A CASE STUDY OF WHO PAYS FOR PRESIDENT TRUMP'S TRADE WAR

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Jonathon Flakne

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Economics

Abstract

President Trump initiated a trade war with China promising to protect industries within the United States. The tariffs he imposed on Chinese imports came with the assurance that China is the country paying for all associated costs. This study determines which country is actually paying for the tariffs, despite the President's claims. Building off prior research that examines the total monetary cost of the trade war to the United States, this study tests to see if tariff related costs to China are present, and if present, are greater than those faced by the United States. In this study, I use the large country theory to determine if the United States is large enough to influence the world price of steel imports and therefore force China to pay for the steel tariff imposed by the United States. To test this theory, I use a fixed effects regression model with Chinese steel import data. My preferred model finds that the United States is facing the same price for Chinese steel imports both before and after the enactment of the steel tariff, not accounting for the cost of the tariff. This result rejects the large country theory and suggests that the full cost of the steel tariff, once accounted for, is paid for by the United States. Furthermore, I correct for delays in market response to the steel tariff and find that the United States is paying more for Chinese steel imports after the tariff goes into effect. This suggests that the steel tariff is costing the United States even more than the cost of the tariff alone, specifically increasing the price of steel imports by $0.79 per kilogram after the tariff is imposed.

KEYWORDS: (Trade, Trade Policy, Tariff)
JEL CODES: (F100, F13, F14)

ON MY HONOR, I HAVE NEITHER GIVEN NOR RECEIVED UNAUTHORIZED AID ON THIS THESIS

Signature

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Introduction

The trade war between President Trump of the United States and the country of China is quite possibly the guerrilla warfare of the twenty-first century. President Trump initiated this war in March 2018 by enacting a 25 percent tariff on all steel imports and a 10 percent tariff on all aluminum imports (Bown & Kolb, 2020). Both of these acts were justified by the President as a way to protect and support the growth of the steel and aluminum industries within the United States (Trump, 2018). President Trump then continued this war with five additional tariffs on Chinese imports exclusively. These additional tariffs, enacted over an 18-month long period, ranged between 10 percent and 25 percent and affected over $362 billion worth of goods imported from China (Heeb & Bryan, 2019). Overall, throughout 2018 and 2019, the United States and President Trump find themselves in a comprehensive and modern-day trade war with China.

In this paper, I ask whether the United States is facing lower prices on imported steel from China since President Trump's first steel tariff is imposed. I ask this because the large country theory suggests that under the condition that the home country, in this case the United States, is large enough, it will be able to enact a tariff that the foreign country, in this case China, will pay for by lowering the price of their exported goods (Krugman et al., 2017). With this theory proven to be effective in the current trade war, President Trump can continue as planned with further tariffs to protect industries within the United States, reduce the trade deficit between the United States and China and increase government revenue. However, if the data disproves the application of this theory in the current trade war, the war itself must be stopped in order to avoid economic harm to the United States and ultimately the producers of the United States from higher prices on imported goods, thereby increasing their costs of production. In either situation, the validation or rejection of this theory will affect future trade policy indefinitely.

In order to answer this question, I evaluate primary data of Chinese imports reported in the United States Census Bureau USA Trade Online division between January 2003 and December 2019 (United States Census Bureau, 2020). This data set tracks the value and weight of the imported goods within 10 different commodity categories. A unit value ratio, the value of all imported goods within each commodity category divided by the weight of all imported goods within each commodity category, is then compared before and after the enactment of the first steel tariff by President Trump. Differences between the before tariff and after tariff unit value ratio within each commodity category are evaluated in order to understand which country is paying for the trade war in an attempt to either prove or disprove the large country theory cited above.

In order to calculate the results of this data, I use a fixed effects regression model. The fixed effects model is able to correct for correlated errors as well as heterogeneity by using each individual commodity as its own control. Using this approach, I assess the effect President Trump's steel tariff has on the unit value ratio of imports as defined above. In turn, the unit value ratio and the fixed effects regression model will allow me to review the true effects the steel tariff is having on Chinese steel import prices.

Due to the recent implementation of these tariffs, current research on this trade war is limited. Some articles have been published about the possible effects of President Trump's tariffs on both the United States and China, while a few working papers have also been published on the actual monetary effects of the tariffs exclusively on the United States. I will add to the research on this trade war by calculating the effect President

Trump's steel tariff has on the real price of imports coming from Chinese producers specifically. This distinction will determine who is paying for the tariff by testing to see if tariff related costs to China are present, and if present, are greater than those faced by the United States, not only quantifying the cost to the United States or China.

If the large country theory is authenticated, it suggests that President Trump's steel tariff will greatly benefit the United States by significantly increasing government revenue without harming domestic producers; conversely, if the large country theory is rejected, it suggests that the producers of the United States will be paying heavily for the steel tariff by an increase in the price of imported steel, possibly passing on these additional costs to end-consumers. In short, with the possibility that millions of individuals are either prospering or suffering from the effects of the steel tariff and other similar tariffs, testing this theory is essential for all current and future trade policy.

