Study on the impact of U.S. deindustrialization on china's economy based on a vector autoregressive model

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Abstract. While economic structures of China and the United States are constantly changing, trade relations are also moving from complementarity to competition. China's economic growth poses a threat to the United States. And the United States curbs China's development through economic means, leading to increased trade friction. This paper analyzes the causes of Sino-US trade friction from the perspective of American economic structure transformation and uses the economic data of China and the United States to establish a vector autoregressive model for empirical analysis to study the effect of American de-industrialization on China's economic structure transformation and upgrading. Specifically, this paper explains the reasons for the re-industrialization of the United States and its impact on China's economic structure, and then explains the internal logical relationship between economic structure transformation and trade friction.

Keywords: component; trade friction; economic structure transformation; de-industrialization; re-industrialization

1 Introduction

On March 23, 2018, former US President Trump announced at the White House that it would be possible to impose tariffs on $ 60bn of imports from China and limit Chinese companies ' investment in the US. On June 16, 2018, China's commerce ministry decided to impose tariffs on agricultural products, such as soybeans, and imported goods, such as cars originating in the United States, after several rounds of consultations agreed but Trump still said it would impose tariffs on China. This marks the beginning of Sino-US trade friction. Until January 2020, when China and the US signed the "Phase I Economic and Trade Agreement" at the White House, both parties imposed third-round tariffs on each other's goods. There are many reasons for Sino-US trade friction and many scholars have analyzed it.

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The national labor force data reflects the overall trend of deindustrialization in U.S. The total employment in the U.S. manufacturing industry peaked at World War II at the end of 1943, declined slowly in 1979, and lasted until 2000. In the past few decades, the employment of many American workers has shifted from the secondary industry to the service industry. From2000 to 2010, the country lost nearly 36% of manufacturing jobs [1].

Scholars also analyzed the reasons for the deindustrialization of the US. First, because of the awareness of labor protection, coupled with the deterioration of the downtown area and environmental quality, entrepreneurs move manufacturing factories from major cities to small and medium-sized towns and production factories in rural areas, or even abroad; Second, due to the exhaustion of resources and the increase in production costs, some manufacturing industries, which are mainly concentrated in some old industrial bases, such as the steel industry and textile industry, have experienced a serious decline; With the development of technology, companies can move part of the production process, especially the development of labor-intensive processing technology, to areas where foreign labor is relatively cheap.

In addition, the development of deindustrialization in the United States is uneven. Because American industry is highly regional, the deindustrialization of the US is also a regional process. For different states, we can identify many different stages, such as Detroit, St. Louis, and New York, and other cities that began deindustrialization in the mid to late 1950s.

Before 2000, "complementarity" is a main characteristic of the Sino-US trade structure. The United States had a comparative advantage in capital-intensive production, while China had a comparative advantage in labor-intensive production. The common goal of both parties is a win-win cooperation; However, as China has gradually grown to be a processing and manufacturing center, developed countries do not want China to gain competitive competitiveness in terms of independent innovation, emerging industries, and brand technologies, in order to maintain existing interests and trade hegemony; Therefore, U.S. will inevitably intervene and restrict the transformation and upgrading of China's economic structure, whether it is from controlling technology transfer, strengthening the advantages of intangible assets, or suppressing China's independent innovation and suppressing emerging brands. From the perspective of economic structural transformation, this article analyzes the internal causes of Sino-US trade frictions and explores their internal logical connections.

The rest of the paper is arranged as follows. The second part is the literature review, which sorts out the manifestations and causes of trade friction between China and the United States, as well as the influence of de-industrialization and re-industrialization of the United States on China's economic structure. The third part analyzes the promoting effect of US deindustrialization on China's economic structure transformation through data analysis. The fourth part explains the logic behind Sino-US trade friction from the perspective of American re-industrialization. The fifth part is the conclusion.

