The Impact of the US-China Trade War on Chinese Trade

by

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Abstract

This paper studies the impact of the early 2018 US-China trade war on Chinese trade with the US and other trading partners. A time series regression model was first used to evaluate the trade war effects on aggregate Chinese trade with the US, and it shows that the tariffs had no significant effect on aggregate trade. The paper therefore turns to a sectoral-level analysis. Using data retrieved from the General Administration Customs of the People's Republic of China, panel data models were used with a difference-in-difference approach to capture the estimated tariff impacts on Chinese trade on individual sectors; results reveal a significant and negative correlation between tariffs and US-China trade. The above finding confirms past studies on evaluating the impacts of the trade war on US trade and the US economy.

List of Abbreviations and Symbols Used

COVID-19 – Coronavirus Disease
CPI – Consumer Price Index
FE – Fixed Effects
FRED - Federal Reserve Bank of St. Louis
GDP - Gross Domestic Product
HS - Harmonized System
OECD - Organization for Economic Co-operation and Development
PIIE – Peterson Institute for International Economics
RE – Random Effects
RER – Real Exchange Rate
RMB - Renminbi, Chinese currency
ROW – The rest of the world
US - United States of America
USITC – United States International Trade Commission

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Chapter 1: Introduction

Back in 2016, then US presidential candidate Donald Trump accused China of "the greatest theft in history", calling China a "currency manipulator". During his presidential campaign he claimed that he would end "China's illegal export subsidies" (BBC News, 2016). After Donald Trump was successfully elected as the President of the United States in November 2016, people around the world started to pay attention to how he would put his campaign promises into reality. On January 22, 2018, President Trump approved the global safeguard tariffs of a combined value of over $10 billions on imports of solar panels and washing machines. This has been considered as the official start of the China-US trade war.

In the past three years, the trade conflict between China and the US has become a major topic in the literature. Between 2018 and 2019, several studies have been published using different models and approaches to simulate the outcomes of the trade war (Balistreri et al., 2018; Guo et al., 2018; Li et al., 2018; Itakura, 2019). Most of them reach the same conclusion that the US would experience a welfare and economic loss because of the trade war. In the meantime, based on different scenarios, researchers show different results on how the Chinese economy and trade would be affected by the trade war.

As time passed, researchers had the opportunity to collect trade data during the trade war period and use them to evaluate the impact of the conflict. Fajgelbaum et al. (2019) and Amiti et al. (2019) used data from 2018 to evaluate the impact of the trade war on the US economy; they found that the US experienced a great loss in trade and social welfare, as the burden of tariffs was completely passed through to US customers.

Although Trump claimed that the trade war would help to restore the trade balance between US and China, Archana (2020) found in his study that Trump's claim doesn't seem to hold in reality. In fact, nothing has happened to the trade deficit due to the trade war, and there has been even an increase in the US goods trade deficit with China in 2018 compared to 2017 (Archana, 2020). The effects of the trade war on the US economy have been well studied with real data, and the results found by the researchers don't correspond with what President Trump claimed.

However, very little literature has focused on the impacts of the trade war on the Chinese economy using trade data, and this paper aims to fill this gap. It differs from previous studies in several dimensions. First, it uses trade data collected from General Administrations Customs of P.R. China covering the period of 2017 to 2021, before the trade war starts and after the beginning of the trade war. Conducting an analysis with data before and during the trade war provides us with a more direct insight of how the tariffs have affected bilateral trade between the two countries. Second, this paper uses a difference-in-difference approach to analyze the treatment impact of the tariff. The difference-in-difference strategy has been a standard method in evaluating impact of a policy change based on a combination of before-after and treatment-control group (e.g. Fredriksson & Oliveira, 2019). In this paper, three tariff dummy variables are used to capture the difference-in-difference effects of tariffs on trade; by comparing the change in trade value before and after the tariffs have been imposed, and the industries that are affected or not affected by the tariffs.

A regression model was first run to evaluate the impact of the trade war on aggregate Chinese trade with the US. Nevertheless, no significant effect on total trade due to tariffs was identified. A deeper dive into sectoral level trade with both the US and the rest of the world was then performed, using a panel dataset model. Analyzing the relationship between the China-US tariff and China's trade with other countries at the industrial level provides an insight as to whether the imposition of the restricted policy during the trade war had a spillover effect on other nations. Furthermore, China's trade with other countries provides a picture of how the overall trading activities have changed over the trade war period, taking other factors (for example, the Covid-19 pandemic) into consideration.

The results suggest that, while both China's exports and China's imports were significantly affected by the tariffs, the effect of the tariffs on China's imports from the US is greater than their effect on China's exports to the US. Results also show that the coefficients of the tariff dummy are significant and positive in the China to the ROW exports and imports regressions, pointing to elastic supply; US tariffs on Chinese exports result in a decrease in Chinese exports to the US but also an increase in Chinese exports to the ROW. This paper supports Balistreri et al.'s (2018) statement that other countries benefited from China's trade dispute with the US.

The rest of the paper is organized as follows. Chapter 2 provides an overview of the waves of the trade battles between China and the US. Chapter 3 reviews some previous literature that is relevant to our topic. Chapter 4 describes the variables, models, and data used in this paper, and Chapter 5 will provide the results and the discussion. Finally, Chapter 6 presents the conclusion of this paper.

