the 1980s), and the Four Asian Tigers (Malaysia, Thailand, Indonesia, and the Philippines in the 1990s) as manufacturing and export hubs. After the end of the Cold War, the world's economic and trade pattern ushered in major changes. In 1995, the GATT was reorganized into the WTO. In 1998, the Asian financial crisis severely hit the Asian economy. In 2001, China joined the WTO, which cleared the way for China to become the center of the Asian factory. Since China's entry into the WTO in 2001, the Asia-Pacific supply chain with China as the center of manufacturing and assembly has evolved, forming an Asian supply chain pattern in which Japan, South Korea, and China's Taiwan occupy the upstream supply chain, and mainland China engages in processing and assembly in the midstream supply chain, while Southeast Asia not only accepts China's production capacity but also competes with China for overseas markets and has become an important export market for China.

The Sino-US trade war is bound to have an impact on the Asian supply chain pattern. On the one hand, the US imposition of additional tariffs on mainland China's exports reduces mainland China's exports to the United States, which is transmitted to the upstream supply chain, reducing its imports from Japan, South Korea and Taiwan by 6.3%. However, both China and the United States have transferred some supply chains to ASEAN countries. As shown in Fig. 16 (a), after the outbreak of the Sino-US trade war, the proportion of China's exports to the United States in its total exports decreased from 19% in 2017 to 16.7% in 2019. In the same period, China's export share to ASEAN increased from 12.3% in 2017 to 18.1% in 2019; and the share of US imports from ASEAN increased from 7.3% in 2017 to 8.3% in 2019 (Fig. 16 (b)). The results of the quantitative estimation show that the increases in US tariffs against China increased China's exports to ASEAN by 6%. In addition, Ma et al. (2023) found a similar pattern in China's and the US trade with India and Mexico.

Although mainland China's share in US imports has fallen dramatically since the outbreak of the Sino-US trade war, Ma et al. (2023) used the multi-regional input-output tables in 2022 and found that in terms of value-added import, the US's dependence on China's products increased. As shown in Fig. 17, after considering the part of US imports from third countries embedded with China's value added, the share of US value-added import from China increased from 21.6% in 2017 to 23.3% in 2021. This is similar to the finding of Baldwin et al. (2023), which emphasized the importance of the input-output correlation in measuring supply chain dependence.

In recent years, especially in the context of the Sino-US trade war, traditional trade policies have gradually changed to industrial policies, reflecting the new focus of global economic competition. For example, through policies such as the Chips and Science Act, the US government directly supports high-tech industries such as semiconductors, showing a shift from traditional trade policies to more strategic industrial policies. Juhász and Steinwender (2023) emphasize the importance of industrial policies in the global economic history of the nineteenth century and found that industrial policies played a key role in shaping a country's direction of economic development, especially for high-tech industries. In addition, they also discussed the interaction between trade protectionism and industrial policies and the impact of these policies on the global economic structure and trade rules. Lashkaripour and Lugovskyy (2023) study the optimal trade and industrial policies in the quantitative trade model and analyzed the effectiveness of suboptimal trade restrictions to correct sectoral misallocation caused by economies of scale or profit markup.

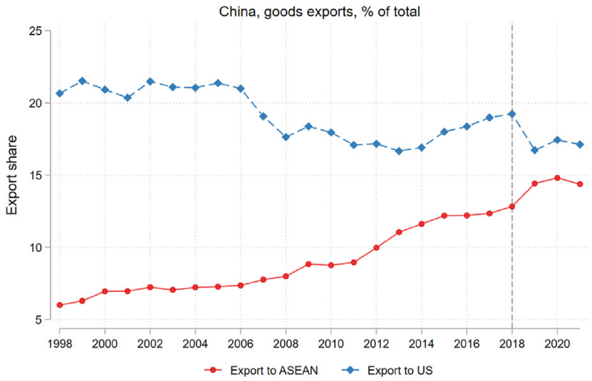
Ju et al. (2024) focus on trade and industrial policies during the Sino-US trade war and found that the Trump administration's motive to launch a trade war with China was not to reduce the trade deficit or protect employment,[21] but to restrict the development of China's high-tech industries and compete with the industrial policies of the Chinese government. If industrial competition policies are properly implemented, industrial subsidies, as a means of international competition, may cause less distortions than import tariffs.