2 Literature Review

Studies related to this paper include research on the causes of Sino-US trade friction. The causes of trade friction are discussed by scholars from various perspectives. From the aspects of intellectual properties, Zhu and Zheng analyzed the causes based on the trade added value. They found that as a producer and exporter of the world's major industrial products, China's gradual transition from the downstream value chain which relies heavily on foreign advanced technology to the upper and middle reaches subtly affects the reconstruction of the global value chain and the adjustment of the international industrial structure [2]. It also broke the “balance" of the labor division in the Sino-US industrial chain. The rise of China's economy has made the long-standing "global hegemony" of U.S. unilaterally regarded as a threat and provoking trade disputes. Similarly, Weeda found that recent trade disputes are mainly related to protecting intellectual properties. In addition, most countries received less profit before copyright protection [3]. The conditions for protecting intellectual property rights are disadvantageous in China. In April 2005, the Office of the U.S. Trade Representative launched the "Special 301 Report", which stated that China's intellectual property infringement level reached more than 90%, causing annual losses of 2.8 billion to 3.5 billion U.S. dollars to the United States [4].

Scholars also analyzed trade frictions from the aspects of mercantilism and trade protectionism. McKinnon analyzed the American economy. He concludes that under trade imbalance, U.S. would implement trade protectionism [5]. C. H. Kwan indicates that the trade deficit is an important cause of trade friction. Since 2000, China has replaced Japan becomes the largest trade deficit source country for the U.S. He indicates, in 2019, the U.S. deficit with China take as much as 40.5% of the overall U.S. trade deficit and peaked at 49.3% in 2015. The US trade imbalance reflects excessive domestic consumption [6]. While China is in a state of excess savings, capital flows from China are used to make up for the trade deficit to maintaining excessive consumption. D. Uzunidis and B. Laperche identified that to protect domestic production; The main actions of the ‘New Mercantilism’ include encouraging exports and restricting imports [7]. Since July 2, 1980, the United States has implemented more than 100 anti-dumping measures on Chinese export products, covering a wide range of Chinese products, such as textile, furniture, chemical and other manufacturing industries. B. Jian indicates that the amount involved is expanding. Anti-dumping friction has become an important form of Sino-US trade friction [8]; Meanwhile, D. Tan and X. Shuaib discovered that China has inappropriate product structures of export [9].

Some scholars believe that U.S.’s deindustrialization is one of the causes of Sino-US trade friction. They explored the deindustrialization of developed countries from different aspects. W. Jing and W. Pei believe that the transfer of labor from the primary industry to the secondary industry and then to the tertiary industry is a natural result of economic development and the increase in per capita national income. They find that international factors are one of the most important sources of manufacturing employment decline [10]. For this view, R. Lawrence and L. Edwards also conclude that the existence of developing countries with qualified manufacturing capabilities is a prerequisite for U.S. to implement deindustrialization [11]. L. Sheng indicates that China’s

manufacturing export growth satisfies the rising U.S. demand for consumption goods under deindustrialization [12]. Sheng believes that the foreign demand for manufacturing imports has affected China's economic structure. McKinnon affirmed in his research that deindustrialization of U.S. has had an impact on China's economy, which mainly reflected in America's long-term saving rate declined relative to China's rising rate from 1965 to 2010 [5].

W. Jing and W. Pei classify the deindustrialization of the United States into two types: The first type is characterized by the shifting of manufacturing capital to service industries, especially virtual economy industries. The second type is characterized by the spatial shift of the manufacturing process. These two types reflect the two stages of American industrialization. The first type of deindustrialization appeared in the 1970s, and the second type of deindustrialization gradually appeared after the 1990s. From the perspective of the impact, thorough deindustrialization (the second type) will lead to an excessive weakening of the manufacturing capacity, seriously jeopardizing the foundation of economic growth in developed countries, and its impact is mainly negative. Moreover, this negative impact will create hidden dangers for trade frictions between developed countries and their manufacturing importing countries [10].

These scholars discussed the causes of Sino-US trade friction from different aspects; however, the impact of the deindustrialization of U.S on the Sino-US trade fraction has not been thoroughly studied; Therefore, it is worthy of being studied.

