

The Influence of Sino-US Trade Friction on the Export Volume of China's High-tech Products

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Abstract. With the rapid development of economy, witnessing the extraordinary progression of the economy, China has ascended as the second largest economy globally, and the gap with developed countries is getting smaller and smaller. For a long time, there has been a huge trade deficit from China to the United States. The United States provoked trade friction on the grounds of trade protectionism, restricting trade with China, high-tech industries being the focus. Employing the difference-in-differences (DID) methodology, this paper scrutinizes the influence of Sino-US trade frictions on the export value of China's high-tech industries, utilizing the export data of China's high-tech industries to the United States spanning from 2012 to 2022. It is found that after the Sino-US trade friction began, China's exports of high-tech products to the United States have declined significantly, which has caused trade destruction effect and trade deflection effect from China to the United States.

Keywords: Sino-US trade friction, high technology, difference-in-differences method.

1. Introduction

With rapid economic development, China has become the country with the fastest economic development in the world. China's trade data has always been very eye-catching, its export volume surpassing that of the United States for the first time and ranking first in the world in 2013. Since US President Donald J. Trump assumed office, he implemented a series of policies under the banner of trade protectionism. China enjoys the largest trade surplus with the United States. In 2017, the trade deficit between the United States and China escalated to US \$278.5 billion, and China became the key target of the Trump administration.

In August 2017, the United States declared the initiation of the "301 investigation" against China, which kicked off the Sino-US trade friction. On April 4th, the United States released the "301 Investigation List", proposing to impose additional tariffs on \$50 billion worth of Chinese products and tariffs on \$100 billion worth of other Chinese products. On August 23rd, the United States further to impose additional 25% tariff on \$16 billion worth of Chinese products. In this series of sanctions, high-tech industries had been the main targets of sanctions imposed by the United States [1].

Employing the methodology of difference-in-differences, this research scrutinizes the repercussions of Sino-US commercial frictions on China's export worth of advanced technology products. Using the year 2018 as the boundary, the impact of Sino-US commercial frictions on China's export volume of advanced technology products is confirmed via a juxtaposition with sectors that have remained unaffected.

It is discerned that subsequent to the Sino-US commercial frictions, China's exports of advanced technology products to the United States have precipitously declined, engendering trade disruption between China and the United States.

2. Literature Review

Sino-US trade is a research hotspot nowadays. Brown C P et al. believe that in the economic downturn; in order to protect their own interests, countries would spontaneously use temporary trade barriers to restrict the import and export of other countries or regions, thus causing trade disputes and

aggravating friction [2]. Fatma believed that the main reason for the United States to launch economic sanctions against China was to develop domestic trade and dollar hegemony [3]. Chen Jiyong believed that the United States was worried that China would form a direct strategic competitive relationship with the United States after the upgrading of its industrial structure, which would affect the United States' leading position in high-tech fields and challenge its hegemonic position [1]. Jiang Zhengrui believed that there was an unbalanced interdependence in Sino-US trade relations through research on the development of Sino-US trade relations, and the United States was in a dominant position in Sino-US trade [4]. Wu Mingming believed that the reason for Sino-US trade friction was that Trump's populism affected US trade policy and imposed economic sanctions on China [5]. Liu Feitao believed that the competition between China and the United States was constantly strengthening, but the competition was within a controllable range, the interaction of the interests of both sides had not changed, and cooperation remained the main direction of Sino-US relations [6]. Lu Siying believed that in the context of Sino-US trade friction, China's macroeconomic trend was stable, and although the current situation of the financial industry fluctuated, it remained within a controllable range [7]. Yang Yiwen believed that Sino-US trade friction had a negative impact on Chinese high-tech enterprises, and enterprises must strengthen their independent innovation capabilities to survive in the market [8]. Zhou Donghua, Peng Jianfei and Zhao Yujie believed that Sino-US trade friction not only significantly reduced inventory investment of the affected enterprises, but also seriously blockaded the channels for enterprises to study overseas, aggravating the financial restriction within and outside of enterprises, and reducing their risk-taking capacity [9].