My findings show that the United States is paying for the full price of the steel tariff. In my first fixed effects model, enacting a steel tariff has no significant impact on the unit value ratio of steel imports. This means that overall, Chinese producers do not lower the prices of their exported steel and the United States is left paying for the increase in the costs of imported steel due to the tariff. Further regressions attempt to correct for possible delays between policy enactment and real-world price change. The preferred regression accounting for delays shows a statistically significant increase in the unit value ratio after the enactment of the steel tariff. This suggests that the United States is left paying not only for the increase in the costs of imported steel due to the tariff, but also the price increase in steel from Chinese producers. Policy implications and discussions on these critical results are evaluated below.

Literature Review

Tariffs Cause Dead Weight Loss

I first view the economic theory behind how a tariff leads to dead weight loss. Economic theory states that a tariff is effectively a tax on imports. This tax on imports increases the price of a good coming from a foreign country. With this price increase, all consumers of the home country face higher prices for that good (Perloff, 2013). These higher prices for the same good cause a loss of consumer surplus. However, the home country producers of those same goods benefit from higher domestic prices of the imported good as well. This higher price protects the home country producer from cheap imports, allowing them to supply more of the good to the home market and ultimately increase producer surplus (Perloff, 2013). Overall, the producer of the good in the home country will gain at the cost of the consumers and all other producers who produce other goods not included under the tariff, all while the government will gain from increases in tax revenue. Although both the producer and the government of the home country will benefit from the tariff, the losses of the consumers and other producers outweigh both of these gains; therefore, the home country will be worse off with a tariff enacted. These losses in overall surplus are known as dead weight loss.

Loss passes to Consumers and Producers of the Home Country

I now view how the dead weight loss caused by a tariff is passed on to both the consumers and producers of the home country. Mordechai E. Kreinin (1961), in his paper *Effect of Tariff Changes on the Prices and Volume of Imports*, discovered that the 1955 and 1956 United States tariff reductions benefited the consumers by reducing the price of an average basket of goods by 2.7 percent and benefited the producers by increasing the price of an average basket of exports by 6 percent. Kreinin (1961) also states that the total annual gain in welfare for the United States from reducing tariffs was $31.5 million in 1955 dollars. In this situation, reducing tariffs greatly benefitted the consumers and producers of the home country, implying that the presence of these tariffs was inducing great economic loss to the United States.

More recent studies have also indicated this same result. In *The Day after Tomorrow: Evaluating the Burden of Trump's Trade War* by Guo et al. (2018), the authors estimated that if President Trump’s 45 percent tariffs on imports from China were indeed imposed, the United States would experience a 0.66 percent welfare loss while China would face a welfare loss of only 0.04 percent. This result assumes that China would not retaliate with their own tariffs. If China was to retaliate, the United States would experience a 0.32 percent welfare loss and China would experience a welfare loss of 0.37 percent (Guo et al., 2018). In both theoretical situations, the enactment of tariffs was expected to decrease welfare within the United States, the home country.

Another recent study by Amiti et al. (2019) assesses the true before tariffs and after tariffs pricing faced by United States producers. This study titled, *The Impact of the 2018 Tariffs on Prices and Welfare*, again confirms that the home country, in this case the United States is paying for President Trump’s tariffs (Amiti et al., 2019). Specifically, Amiti et al. (2019) find that the cumulative deadweight welfare cost (reduction in real income) from President Trump’s tariffs is around $8.2 billion in 2018, with an additional cost of $14 billion to domestic consumers and producers in the form of tariff revenues paid to the government. This study finds a real monetary loss taken by the United States, the home country, with the enactment of President Trump's tariffs.

The Return to Protectionism by Fajgelbaum et al. (2020) views the real short-run impact of President Trump's protectionism. The study examines both the amount and price of imports before and after the tariffs were enacted. Overall, the authors found that due to a large decrease in imports and an increase in the price of the remaining imports, the resulting losses to United States consumers and producers who buy imports were $51 billion. After accounting for tariff revenue and gains to domestic producers, the authors found that the aggregate real income loss is $7.2 billion (Fajgelbaum et al., 2020). Overall, barriers to trade, such as tariffs, create higher prices and therefore dead weight loss in the market for the United States, the home country.

Loss passes to Producers of the Foreign Country

I now view how the dead weight loss caused by a tariff is passed on to the producers of the foreign country. Returning to Kreinin (1961) and his research on the 1955 and 1956 tariff reductions in the United States, he ultimately discovered that 31 percent of the pre-reduced tariffs granted by the United States were passed on to United States consumers, while 69 percent of the tariffs were accrued to the foreign producers. This evidence suggests that although the United States was better off with massive tariff reductions, the United States consumers and producers were not paying for the complete cost of the tariff. Rather, the foreign producers were lowering prices, covering for the majority, or 69 percent, of the tariff.