3 Quantitative Analysis

3.1 Variable Selection

According to the existing literature, "deindustrialization" can be measured by the proportion of manufacturing (or service) employment to total employment and the proportion of output value or value added in manufacturing (or service) to GDP. We select the proportion of added value of China's three industries to measure the index of economic structure transformation and upgrading.

3.2 Data Set and Sample Selection and Model Establishment

We select the data of the corresponding indicators of China and the United States from 1985 to 2017. To analyze the effect of U.S.'s deindustrialization on China' s economic structure transformation, the proportion of value added in China' s primary industry, secondary industry and tertiary industry is taken as the predicted variable, and the VAR model is established for analysis. The model is as follows:

$$Y_t = C + \phi \sum_{j=1}^{P} Y_{t-j} + \varepsilon_t \tag{1}$$

Among them, $Y_t = [MS_t \ \ PPI_t]^T$, $Y_t = [MS_t \ \ PSI_t]^T$, $Y_t = [MS_t \ \ PTI_t]^T$, C is a constant, ϕ is a coefficient matrix, ε_t is a residual term. MS_t is the proportion of manufacturing added value to GDP in the United States; PPI_t is the proportion of China's primary industry added value to GDP, PSI_t is the proportion of the value added of

China's secondary industry to GDP; PTI_t is the proportion of value added of China's tertiary industry to GDP. Next, the model is going to be further estimated.

3.3 Empirical Results

- Time series stability test

From the test results in Table 1, it is evident that, except for China's secondary industry added value ratio, the other three variables are stable. But the first-order difference scores of all variables at 1 % significance level reject the original assumption that there is unit root. Therefore, it can be determined that the above variables are I (1) processes.

Table 1. The result of unit root test

variable	Level test results			First-order difference test results		
	Form of inspection (*T*, *C*, *L*)	*ADF* value	*P* value	Form of inspection (*T*, *C*, *L*)	*ADF* value	*P* value
MS	(0,0,1)	-3.62569	0.0007***	(0,0,1)	-3.98372	0.0003***
PPI	(1,1,1)	-5.00576	0.0016***	(0,0,1)	-6.77354	0.0000***
PSI	(1,1,1)	-2.87114	0.1845	(0,0,1)	-6.24687	0.0000***
PTI	(1,1,1)	-3.34421	0.0773*	(0,0,1)	-8.71537	0.0000***

- Variable co-integration test

In this paper, the proportion of added value of three industries as explained variables co-integration test, the test results are shown in Table 2. The results show that there is a long-term stable co-integration relationship between the proportion of added value of China's three major industries and the proportion of added value of US manufacturing industry.

Table 2. Co-integration Test Table

dependent variable	original hypothesis	Trace statistics	5 % threshold	Maximum eigenvalue	5 % threshold
PPI	None*	29.2120	12.3209	18.2189	11.2248
	At most1*	10.9932	4.1299	10.9932	4.1299
PSI	None*	19.1785	12.3209	14.1743	11.2248
	At most1*	5.0042	4.1299	5.0042	4.1299
PTI	None*	13.0406	12.3209	11.6193	11.2248
	At most1	1.4213	4.1299	1.4213	4.1299

Note: * represents rejecting the original hypothesis at 0.05 significance level.

- Determination of lag orders

We use unrestricted VAR model to analyze PPI and MS, PSI and MS, PTI and MS respectively. Firstly, common indicators such as LR statistics of likelihood ratio test, final prediction error FPE, AIC information criterion, SC information criterion and HQ information criterion are used as the judgment criteria for the selection of lag order. The judgment results of lag order are shown in Table 3. Table 4 shows the index values of the VAR model from order 0 to order 4, and the results show that the lag order is determined to be 1.