The initial additional tariffs imposed by the US on China (July–August 2018) had nothing to do with reducing the deficit and were not aimed at the goods the US imports the most from China, such as computers and mobile phones. The initial additional tariffs imposed by the US (July–August 2018) were not aimed at solving the employment problem of the US and had nothing to do with changes in the penetration of US imports from China or changes in US employment in various industries from 2000 to 2014.

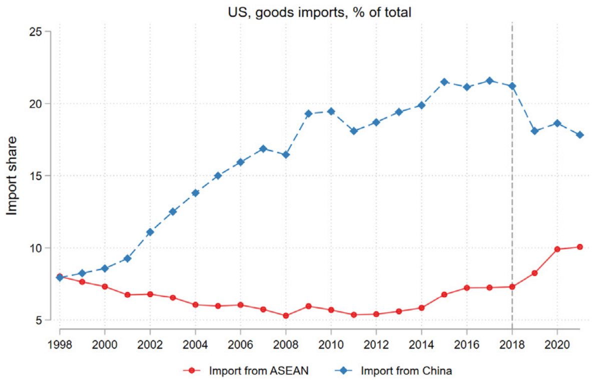
Trump's motivation for launching the trade was mainly aimed at China's industrial policies. How do trade disputes interact with industrial policies? Ju et al. (2024), based on the multi-country, multi-sector general equilibrium model in Caliendo and Parro (2015), introduce the external economies of scale of different sectors, and quantitatively estimate the impact of the Sino-US trade war and the industrial policy competition. They find that the subsidy policy of the 'Made in China (2025)' program would increase the welfare of both China and the US under the setting of economies of scale. The welfare effect of the trade war depended on China's industrial policies. If only unilateral import tariffs were considered (that is, China did not impose retaliatory tariffs), the US would enjoy more benefits when China implemented the optimal industrial policy in China. As far as policy competition was concerned, in the non-cooperative game, China and the US suffered from the high tariffs. In addition, they also found that if it was feasible for the US to subsidize its high-tech industries through industrial policies, its best policy choice should be to subsidize American industries and reduce the tariff rates.

With external economies of scale, trade policies were mostly ineffective in correcting misallocation, while industrial policies with cooperation and coordination among different countries are more transformative than any unilateral policy (Lashkaripour and

[21] Ju et al. (2024) find that the initial additional tariffs imposed by the US on China (July–August 2018) had nothing to do with reducing the deficit, and were not aimed at the goods that the US imports the most from China, such as computers and mobile phones. The initial additional tariffs imposed by the US (July–August 2018) were not aimed at solving the employment problem in the US and had nothing to do with the changes in the penetration of US imports from China or with the changes in employment in various industries of the US from 2000 to 2014 (see Ju et al. (2024), 2024 Figure A5).



(a) Additional tariffs imposed by the U.S. on China



(b) Retaliatory tariffs imposed by China on U.S.

Fig. 16. Changes in U.S. tariff increases and China's retaliatory tariffs
Notes: The figure is from Ma et al. (2023).

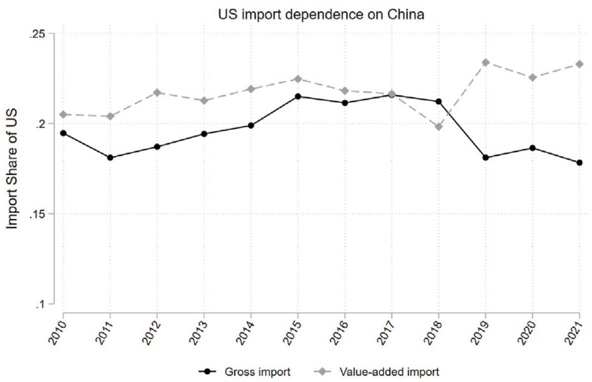


Fig. 17. The U.S. import dependence on China
Notes: The figure is from Ma et al. (2023).