As for limitations, the bulk of extant research is predicated on historical information. Following the "301 Inquiry," there exists a scarcity of empirical examination into alterations to the trading landscape between China and the United States as they encounter trade disputes. The unique contribution of this study stems from its implementation of the DID methodology, which effectively eliminates the influence of other macroeconomic variables. Utilizing the most recent trade statistics between China and the United States, this paper scrutinizes the repercussions of the Sino-US trade discord on China's exports of advanced technology goods.

3. Policy Background

With accelerated economic prosperity, China has ascended to the position of the world's second largest economy and the gap with developed countries is getting smaller and smaller. For a long time, the United States has had a huge trade deficit in trade with China. The United States provoked trade friction on the grounds of trade protectionism, restricting trade with China, high-tech industries being the focus. Since China joined WTO in 2001, trade anti-dumping investigations against China have been increasing. According to WTO statistics, from 1995 to the end of June 2020, countries around the world launched a total of 5,983 anti-dumping investigations, of which Japan, the United States and South Korea have been targets of 295, 314 and 443 anti-dumping investigations respectively. However, China have been the target of as many as 1,656 anti-dumping investigations, accounting for approximately 27.68%, making it the country that has received the most anti-dumping investigations. The number of anti-dumping inquiries initiated by the United States and the European Union against China stood at 225 and 164 respectively, comprising 39.83% and 34.02% of the total number of foreign inquiries orchestrated by these two entities. China has become the primary target of anti-dumping measures of many countries. Circa 2018, the United States initiated the "301 Investigation" against China, which initiated the Sino-US trade sparking off. In 2017, China's exports of high-tech goods to the United States amounted to US \$171.067 billion, but by 2020, the export volume was only US \$133.473 billion, a decrease of 22%.

4. Theoretical Hypotheses

The main reason for the Sino-US trade friction is that the US high-tech industry is affected by China's high-tech industry, and China's products are superior to those of the United States in terms of price, quality and function. For the development of local high-tech industry, the United States proposed trade protection and imposed sanctions on China's high-tech industry.

Hypothesis 1: The intensity of Sino-US trade disputes is positively correlated with the technological advancement of products traded between these two nations, suggesting that heightened Sino-U.S. trade tensions prompt Chinese high-tech firms to prioritize the global marketplace, thereby compelling them to invest heavily in technological innovation and bolster their commitment to product research and development, ultimately aiming to secure a greater market share internationally.

Hypothesis 2: The intensity of Sino-US trade disputes directly influences the export volume of high-tech goods exchanged between China and the United States.

5. Research Design

5.1. Model settings

In this study, the paper employs the difference-in-differences method (DID for short). DID method has gained significant traction in assessing policy impacts in recent years. Conventional measurement strategies often incorporate an extensive array of variables into the model for control, however, the incorporation of novel variables may engender endogenous issues, and certain variables prove challenging to quantify. Conversely, the DID method is another approach. In addition to the experimental group, there is also a control group that is not affected by the policy. By contrasting the data of the intervention group with that of the control group prior to and subsequent to the policy's enactment, the impact of the policy's execution can be appraised. The proposed model for examining the influence of Sino-US trade frictions is outlined below:

$$\ln \text{number}_{it} = \alpha + \beta \text{treatment}_{it} * \text{post}_{it} + \gamma X_{it} + \mu_i + \nu_t + \varepsilon_{it}$$

In this context, the predictor variable 'lnnumber' signifies China's export volume to the United States during a specified period 't'. The independent variable 'treatment', a new gauge, demarcates the research group from the comparison group, with one indicating China-US business transactions and zero signifying China- other nation interactions. In terms of 'post', it serves as a binary indicator distinguishing pre-Sino-US trade dispute periods (coded as zero) from those subsequent to such disputes (coded as one). The product of 'treatment' and 'post', 'treatment * post', represents their joint impact. The constant term 'A' denotes the baseline value, while 'β' represents the influence imparted by Sino-US trade frictions. Lastly, 'γ' denotes the coefficient associated with the control variable 'X_{it}'. This includes a range of control variables, represented by 'μ_i', 'ν_t', and 'ε_{it}', which respectively denote the industry fixed effect, time fixed effect, and random disturbance term.