Chapter 2: Overview of the Trade War between China and the US

The trade war overview in this chapter is based on the most up-to-date (March 28, 2022) version of "Trump's Trade War Timeline: An Up-to-Date Guide" published by the Peterson Institute for International Economics (PIIE). The present review is only focused on the back-and-forth waves between China and the US. Fajgelbaum and Khandelwal (2021) explained that, by late 2019, the US had imposed tariffs on roughly $350 billion of Chinese imports while China retaliated and imposed tariffs on $100 billion worth of US exports. They also pointed out that US average tariffs increased from 3.7% to 25.8%, corresponding to about 2.6% of US GDP, and the trade war affected transactions equivalent to 5.5% of Chinese GDP. The trade battles between China and the US can be categorized under three rounds. The first round is targeting the solar panel and washing machine industries. The second round is regarding steel and aluminum, and the final round acts like a punishment tariff for "unfair trade practices in technology and intellectual property" activities.

2.1 Round 1: Solar Panels and Washing Machines

At the end of 2017, the US International Trade Commission reported their research results on the imports of solar panels and washing machines. In their report, they claimed that imports of the solar panels and washing machines from other countries were impacting the local solar panels and washing machines industry. President Trump then approved the global safeguard tariffs proposed by USITC on $8.5 billion worth of solar panel imports and $1.8 billion worth of washing machine imports on January 22, 2018. According to USTR, a safeguard tariff is used to restrict imports of a product temporarily, if a domestic industry is seriously injured or threatened with serious injury caused by a surge in imports (Safeguard Actions, n.d.). Two weeks later, China started the investigation on US exports of sorghum, and imposed a duty of 178.6% on sorghum imports from US. China's tariffs on sorghum ended on May 18, 2018, after China's Commerce Ministry claimed the US and China negotiation teams had met and resolved the trade dispute. However, the US didn't lift the tariff on China's exports of solar panels and washing machines, and US President Biden announced that the tariffs would be extended even further in February 2022.

2.2 Round 2: Steel and Aluminum

On March 1, 2018, Trump announced a 25 percent tariff on steel imports and a 10 percent tariff on aluminum imports from all US trading partners. Many countries struck back. China retaliated one month later and imposed retaliatory tariffs on US products worth $2.4 billion in export value in 2017. In January 2020, Trumps broadened the tariff to cover almost $450 million worth of steel and aluminum products which not only affected China, but also some US allies. These tariffs are still in place between China and the US as of April 2022.

2.3 Round 3: Punishment Tariffs

In this battle, there were three waves of back-and-forth rounds between China and the US. In April 2018, the Trump administration released a list of 1,333 Chinese products and threatened to impose tariffs covering $50 billion worth of goods. China retaliated and published a list of 106 US products on which to impose tariffs, covering $50 billion of

China’s imports from the US. On June 15, 2018, the first phase of US and China $50 billion list went into effect. Two months later, the second phase of the $50 billion tariffs was imposed and each country imposed tariffs on $50 billion value worth of import to each other. In September, the US imposed the next phase of tariffs on $200 billion worth of Chinese imports, while China imposed tariffs on $60 billion worth of US imports in the same month. Although there were some signs of tariff removing between two countries afterward, tension remains after the US accused China of failing to fulfill the deal signed between the two countries in January 2020. As of April 2022, the majority of the tariffs are still in effect and the trade war between China and the US have not reached an end yet.

Chapter 3: Literature Reviewed

Since Trump discussed his desire to impose punitive tariffs on China in the run up to the 2016 presidential election, the issue started to attract wide attention from scholars. Researchers used different simulation models to predict and try to estimate the economic impact of the potential China-US trade war on the two parties and the rest of the world.

Most of the scholars believed that the trade war would result in a negative impact on the US and China's trade and economy. Balistreri et al. (2018) built a series of simulation models to provide a quantitative prediction on the impacts of the trade war between the US and its major trading partners. They found that disruptive trade policy was harmful to both the US and the Chinese economies, and other regions may have benefited from trade diversion. Following Balistreri et al. (2018), Itakura (2019) used a recursively dynamic computable general equilibrium model to evaluate the potential economic effects of the US-China trade battle under three scenarios: raising tariffs, deterring foreign investment, and lowering productivity. Using the same database as Balistreri et al. (2018), he drew the conclusion that a trade war would cost China and the US a 1.41% and 1.35% reduction in their domestic production, respectively, and would reduce the world GDP by 450 billion USD from the trade war effects on investment and productivity.

Some researchers were interested in evaluating who will "win" from the battle. Long before the trade war occurred, Dong and Whalley (2012) conducted an analysis using two numerical general equilibrium models to simulate the gain and loss that may occur if there is a trade conflict between the US and China. Results from the simulation suggest that the US will experience a welfare improvement from substituting expenditures into its own goods and improve its terms of trade with non-retaliatory regions, while China will be adversely affected. Research done by Li et al. (2018) used a multi-country global general equilibrium (GE) model to simulate the potential effects from the China-US trade wars. Although their results also show both China and the US would be significantly hurt by the dispute, they believed China would lose more than the US. Unlike Li et al. (2018), who used past data to simulate the results, Archana (2020) used 2018 US and China trade microdata collected from the UN Comtrade database to examine the impact of the trade and welfare gains across sectors in China and the US. By analyzing different scenarios, they concluded that tariff imposition between the US and China was harmful to their trade and welfare, with US losses being considerably higher than China's.