Table 3. The choice of lags

Dependent variable	*Lag*	*Log L*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
PPI	0	-152.4131	NA	144.5286	10.6492	10.7435	10.6787
	1	-99.7665	94.4008*	5.0529*	7.2942*	7.5771*	7.3828*
	2	-98.8608	1.4991	6.2893	7.5076	7.9791	7.6553
	3	-97.9460	1.3880	7.8781	7.7204	8.3805	7.9271
	4	-97.0638	1.2167	9.9942	7.9354	8.7841	8.2012
PSI	0	-156.6072	NA	193.0079	10.9384	11.0327	10.9680
	1	-97.9746	105.1344*	4.4656*	7.1707*	7.4536*	7.2593*
	2	-96.6592	2.1773	5.4033	7.3558	7.8273	7.5035
	3	-92.5420	6.2467	5.4271	7.3477	8.0078	7.5545
	4	-90.1851	3.2509	6.2190	7.4610	8.3097	7.7268
PTI	0	-148.5866	NA	111.0062	10.3853	10.4796	10.4148
	1	-92.4906	100.5860*	3.0593*	6.7925*	7.0753*	6.8811*
	2	-91.5455	1.5644	3.7975	7.0031	7.4746	7.1508
	3	-90.3731	1.7787	4.6731	7.1981	7.8582	7.4049
	4	-90.1059	0.3686	6.1852	7.4556	8.3042	7.7214

Note: * Represents the selection of the optimal lag order.

- Stability test of VAR model

The order of lag is selected as 1, and three groups of VAR models are established respectively. To determine whether the model is stable, the stability of the VAR system is tested respectively. The results are shown in Figure 1. Obviously, the roots of the characteristic equation of the model fall within the unit circle. Therefore, the three models are stable.

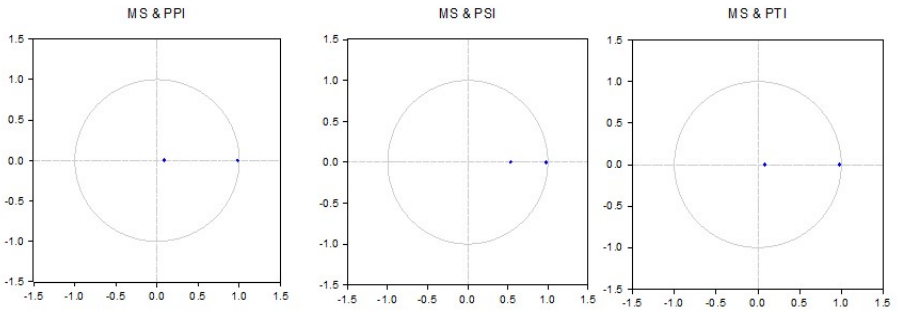

Fig. 1. Stationary test

- Granger causality test of VAR model variables

To determine the interaction between PPI, PSI, PTI and MS, Granger causality test based on VAR model is needed. Granger causality test is shown in Table 4. From the test results, taking the proportion of added value of China's primary industry as the explained variable, at the significant level of 5 %, the proportion of added value of manufacturing industry in the United States is the Granger cause of added value of China's primary industry. Taking the proportion of added value of China' s secondary industry as the explained variable, at the significant level of 10 %, the proportion of added value of manufacturing industry in the United States is the Granger cause of added value of China' s secondary industry. Taking the proportion of added value of China' s tertiary industry as the explained variable, at the significant level of 5 %, the proportion of added value of US manufacturing industry is the Granger cause of added value of China' s tertiary industry.

Table 4. Granger Causality Test

original hypothesis	lag order	observed value	F statistic	*P* value	conclusion
PPI is not the Granger cause of MS	1	32	0.00005	0.9944	Accept
MS is not the Granger cause of PPI			6.65046	0.0153**	Reject
PSI is not the Granger cause of MS	3	30	0.75000	0.5335	Accept
MS is not the Granger cause of PSI			2.74329	0.0663*	Reject
PTI is not the Granger cause of MS	1	32	2.09276	0.1587	Accept
MS is not the Granger cause of PTI			6.58050	0.0157**	Reject

Note: * and * * represent rejecting the original hypothesis at the significant levels of 10 % and 5 %, respectively.

- Impulse response analysis

Figure 2 shows the changes in the current and future values of China's proportion of the added value of the primary industry, the proportion of the added value of the secondary industry and the proportion of the added value of the tertiary industry standard

deviation of the proportion of value added in manufacturing industry in the United States.