Lugovskyy, 2023). Policy changes may cause changes in the global economic structure and international trade rules. In the future, the framework of global economic cooperation, especially in the high-tech field, may need to be redefined to adapt to the shift from trade policies to industrial policies.

6. Concluding remarks

This paper briefly summarizes the effects of the Sino-US trade war. As an overall evaluation, the Sino-US trade war has not achieved the expected outcomes of policymakers. First, the additional tariffs imposed by the US on China did not correct the trade imbalance, and its overall trade deficit continued to expand and shifted to other trading partners. Simply put, it did not bring manufacturing back to the US. Secondly, even if we acknowledge that the 'China shock' has caused a distribution effect and unemployment (as mentioned above, this is still controversial), the additional tariffs imposed by the US have not effectively corrected these distribution imbalances. In fact, most of the existing studies show that the Sino-US trade war has caused welfare losses to both countries, but had little impact on employment. This means that even if the trade war is aimed at protecting US industries and workers, its role in rebalancing the economy is very limited. The latest study by Autor et al. (2024) found that the Sino-US trade war in 2018–2019 did not contribute to the US heartland economically. The positive impact of import tariffs on employment was not significant, while foreign retaliatory tariffs caused obvious negative effects in the agricultural sector. Moreover, the increase in tariffs has led to an increase in the cost of imported intermediate goods, which has hurt downstream businesses in the US.

From the perspective of political economy, the trade war appeared to be beneficial to the Republican Party to some extent, as residents of areas severely affected by import tariffs were more inclined to support the Republican Party (Autor et al., 2024), indicating that trade policies and tariff changes may directly affect political position and voter behavior. However, Blanchard et al. (2024) find that support for Republican candidates decreased in counties that were vulnerable to tariff retaliation; and in counties directly affected by US tariff protection measures, support for Republican candidates did not increase, indicating that the influence of trade policies on domestic politics was complex and there may be significant regional differences.

The existing literature paid relatively limited attention to China. As an export-oriented economy, China suffered mainly from the decline in exports, the decrease in export companies, the increase in uncertainty in the investment environment, and the pressure of global supply chain restructuring. These factors may lead China to accelerate the transformation of its economic structure. Specifically, China may increase its efforts to shift to the development of industries with higher value added and technology-intensive industries, thus promoting industrial upgrading and the transformation of economic growth. This is not only a direct response to trade frictions, but is also a part of China's long-term economic development strategy. In the short term, China's retaliatory tariffs did not force the US to suspend or cancel its additional tariffs. The slowdown in external demand can be accompanied by challenges such as slowing economic growth and changes in the labor market. Since 2017, China has adopted the 'all-round opening-up' strategies, including reducing tariffs on products imported from other countries (except the US) (Qin and Ma, 2023), joining the RCEP (Qin and Ma, 2022), and actively promoting the Belt and Road, which has achieved positive results. In the long run, these measures will help alleviate the negative impact caused by external uncertainties and strengthen the resilience of China's economy and its competitiveness in the global economy. It should be a focus of future research of China's scholars to estimate the impact of trade conflicts on the Chinese economy and study China's strategies to cope with changes in the global trade system.

In summary, unilateral trade policies have limited ability to address the complex economic and social challenges brought about by globalization and can result in unexpected political and economic consequences. Despite the escalation of trade war and industrial policy competitions, there is still room for major economies — particularly China, the US, and the EU — to cooperate in areas such as green technologies, space development, etc. Balancing economic efficiency with security concerns is also imperative for major players in the global trading system. Therefore, future research should focus on the cross-disciplinary impacts of trade policies and the development of a comprehensive trade strategy that effectively balances economic growth, distributive justice, and political stability.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests (e.g., any funding for the research project)/personal relationships (e.g., the author is an employee of a profitable company) which may be considered as potential competing interests:

Hong Ma received financial support of the Social Science Foundation of China (Grant No.23&ZD046) and Tsinghua University Scientific Research Program (Grant No. 2023TSG08102).

Jingxin Ning received financial support from the Fundamental Research Funds for the Central Universities in UIBE this project (Grant No. 23QD10).

No other financial support was received and there are no other interested parties. Human subjects were not used in this research.

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