The majority of scholars focus on how the trade war initiated by the US would affect the US economy. Guo et al. (2018) used Eaton and Kortum (2002)'s multi-sector, multi-country general equilibrium model to forecast how trade, output, and real wages would change if there were a 45 percent tariff imposed by the US on Chinese exports. In addition to this, they also included simulations either assuming that trade balance is restored between the US and China, or assuming that the trade balance remains unchanged. All their simulation results show that US will experience a significant social welfare loss, while China may lose or gains, depending on whether the trade balance is restored.

Fajgelbaum et al. (2019, 2021) estimated the impact of tariffs on US trade quantities and prices by exploiting a panel variation in sectoral and aggregational level. The results show that there is complete pass-through of retaliatory tariffs to US consumers. The resulting real income loss to US consumers and firms is about $51 billion, approximately 0.27% of US GDP. They then updated their estimation using 2019 tariffs in their 2021 paper, and found that the consumer cost rose to an equivalent of 0.58% of US GDP, and the US aggregate welfare loss was equivalent to 0.10% of GDP. Amiti et al. (2019) share a similar opinion with Fajgelbaum et al. (2019). Based on their calculations, US real income was reduced by $1.4 billion per month by the end of 2018, with the revenue gain from the tariffs being unable to compensate losses born by US consumers. Amiti et al. (2019) also estimated an approximately $165 billion loss to the US if the tariffs continue. Finally, Wu et al. (2021) used the OECD Inter-Country Input-Output model to measure the cumulative tariff costs incurred in the five rounds of tit-for tat tariff escalation. They found that the tariffs have resulted in an indirect tariff burden of about $23 billion in total, 67% of which was caused by the US's tariffs on Chinese imports. However, Eichengreen (2020) pointed out that the real impact of the restrictive trade policy actions of the US on other countries is more moderate than what economic commentators predict. The estimated significant tariff impact on the US brings up the attention of how the tariffs have impacted the Chinese economy.

Several researchers examined the response of the Chinese economy to the trade war. Liu (2020) used Google Trends data to measure the severity of the trade war on Chinese currency, trade, and stock markets. He found that the Chinese RMB depreciated by 12.3% relative to the USD during the period, of mainly driven by the trade war. Chinese stock markets also experienced a 29.9% loss in the year of 2018 (Liu, 2020). On the other hand, China's overall goods trade surplus with the US was increased during the trade war period (Liu, 2020). Wang et al. (2021) focused on the Chinese stock market reaction to the US-China trade war to assess the direct impact of the trade war on Chinese firms. Their results showed that the cross-sectional variation in stock market reactions was significant, and firms with prior export exposure to US performed worse, especially non-state firms.

So far, no literature uses trade data from before and during the trade war period to discuss the impact of the trade war on Chinese trade only, and includes the Covid-19 pandemic into consideration in their research design. This paper fills this gap. Kruger et al. (2017) found that Chinese exports are becoming more sophisticated and less price sensitive in the past few years, which indicates Chinese exports are gaining pricing power over time. The topic of how the Chinese trade has responded to the trade conflicts with US is worth discussing.

Chapter 4: Data and Methodology

4.1 The Data

All panel data were gathered over the period July 2017 to September 2021 in monthly frequency. The monthly trade data used in the panel regression were retrieved from General Administration Customs of P.R. China; the quarterly aggregate trade data used in the time series model, monthly and quarterly nominal exchange rate data, and the US and China's quarterly GDP data were retrieved from FRED; China and US CPI data were retrieved from OECD using 2015 as the based year; and the tariff dummies were manually generated based on the record from "Trump's Trade War Timeline: An Up-to-Date Guide" published by PIIE (2022).

The unit of the trade data used in the aggregate regression model is the USD and the tariff dummy was set to equal 1 after the three rounds of tariffs were imposed (Q2 2019). Trade data in the panel dataset includes the monthly sectoral bilateral trade between China and the US, and China's sectoral trade with the rest of the world (ROW) for 98 industries. The unit of the trade values are thousands of USD and the industries were categorized at HS 2 product level. The ROW's exports and imports variables are the sum of exports and imports for the 43 countries as reported by the General Administration Customs of P.R. China excluding US.

The sectoral exports and imports ratios were calculated as the ratio of each sector's exports and imports to the aggregate exports and imports between China and the US. From Table 2, we can see that the average value for the exports ratio and imports ratio are almost the same, around 1.00% to the total exports and imports. The sector with the highest exports ratio was the "Electrical machinery and equipment and parts thereof" industry, which constituted over 31% of the total Chinese exports to the US in October 2018. The "Aircraft, spacecraft, and parts thereof" industry constituted the biggest sector of Chinese imports from the US (21.4%) in the same month. Both industries were hit by the trade war tariff in the next month. In most of the cases, tariffs were imposed by the end of a month. Therefore, the three tariff dummies were set to equal 1 in the following month.