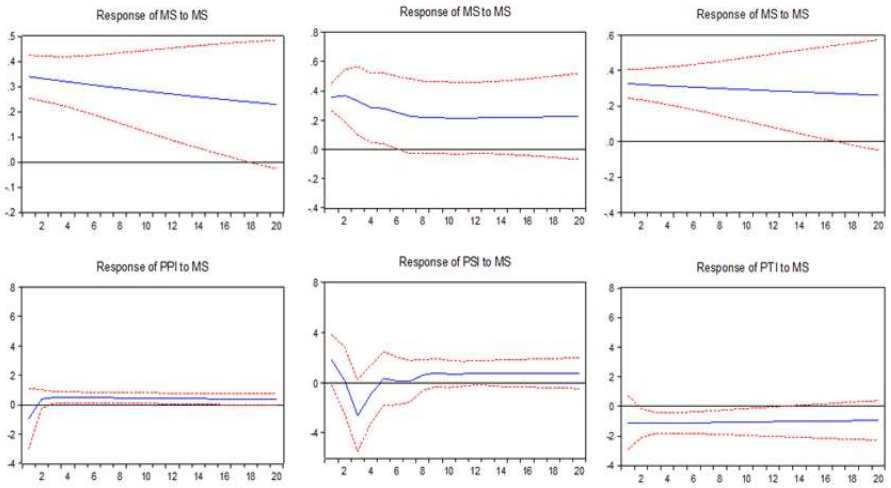

Fig. 2. Impulse response diagrams

According to Figure 2, when the proportion of manufacturing value added in the United States is subject to a positive impact, the proportion of value added in the first industry decreases in the first period, and gradually maintains a stable growth state after the second period. Thus, the degree of de-industrialization in the United States is negatively impacted, which will increase the added value of China's primary industry in the short-term and will have a sustained and stable impact for a long time. When the proportion of the value added of the manufacturing industry in the United States is impacted positively, the proportion of the value added of the secondary industry decreases from positive to below 0 in the first period and reaches the lowest peak in the second period. The value has continued to grow significantly since the third phase. It can be seen that the degree of deindustrialization in the United States is negatively impacted. Although the impact on the proportion of added value of China's secondary industry in the short-term is not significant, it will maintain significant growth in the long term. Finally, when the share of manufacturing value added in the United States was positively impacted, the share of tertiary industry value added declined in the first phase and remained low for a long time. The reverse impact on the degree of de-industrialization in the United States will reduce the value added of China's tertiary industry and continue this impact for a long time.

4 Conclusion

This paper examines one of determinants of Sino-US trade friction from the perspective of de-industrialization, reindustrialization, and economic structure transformation. The

empirical results demonstrate that U.S.'s de-industrialization promotes the upgrading of China's economic structure, and re-industrialization is also a manifestation of competition among two countries. First and foremost, the re-industrialization of the United States has brought back some labor-intensive and capital-intensive manufacturing industries, putting pressure on employment in related industries in China. Secondly, Trump's tax cut plan stimulates and motivates the development of enterprises and adversely affects the willingness of American enterprises to invest in factories in China. In addition, U. S. manufacturing and some high-tech industries have been intervened by the U. S. government when investing in factories or transfers, and some high-tech industries with high technology content and high value added are difficult to flow to China, while the technology gap between China and the U. S. remains huge, and China is under increasing pressure to catch up with advanced developed countries. With the continuous improvement of China's international status and the strengthening of comprehensive national strength, the contest between China and the United States will become fiercer. Indeed, trade frictions provide a range of development opportunities as well as economic fluctuations. Although the recession will make the U.S. market demand decline, it does not affect China's exports to the United States. On the contrary, exports increased. This suggests that US consumers, whose incomes have fallen because of the economic turmoil, have increased demand for Chinese goods. Therefore, despite the objective existence of trade frictions, China can still seize the opportunities to achieve economic structural upgrading and high-quality economic development through continuous exploration and efforts.

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