5.2. Sample, Data Description and Variable Description

5.2.1. Sample and Data Specification

This discourse isolates the annual metrics of China's exports of innovative technology commodities to the United States spanning a trajectory from 2012 to 2022. On the one hand, due to the 301 Investigation against China by the United States in 2017 and 2018, tariffs were increased on some Chinese products. The raw data were sourced from UN Comtrade and China Statistical Yearbook. Divided into 9 broad categories: materials technology; electronic technology; optoelectronic technology; aerospace technology; computer integrated manufacturing; computer and communication technology; life and science and technology; biotechnology; other technologies.

5.2.2. Variable description

Explaining variables: Explaining Variables. Drawing from existing literature methodologies, this study employs the logarithm of China's shipments to the United States as the explanatory variable (table 1).

Explanatory variables: This paper selects post, treatment and treatment * post as explanatory variables. In 2018, the Trump administration announced a 25% tariff on more than 1,300 kinds of goods originating in China, which is taken as the time node when Sino-US trade friction occurred. The previous data post is set to 0, for data from 2018 and beyond, the post is set to 1. treatment is set to 1 for Sino-us and 0 for other country, and treatment * post is the intersection of the two (table 1).

Control variables: This manuscript meticulously regulates additional elements that might potentially influence export quantum, encompassing the dimensions of Economic sophistication, Infrastructure establishment, Industrial fragmentation, and financial advancement (table 1).

Level of economic development: This distinct entity encapsulates the extent or magnitude of socioeconomic phenomena across diverse epochs, serving as a foundational element for the computation of multiple indicators pertaining to dynamic analyses (table 1).

Infrastructure construction: Infrastructure denotes installations providing universal conditions and communal amenities integral to the operations of direct sectors of production and societal life (table 1).

Industrial structure: The concept of industrial structure was conceptualized within the purview of developmental economics. This construct, also identified as the industrial system, serves as the foundational component of our societal and economic framework (table 1).

Level of financial development: Financial progress demonstrates a positive correlation with commerce, demonstrating that robust financial growth can stimulate the progression of trade (table 1).

Table 1. Variable settings and descriptive statistics

Variable	Meaning	Minimum value	Maximum value	Mean value	Standard deviation
Ln-export	Logarithm of China's exports to other countries	17.056	24.697	20.847	1.933
Treatment	Whether high-tech products or not	0	1	0.071	0.258
Post	Whether around 2018 or not	0	1	0.455	0.500
Treatment*post Treatment * post	The intersection of treatment and post	0	1	0.032	0.178
Level of economic development	Logarithm of GDP per capita	10.435	11.597	10.882	0.255
Infrastructure construction	Per capita urban road area	7.004	11.934	9.417	1.412
Industrial structure	Economic Indicator: Ratio of Generated Value Contributed by the Secondary Sector to Total GDP	0.201	0.396	0.292	0.057
Level of financial development	The end-of-year ratio of the financial institution's deposit and loan balance to nominal GDP	0.590	0.799	0.689	0.062

6. Empirical Analysis

6.1. Basic Data Regression

In this paper, the aforementioned model undergoes linear regression, yielding the regression outcomes illustrated in Table 2. These correspond to the findings attained through the linear

regression of the logarithmically transformed export data, and the control variables is c1, c2, c3 and c4.