4.2 The Variables

The major topic studied in the present paper is to examine the impact of the China-US trade conflict on Chinese trade performance. It has been shown in the literature that economic scale, the real exchange rate, and trade openness crucially impact China's trading activities with other countries (Azu & Abu-obe, 2016; Guan & Ip Ping Sheong, 2020; Tran et al., 2020). In research on bilateral trade, GDP is the standard measure used to evaluate the economic scale of a country (Ali and Guo, 2005; Azu & Abu-obe, 2016; Guan & Ip Ping Sheong, 2020; Tran et al., 2020). The real exchange rate is another important determinant in bilateral trade (Azu & Abu-obe, 2016; Guan & Ip Ping Sheong, 2020). The exchange rate in this paper is defined as the value of Chinese currency per unit of US currency. The real exchange rate used in the present paper was calculated as the product of the nominal exchange rate between the USD and the RMB and their relative CPIs (RER= nominal exchange rate $* \frac{Chinese\ CPI}{USA\ CPI}$). There are three tariff dummy variables used in this paper. Tariff is the key factor being studied in the present work, which represents the trade openness of a nation. The description of all variables used in the present study are summarized in Table 1, and Table 2 shows the summary statistics.

4.3 Empirical Model

In order to have a general picture of how the trade war has affected China's trade with the US, a set of time series regressions listed below were estimated over the period of 2000 to 2021:

$$\ln\,(Exports_T) = \beta_0 + \beta_1 \ln(\text{USGDP}_T) + \beta_2 \ln\,(CNGDP_T) + \beta_3 Tariff + \varepsilon_{it} \qquad (1)$$

$$\ln\,(Exports_T) = \beta_0 + \beta_1 \ln(\text{USGDP}_T * CNGDP_T) + \beta_2 Tariff + \varepsilon_{it} \qquad (2)$$

$$\ln\,(Imports_T) = \beta_0 + \beta_1 \ln(\text{USGDP}_T) + \beta_2 \ln(CNGDP_T) + \beta_3 Tariff + \varepsilon_{it} \qquad (3)$$

$$\ln\,(Imports_T) = \beta_0 + \beta_1 \ln(\text{USGDP}_T * CNGDP_T) + \beta_2 Tariff + \varepsilon_{it} \qquad (4)$$

The regressions estimate the impact of the GDPs of the two countries, the real exchange rate between the RMB and USD, and the tariffs on China's aggregate quarterly exports to the US and China's aggregate quarterly imports from the US.

To study the effect of the trade war on Chinese trade in a deeper level, a series of panel regressions were run at the sectoral level. Difference-in-difference methods are introduced in the model. Difference-in-difference is one of the most frequently used methods in research for impact evaluation (Fredriksson & Oliveira, 2019). The tariffs imposed are considered a treatment to the economy at a certain point of time. The impact of the treatment can be captured by the estimated coefficient of the treatment variables. At the top of that, the trade war coincided with the Covid-19 pandemic outbreak in time since early 2020 and gradually hit the entire world; if the trade between China and the ROW is significantly decreasing over this period, the tariff might not be the only reason causing the reduction in trade between China and the US. To take the impact of the pandemic on people's trade and consumption into consideration, the trade performance between China and the rest of the world (other 43 countries reported by the General Administration of Customs P.R. China), and trade ratios are included in the discussion.

Alternative models using the sectoral "export ratio" and "import ratio", were also estimated to remove any aggregate effects. The trade ratios were constructed as the ratio of trade value in sector *i* to total trade value in month *t* ($ratio_{it} = \frac{x_{it}}{\Sigma x_{it}}$). The trade ratio models were designed under the same criteria as the trade flow models except for using the trade ratio as the dependent variables. These regressions can evaluate the trade war effects on sectoral trade at a deeper level, excluding other factors (for example, the Covid-19 pandemic) that might influence the bilateral trade between China and the US from the analysis. Just as in the trade flow models, a tariff dummy is used to capture the difference-in-differences impact evaluation of the trade war on sectoral trade. By studying how each of these ratios change over time, we can compare the change in the composition of exports and imports between China and the US. By comparing the sectors with tariffs imposed to the sectors without tariffs, we can capture the tariff effects on sectoral exports and imports alone, while excluding any aggregate effects such as the pandemic effects: if any reduction in the trade value of the tariff-imposed sectors may be explained by an overall reduction in trade activities in the country. In this method, we can capture the individual tariff effects on the affected sectoral trade over time. If the tariff dummy doesn't have a significant coefficient, we don't have sufficient support to state that tariffs have a significant effect on sectoral trade.

To investigate all the issues mentioned above, a set of 6 panel regressions listed below will be estimated:

$$\ln export_{it}US = \beta_0 + \beta_1 TariffUS + \beta_2 RER_t + \varepsilon_{it} \quad (5)$$

$$\ln import_{it}US = \beta_0 + \beta_1 TariffCN + \beta_2 RER_t + \varepsilon_{it} \qquad (6)$$

$$ln\, export_{it}ROW = \beta_0 + \beta_1 Tariff + \beta_2 RER_t + \varepsilon_{it} \qquad (7)$$

$$\ln import_{it}ROW = \beta_0 + \beta_1 Tariff + \beta_2 RER_t + \varepsilon_{it} \qquad (8)$$

$$exportratio_{it} = \beta_0 + \beta_1 TariffUS + \beta_2 RER_t + \varepsilon_{it} \qquad (9)$$

$$importratio_{it} = \beta_0 + \beta_1 TariffCN + \beta_2 RER_t + \varepsilon_{it} \qquad (10)$$

where TariffUS=1 when tariffs were imposed by the US government on sector *i* in month *t*; similarly, TariffCN=1 when there was a tariff imposed by Chinese government on sector *i* in month *t*; Tariff=1 when there was a tariff imposed on sector *i* in month *t* by either government; RER is the real exchange rate between USD and RMB in month *t*; and ε_{it} is the error term.

Chapter 5: Results and Discussion

Table 3 reports the results of time series regressions run on quarterly China's trade data with the US from Q1 2000 to Q4 2021. General speaking, US GDP had a more significant impact on trade between US and China. The Gravity Model prediction is also supported by the results as the product of the two countries' GDPs is significantly and positively correlated with trade. However, it is interesting to find that the real exchange rate has the same direction impact on both exports and imports, and the tariff effect on trade doesn't seem to be significant in this model. These results might be caused by the fact that the period of the tariffs only covers about 10% of the whole dataset time. The effect of the tariffs is not well represented in the sample. In addition to this, these regressions estimate the effects on the aggregate level of exports and imports. In the trade war period, tariffs were not imposed on all industries and some of the industries are exempted from the restricted policy. Therefore, the tariff effect on trade might not be present at an aggregate level in these models.

5.1 Trade Flow Models Estimation

Equations (5), (6), (7), and (8) are the trade flow panel regression models. Since the models are using logs of the trade values as the dependent variables, the actual estimated tariff effects on the trade value are captured by the exponent of the coefficients' value relative to one. Each model was run with fixed effects and random effects, and a Hausman test was performed to determine which estimator is more efficient. After the Hausman test has picked one regression for us, the chosen regression was run again with robust standard errors clustered by sector.

Table 4 reports the results of the trade flow panel data models. All tariff coefficients have the expected sign and are statistically significant. The tariff dummies for China-US trade all report a negative and statistically significant coefficient. The US tariff dummy coefficient is -0.127, which means the US dummy results in a 11.9% reduction in China's exports to the US. The coefficient of Chinese tariff dummy is -0.292, indicating a nearly 25.3% reduction in China's imports from the US in affected vs non-affected sectors. According to these results, the trade war has a stronger negative effect on China's importing sectors from the US compared to China's exporting sectors to the US.

The regressions showing China's trade with the rest of the world all report a positive and statistically significant coefficient on the tariff dummy, which aligns with Balistreri et al.'s (2018) simulation expectation. The estimated tariff dummy coefficients on China's exports to ROW and China's imports from ROW are both 0.116. These results indicate that the trade conflict between China and the US has boosted Chinese affected sectors trade with the ROW by 12.3%. The effect of the tariffs has a significant spillover effect on China's trade with other countries so that other countries benefit from the trade diversion. These results also indicate that the reduction in China and the US sectoral trade value was not explained by the pandemic effects.

On August 5, 2019, then US President Donald Trump accused China of being a currency manipulator, claiming that China controlled the RMB to an historical low to make Chinese products cheaper for exports (Imbert, 2019). What is interesting about the data in Table 4 is that the real exchange rate impacts China's exports and imports with all of its trading partners studied in this paper in the same direction. Typically, an appreciation in one country's currency should result in a rise in its imports and a fall in its exports. In our analysis, all the real exchange rate coefficients are negative and statistically significant. The real exchange rate has the strongest negative effects on China's imports from the US. The real exchange rate coefficient on China's imports from US is -0.331, which means a 1-unit depreciation in the RMB decreases the tariff-imposed sector's trade by 33.1%. However, the real exchange rate also has a greater than 20% negative effect on China's trade with other countries. In the regressions of China's exports to the US and the ROW, the real exchange rate's coefficients are -0.268 and -0.222, respectively. A 1-unit depreciation in the RMB will decrease China's exports to the US by 26.8 % and decrease China's exports to ROW by 22.2%. There is no support for the statement that a cheaper Chinese currency would help China's exports to the US or any other country in the world.

The reason behind these surprising results may be related to the high Chinese trade surplus with the US and the ROW. From the summary statistics in Table 2, the average of Chinese sectoral exports to the US is three times higher than the average of China's sectoral imports from the US. Although the gap between the mean of China's sectoral exports and imports with the ROW is smaller, the average of China's sectoral exports is still over 259 million USD higher than its average imports. A high trade surplus indicates a high demand for the domestic currency. Higher demand for one currency makes it more valuable and leads to an upward pressure on the currency value. The higher demand for the RMB has overtaken the RMB depreciation effects on Chinese exports, resulting in a negative correlation between the RMB-USD real exchange rate and China's exports. In Azu and Abu-obe (2016), they found the same pattern in their research. The correlation between the Nigerian-Chinese real exchange rate and the exports and imports are both negative. Their analysis found that a one percent increase in the naira against the RMB results in a 0.01% reduction in its exports and imports (Azu and Abu-obe, 2016). Our finding is supporting their statement.