Table 2. Benchmark regression results

VARIABLES	Ln-export
did	3.904*** (0.794)
c1	-2.533*** (0.545)
c2	0.134 (0.132)
c3	-1.962 (3.616)
c4	2.821 (3.668)
Constant	45.65*** (6.833)
Observations	154
R-squared	0.269

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

6.2. Parallel Trend Test

In employing the DID methodology to assess policy impact, the prerequisite for the reliability of the empirical data lies in ensuring compliance with the parallel trend hypothesis, specifically, that prior to the implementation of the policy, there existed a comparable trend between China and both the United States and other country. To substantiate this parallel trend presumption, the following analytical framework can be utilised:

$$\ln \text{numberita} = \alpha_3 + \sum_{t=-5}^4 \delta_t \text{Dit} + \lambda_3 \text{Xita} + \mu_i + \nu_t + \varepsilon_{it}$$

Where Dit denotes a proxy indicator utilized to mirror potential occurrences of a range of punitive actions such as escalating tariffs instigated by the United States. Should these measures be enacted during the t -th fiscal period, the corresponding value will reach 1; conversely, it shall remain at zero. The symbolic meanings associated with the remainder of the variables remain consistent with those specified within Equation (1). Within this empirical investigation, our primary focus lies on analyzing the coefficient δ_t , representative of the disparity in export volumes between China and the United States, and also between China and France, during the t -th year subsequent to the implementation of the policy instigated by Sino-US trade frictions.

As depicted in Fig.1, prior to a series of punitive actions like escalating US tariffs, there existed no discernable disparity between the Chinese and American trade volumes, signifying the successful adherence to the parallel trend criteria.

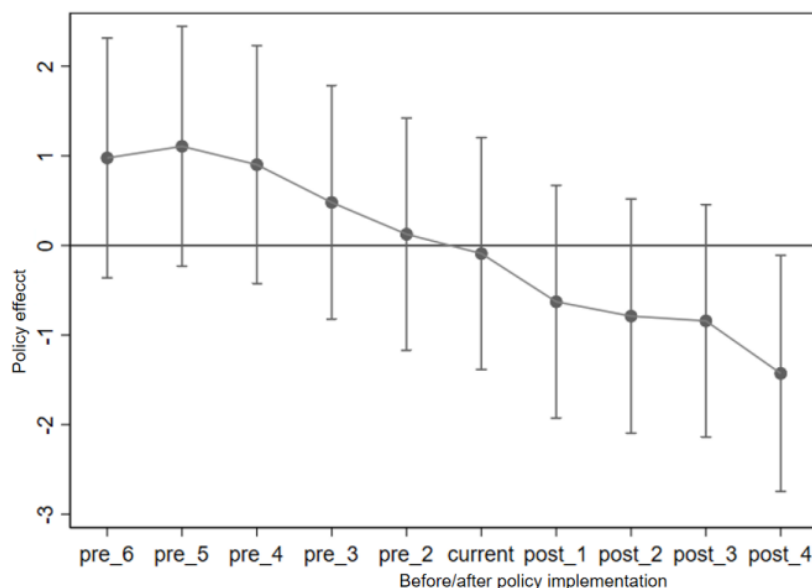


Figure 1. Results of the parallel trend test

6.3. Placebo Test

In order to exclude the possibility of empirical results being generated randomly, this paper borrows insights from the practices of Chetty and Cai et al., and conducts placebo tests by replacing the treatment group countries and the time of reform [10, 11]. Since the Sino-US trade friction involves 11 years, the sample covers 154 years and 14 different countries from 2012 to 2022. Therefore, it is divided into 154 groups, and 11 groups are randomly selected as false control groups. At the same time, the reform year is randomly generated, and the randomized trial at two levels of time-country is constructed. An estimate for the influence of a placebo Sino-U.S. trade friction policy on China's high-tech product export volume could be attained through the aforementioned methodology. A total of 500 iterations utilizing this methodology provided us with 500 regression coefficients, upon which the paper executed the placebo test.

As illustrated in Fig. 2, outcomes from the placebo trial reveal a notable concentration of the treatment*post interaction term's coefficient centric around zero. Furthermore, the estimated coefficient for the previously executed benchmark regression is situated on the periphery of the spurious distribution, signifying a diminished likelihood of the study's benchmark regression outcomes being influenced by extraneous, unforeseen variables. This corroborates the validity of our research findings.