5.2 Trade Ratio Models Estimation

During the trade war period, compared to China, the US has imposed tariffs on more industries. US tariffs targeted 81 out of 98 industries, while China only imposed tariffs on imports in 30 industries from the US. All the industries targeted by China were also targeted by the US. Chinese tariffs mainly targeted agricultural industries, steel and aluminum industries, and vehicle and aircraft industries. US tariffs targeted almost everything except live animals and trees, clothing, footwear, and umbrellas. Based on the data reported by Chinese Customs, the clothing, footwear, and umbrella industries constitute about 10% of total Chinese exports to the US in the period of July 2017 to September 2021, which is much higher than the average Chinese sectoral exports ratio to the US (see Table 2). These industries are perhaps safe from the trade war because of the well-known fact that China remains the major supplier of the US clothing and footwear industries. Based on data reported by UN Comtrade, about one-third of US imports in the clothing and footwear industries are from China, although this ratio is decreasing in recent years, from nearly 40% in 2017 to only 30% in 2021 (UN Comtrade: International Trade Statistics, 2017–2021).

Table 6 reports the results of the trade ratio models. The tariff effects on both the export and import ratio are not significant. These results indicate that the tariff alone doesn't show a significant effect on the specific sector. As trade ratios were constructed as the ratio of trade in each sector to total trade, if there was no significant relation between the tariff imposition to the given sector, tariffs may have an effect on the sectoral trade and total trade equally. Combining the above with trade flow models' results, the trade war is affected the trade between China and the US at a more general level in the trade value but not the sector's share in trade.

The RMB-USD real exchange rate's coefficients also show an insignificant effect on the sector's share in the total trade. Similar to the tariff effect before, any change in the real exchange rate will have the same effect on the sectoral trade and the total trade value, therefore, the two effects cancel each other out.

5.3 Summary

To summarize, the tariff dummies show significant and negative effects on China's trade with the US, and positive and significant effects on China's trade with the ROW. The trade flow models tell us the trade war has had a crucial effect on China's sectoral trade value with the US and the ROW. Other countries benefit from the trade war between China and the US due to trade diversion. However, our trade ratio models tell us that tariff imposition has an effect on both the sectoral trade and the total trade between China and the US. The sector's share in China's exports and imports with the US has not significant changed because of the tariff imposition.

Chapter 6: Conclusion

The purpose of this thesis was to examine the effects of the US-China trade war on Chinese trade. Estimated empirical models, using Chinese monthly trade data and US-China trade value ratio data, revealed that the escalating trade tension between the US and China affected trade flows from both directions. The imposition of tariffs had a significant effect on the sectoral trade value. However, the trade ratios analysis shows the tariff imposition did not affect the proportion of the tariff affected sectors to the total trade compared to the non-affected sectors. Findings reported in this paper also show tariff spillover effects from the tit-for-tat US and China trade battles to other countries, supporting Balistreri et al.'s (2018) expectation that other regions benefit from the trade diversion.

The major limitation in this paper is that the time frame of the sector level panel dataset only covers a period of 4 years; there is a lack of pre-trade war data being studied. Furthermore, publicly accessible export and import trade value data reported by General Administrations Customs of P.R. China are at the 2-digit HS level whereas the tariff-imposed products list published by the Chinese and US governments are all reported at least at the 8-digit HS level. Therefore, the precise tariff-weighted effect on each sector may vary. These limitations may lead to an overestimate in the tariff effects on each sector in the analysis. The size of the economies is considerably important to trade according to the gravity model; however, as monthly GDP data for the US and China are not available, these are not included in the current study.

Bibliography

Ali, S., & Guo, W. (2005). *Determinants of FDI in China.* Journal of Global Business and Technology, 1(2), 21-33.

Amiti, M., Redding, S. J., & Weinstein, D. E. (2019). *The Impact of the 2018 Tariffs on Prices and Welfare.* Journal of Economic Perspectives, 33(4), 187–210. https://doi.org/10.1257/jep.33.4.187

Archana, V. (2020). *Who will win from the trade war? Analysis of the US–China trade war from a micro perspective*. China Economic Journal, 13(3), 376–393. https://doi.org/10.1080/17538963.2020.1785073

Azu, N. P., & Abu-obe, E. (2016). *Economic Determinants of Nigeria's Trade with China: A Cointegration Approach.* International Journal of Economics and Finance, 8(3), 214. https://doi.org/10.5539/ijef.v8n3p214

Balistreri, E. J., Böhringer, C., & Rutherford, T. (2018). *Quantifying Disruptive Trade Policies*. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3338711

BBC News. (2016, May 2*). Trump accuses China of "raping" US with unfair trade policy.* BBC News. https://www.bbc.com/news/election-us-2016-36185012

Bown, C. P., & Kolb, M. (2022, February). *Trump's Trade War Timeline: An Up-to-Date Guide*. Peterson Institute for International Economics.

Dong, Y., and J. Whalley. (2012). *Gains and losses from potential bilateral US-China trade retaliation.* Economic Modelling 29:2226–36. doi:10.1016/j.econmod.2012.07.001.

Eaton, Jonathan, and Samuel Kortum. (2002). *Technology, Geography, and Trade*. Econometrica 70(5):1741–1779.