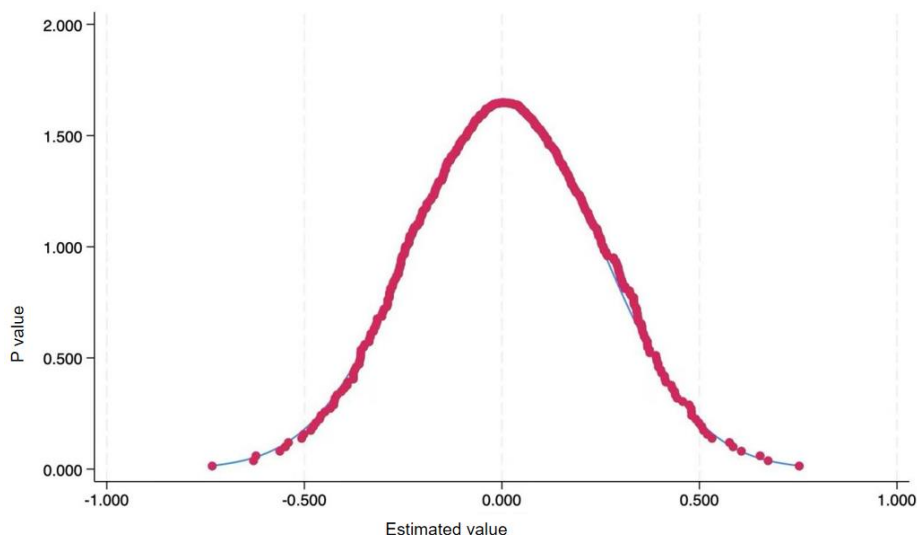


Figure 2. Placebo Test

7. Further Analysis

Since there may be a lag in the policy, it happens that COVID-19 pandemic occurred in 2020, which may have the same effect on the policy. If the trend analysis of China's total exports is conducted, if there is no obvious downward trend, it means that the epidemic has no significant impact on it. In the absence of significant impact, if there is no obvious decline in the first year of the implementation of the policy, it is considered to be lagging behind (figure 3).