Eichengreen, B. (2020). *Why hasn't the impact of the trade war been greater?* Journal of Policy Modeling, 42(4), 820–828. https://doi.org/10.1016/j.jpolmod.2020.03.007

Fajgelbaum, P. D., Goldberg, P. K., Kennedy, P. J., & Khandelwal, A. K. (2019). *The Return to Protectionism*. The Quarterly Journal of Economics, 135(1), 1–55. https://doi.org/10.1093/qje/qjz036

Fajgelbaum, P., & Khandelwal, A. K. (2021). *The Economic Impacts of the Us-China Trade War.* SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3931838

Fredriksson, A., & Oliveira, G. M. D. (2019). *Impact evaluation using Difference-in Differences*. RAUSP Management Journal, 54(4), 519–532. https://doi.org/10.1108/rausp-05-2019-0112

General Administration of Customs of the People's Republic of China. (2017–2021). Exports by Selected Countries (Regions) and by HS Divisions [Dataset].

Guan, Z., & Ip Ping Sheong, J. K. F. (2020). *Determinants of bilateral trade between China and Africa: a gravity model approach*. Journal of Economic Studies, 47(5), 1015–1038. https://doi.org/10.1108/jes-12-2018-0461

Guo, M., Lu, L., Sheng, L., & Yu, M. (2018). *The Day After Tomorrow: Evaluating the Burden of Trump's Trade War.* Asian Economic Papers, 17(1), 101–120. https://doi.org/10.1162/asep_a_00592

Imbert, F. (2019, August 5). *Trump accuses China of "currency manipulation" as yuan drops to lowest level in more than a decade*. CNBC. https://www.cnbc.com/2019/08/05/trump-accuses-china-of-currency manipulation-as-yuan-drops-to-new-low.html

Itakura, K. (2019). *Evaluating the Impact of the US–China Trade War*. Asian Economic Policy Review, 15(1), 77–93. https://doi.org/10.1111/aepr.12286

Kruger, M., Steingress, W., & Thanabalasingam, S. (2017, November). *Product Sophistication and the slowdown in Chinese export growth.* Bank of Canada.

Li, C., He, C., & Lin, C. (2018). *Economic Impacts of the Possible China–US Trade War.* Emerging Markets Finance and Trade, 54(7), 1557–1577. https://doi.org/10.1080/1540496x.2018.1446131

Liu, K. (2020). *The effects of the China–US trade war during 2018–2019 on the Chinese economy: an initial assessment.* Economic and Political Studies, 8(4), 462–481. https://doi.org/10.1080/20954816.2020.1757569

Safeguard Actions. (n.d.). *United States Trade Representative.* https://ustr.gov/trade agreements/wto-multilateral-affairs/wto-issues/trade-remedies/safeguard-actions

Tran, H. X., Hoang, N. T. T., Nguyen, A. T., Truong, H. Q., & Dong, C. V. (2020). *China-ASEAN Trade Relations: A Study of Determinants and Potentials.* The Journal of Asian Finance, Economics and Business, 7(9), 209–217. https://doi.org/10.13106/jafeb.2020.vol7.no9.209

UN Comtrade: International Trade Statistics. (2017–2021). [Dataset]. https://comtrade.un.org/data

Wang, X., Wang, X., Zhong, Z., & Yao, J. (2020). The impact of US–China trade war on Chinese firms: Evidence from stock market reactions. Applied Economics Letters, 28(7), 579–583. https://doi.org/10.1080/13504851.2020.1764477

Wu, J., Wood, J., Oh, K., & Jang, H. (2021). *Evaluating the cumulative impact of the US–China trade war along global value chains.* The World Economy, 44(12), 3516–3533. https://doi.org/10.1111/twec.13125

Appendices

Table 1: Description of Variables

Exports	Total Chinese aggregate exports to the US (value, quarterly)
Imports	Total Chinese aggregate imports from the US (value, quarterly)
Tariff	Dummy=1 when all of the 3 rounds tariff are imposed in quarter *T*
Real Exchange Rate (RER)	Real exchange rate between RMB and USD (nominal exchange rate *(CNCPI/USCPI))
USGDP	USA quarterly GDP, seasonally adjusted
CNGDP	China quarterly GDP, seasonally adjusted
China Exports to US	China monthly exports value to the US at sector level
China Imports from US	China monthly imports value from the US at sector level
China Exports to ROW	The sum of China exports value to 43 countries reported by the General Administration of Customs People Republic of China except US at industrial level
China Imports from ROW	The sum of China imports value from 43 countries reported by the General Administration of Customs People Republic of China except US at industrial level
TariffUS	Dummy=1 if tariff imposed on sector *i* by US government to Chinese export at time *t*
TariffCN	Dummy=1 if tariff imposed on sector *i* by China government to imports from US at time *t*
Tariff	Dummy=1 if there is a tariff imposed on an sector by either US government or Chinese government in month *t*