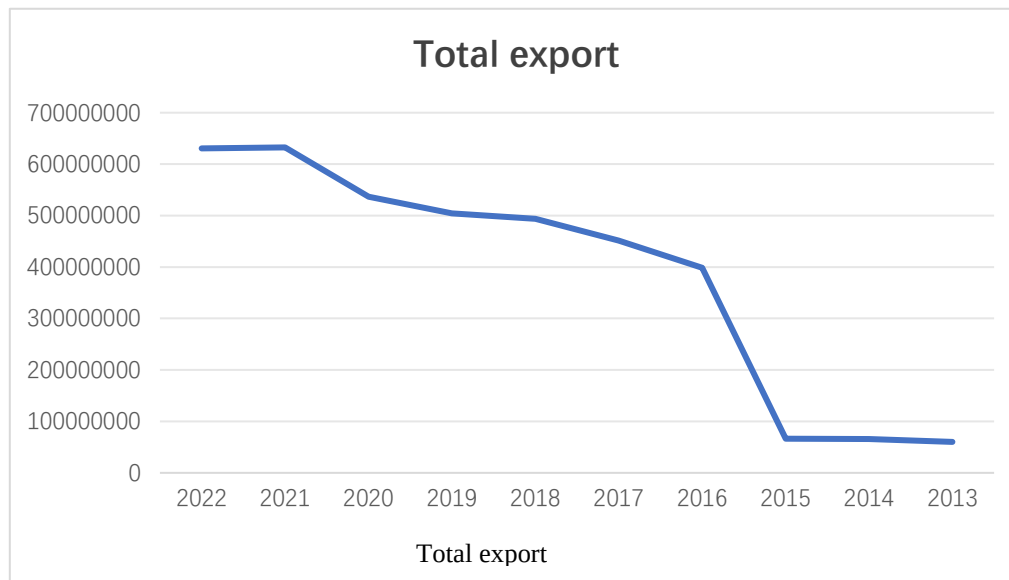


Figure 3. Total export

8. Conclusion

Based on the background of Sino-US trade, this paper analyzes the export value of their high-tech products, and constructs a DID model, using the original data from UN Comtrade and China Statistical Yearbook. They were divided into nine broad categories: materials technology; electronic technology; optoelectronic technology; aerospace technology; computer integrated manufacturing; computer and communication technology; life and science and technology; biotechnology; and other technologies. This study diligently assesses the consequences of Sino-US commercial disputes upon China's exportation of advanced technology goods. It is found that the policies caused by Sino-US trade friction have significantly reduced China's export of high-tech products to the United States. Compared with other countries, the upward trend has been significantly reduced, and it has passed the parallel trend test, placebo test and other robustness tests. In light of these investigation outcomes, the author hereby proposes the ensuing policy directives.

First, in the short term, China should further improve and supplement its intellectual property protection measures of high-tech industries, and further improve its intellectual property policies to create a good investment environment for enterprises, especially for foreign investment in China, and make the rules and procedures open and transparent, so as to show the world that China has a good investment environment. The United States should lift all kinds of restrictions on China, push American enterprises to improve their capabilities and competitiveness, and enhance friendly trade relations between the two countries.

Second, in the medium term, China should formulate corresponding policies to help the development of high-tech industries. Especially in terms of capital and manpower, it should increase investment in scientific research to narrow the gap with American high-tech industries, improve the internal competitiveness of China's high-tech industries to enhance China's ability to resist risks in world trade. The United States should also attach more importance to and help high-tech industries and enhance their international influence.

Third, in the long term, China should further optimize its foreign trade structure. A long-term trade surplus will have a huge trade impact on other countries, so China should focus on the direction of domestic and foreign dual circulation, with the domination of the domestic circulation. It should improve the quality of traded products, strengthen the construction of its trading power, and under the theme of the belt and road initiative, give full play to the ability of China's trading power, promote trade globalization, reduce trade dependence on the United States and promote the diversification of trading partners. Through external reforms and internal adjustments, China should promote supply-side structural reform and build an open, fair and harmonious community of shared future for all mankind.

References

- [1] Chen JY. The background, causes, essence and countermeasures of Sino-US Trade War. *Journal of Wuhan University (Philosophy and Social Sciences Edition)*, 2018, 71 (05): 72 - 81.
- [2] Bown CP, Crowley MA. Emerging economies, trade policy, and macroeconomic shocks. *Journal of Development Economics*, 2014, 111: 261 - 273.
- [3] Fatmaa BN. Perception vs. reality: understanding the US-China trade war. *Transnational Corporations Review*, 2019, 11 (4): 201 - 216.
- [4] Jiang ZR. *Cooperation and Friction: on the Development of Sino-US Trade Relations*. Jilin University, 2017.
- [5] Wu MM. *Analysis of Sino-US Trade Friction under the Trump Administration*. Shanghai Academy of Social Sciences, 2018.
- [6] Liu FT. The United States strengthens competition with China and the trend of Sino-US relations. *International Issues Research*, 2016, (01): 49 - 62.
- [7] Lu SY. On the impact of Sino-US trade war on China's financial industry and countermeasures. *China Market*, 2020, (21): 12 - 14.
- [8] Yang YW. Analysis of the impact of Sino-US trade friction on high-tech enterprises and countermeasures- A case study of Huawei. *Modern Business*, 2024, (08): 135 - 138.
- [9] Zhou DH, Peng JF, Zhao YJ. Sino-US trade friction and innovation of enterprises. *International Trade Issues*, 2023, (11): 106 - 125.
- [10] Chetty R. Sufficient statistics for welfare analysis: A bridge between structural and reduced-form methods. *Annul. Review of Economics*, 2009, 1 (1): 451 - 488.
- [11] Cai X, Lu Y, Wu M. Does environmental regulation drive away inbound foreign direct investment? Evidence from a Quasi-Natural experiment in China. *Journal of Development Economics*, 2016, 11 (123): 73 - 85.