Table 2: Summary Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Exports	88	3.31e+11	1.79e+11	5.33e+10	7.08e+11
Imports	88	3.99e+11	2.23e+11	5.89e+10	8.74e+11
Tariff	88	0.125	0.333	0	1
Quarterly Real Exchange Rate (RER)	88	6.855	0.629	6.036	8.124
USGDP	88	3.97e+12	9.21e+11	2.50e+12	6.00e+12
CNGDP	88	1.85e+12	1.28e+12	2.86e+11	4.60e+12
Product of GDP	88	8.50e+24	7.19e+24	7.14e+23	2.76e+25
China Exports to US	4,947	404,339.2	1,356,275	0	1.59e+07
China Imports from US	4,947	126,069.6	333,976.7	0	3,684,372
China Exports to ROW	4,947	1,904,220	6,288,686	254	7.35e+07
China Imports from ROW	4,947	1,644,923	4,749,392	1	5.20e+07
Exports Ratio	4,947	0.010	0.0341	0	0.312
Imports Ratio	4,947	0.010	0.0270	0	0.214
TariffUS	4,947	0.600	0.490	0	1
TariffCN	4,947	0.217	0.412	0	1
Tariff	4,947	0.609	0.488	0	1
Monthly Real Exchange Rate (RER)	4,947	6.767	0.314	6.262	7.290

Table 3: Chinese Exports and Imports Aggregate Model

VARIABLES	EXPORTS		IMPORTS	
	(1)	(2)	(3)	(4)
USGDP	2.056*** (0.432)	-	2.756*** (0.379)	-
CNGDP	0.0625 (0.131)	-	-0.087 (0.115)	-
Tariff	-0.0463 (0.067)	0.0127 (0.069)	-0.092 (0.059)	-0.008 (0.067)
Real exchange rate	-0.410*** (0.055)	-0.303*** (0.049)	-0.450*** (0.048)	-0.298*** (0.048)
USGDP*CNGDP	-	0.518*** (0.032)	-	0.562*** (0.031)
Adjusted R^2	0.9627	0.9575	0.9742	0.9642
N	88	88	88	88

Note: ***, ** &* stand for 1%, 5% & 10% level of significance in that order

Table 4: Trade Flow Results

	China Exports to US (5)			China Imports from US (6)			China Exports to ROW (7)			China Imports from ROW (8)		
	Fixed Effect	Random Effect	Cluster	Fixed Effect	Random Effect	Cluster	Fixed Effect	Random Effect	Cluster	Fixed Effect	Random Effect	Cluster
TariffUS	-0.126*** (0.0198)	-0.127*** (0.0198)	-0.127*** (0.0458)	-	-		-	-	-	-	-	-
TariffCN	-	-	-	-0.292*** (0.0466)	-0.281*** (0.0466)	-0.292*** (0.0935)	-	-	-	-	-	-
Tariff	-	-	-	-	-	-	0.116*** (0.0142)	0.116*** (0.0142)	0 .116*** (0.0424)	0.115*** (0.0167)	0.116*** (0.0167)	0.116*** (0.0443)
RER	-0.268*** (0.0259)	-0.268*** (0.0259)	-0.268*** (0.0459)	-0.331*** (0.1345)	-0.333*** (0.0345)	-0.331*** (0.0671)	-0.222*** (0.0183)	-0.222*** (0.0183)	-0.222*** (0.0388)	-0.212*** (0.0216)	-0.213*** (0.0216)	-0.213*** (0.0331)
Cons	12.276*** (0.1712)	12.260*** (0.3147)	12.260*** (0.4380)	11.480*** (0.2314)	11.429*** (0.3577)	11.480*** (0.4533)	14.233*** (0.187)	14.233*** (0.226)	14.233*** (0.3050)	13.698*** (0.1424)	13.701*** (0.2567)	13.701*** (0.3237)
R^2	0.0045	0.0045	0.0045	0.0267	0.0254	0.0267	0.0031	0.0031	0.0031	0.0221	0.0222	0.0222
N	4930	4930	4930	4894	4894	4849	4947	4947	4947	4947	4947	4947
Hausman Test (Prob>Chi2)	0.7493		-	0.0000		-	0.9471		-	0.1385		-
Decision		Y	-	Y		-		Y	-		Y	-

Note: ***, ** &* stand for 1%, 5% & 10% level of significance in that order

Table 5: Trade Ratios Results

	Exports Ratio (9)			Import Ratio (10)		
	Fixed Effect	Random Effect	Cluster	Fixed Effect	Random Effect	Cluster
TariffUS	-0.00005 (0.0002)	-0.00005 (0.0002)	-0.00005 (0.0002)	-	-	-
TariffCN	-	-	-	-0.003*** (0.0007)	-0.003*** (0.0007)	-0.003 (0.0025)
RER	0.00003 (0.0002)	0.00003 (0.0002)	0.00003 (0.0005)	0.0005 (0.0005)	0.0005 (0.0005)	0.0005 (0.0013)
Cons	0.010*** (0.0016)	0.010*** (0.0038)	0.010*** (0.0038)	0.008*** (0.0034)	0.008* (0.0042)	0.008 (0.0089)
R^2	0.0003	0.0003	0.0003	0.0281	0.0281	0.0281
N	4947	4947	4947	4947	4947	4947
Hausman Test (Prob>Chi2)	0.9720		-	0.0125		-
Decision		Y	-	Y		-

Note: ***, ** &* stand for 1%, 5% & 10% level of significance in that order