A 2019 study conducted by Francois and Manchin (2019) calculated the pass-through rates to European producers and consumers with the reduction of trade barriers in the mid 1990's. Specifically, Francois and Manchin (2019) found that the consumer pass-through rate of previous tariffs was 41 percent while the producer pass-through rate was 45 percent. This means that Europe's economy was paying for 86 percent of the total tariffs. This left the foreign country to pay for the remaining 14 percent. While 14 percent is less than the majority of the dead weight loss of the tariff, this is yet another real-life example of the foreign country paying for tariffs enacted by the home country.

Returning again to *The Day after Tomorrow: Evaluating the Burden of Trump's Trade War* by Guo et al. (2018), the authors found the dead weight loss of tariffs being passed on to China, the foreign country. In this study, although the United States would experience a 0.66 percent welfare loss, China would encounter a welfare loss of 0.04 percent if they did not retaliate (Guo et al., 2018). This indicates that China would experience an overall welfare loss, possibly paying for part of President Trump's tariffs. If China retaliated, the study finds that the United States would experience a 0.32 percent welfare loss while China would face a welfare loss of 0.37 percent, again passing the loss on to the foreign country (Guo et al., 2018). In conclusion, studies both past and present have found and estimated real losses for the foreign country with the enactment of tariffs by the home country.

Is it possible for loss to pass on to the Foreign Country Only?

I now examine how it is possible for the dead weight loss of an enacted tariff to be passed along to the foreign country only. Kennan and Riezman (1988) in their paper, *Do Big Countries Win Tariff Wars?,* find that the home country is able to benefit greatly from a trade war if the inequality between the home country and the foreign country is large and of significance. In fact, if the inequality between two countries is large and significant, the home country is able to benefit fully from enacting a tariff, meaning the home country is able to force the foreign country to pay for the full price of the tariff. Kennan and Riezman's (1988) findings prove a theory supporting President Trump's claims; however, this has only been proven in theory, making it impossible to tell if the inequality between the United States and China is indeed significant enough for the United States to pass the entire cost of a tariff on to China.

The Trade History between the United States and China

I now view the trade history between China and the United States. The history of trade between the United States and China goes back to 1979 when the United States signed a bilateral trade agreement with China (Library of Congress, 2019). More recently, in 2017, the United States and China exchanged a total amount of goods with a value of over $600 billion (Library of Congress, 2019). In 2018, this amount increased to $737.1 billion, including imports from China of $557.9 billion and exports to China of $179.3 billion (U.S. Trade Numbers, 2020). Also, in 2018 China was the United States' largest supplier of goods. This was before the main effects of President Trump's trade war were recognized. As of July 2019, United States Trade Numbers find that the amount of imports from China is 13.06 percent below that of July 2018 (U.S. Trade Numbers, 2020). This alone is evidence that the United States may be paying for the trade war through substitution, or through substituting goods once imported from China with more expensive goods imported from other countries not impacted by President Trump's tariffs. Although the United States does not have a long history of trading with China, China has quickly become extremely important to both the United States and its economy.

In conclusion, tariffs have different effects depending on the circumstances they are enacted under. The economy of the past is different than the economy of today, possibly yielding different results from enacting tariffs. Furthermore, simply because past theories have suggested that the home country is able to enact a tariff without paying for the dead weight loss, does not mean that it is possible in the world today.

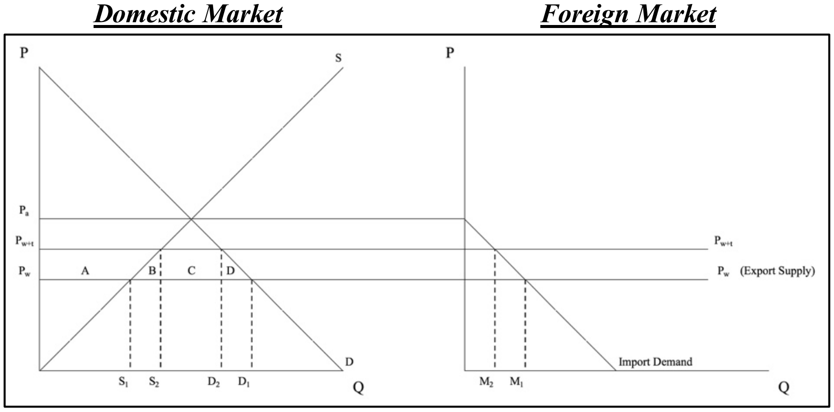
Methodology

Theoretical Model

I first start by delivering the main economic theory behind international trade followed by sub-theories important to this paper. The main theory states that although there may be individual losers within countries, free trade provides overall benefits to every country involved (Perloff, 2013). Economic theory also states that the benefits derived from free trade will be reduced with the introduction of dead weight loss (Perloff, 2013). Dead weight loss is introduced into international trade when one of the following is present: tariff, quota, subsidy and/or any other barrier to trade. Therefore, as basic economic theory implies, the tariffs enacted by President Trump will bring about dead weight loss and limit the benefits of free trade.

Figure 1 **-** ***Small Home Country = No Ability to Control World Prices + Enacts a Tariff***

Domestic Market ***Foreign Market***



Home Welfare:
Δ cs = - (A+B+C+D)
Δ ps = +A
Δ gov. revenue = +C
Δ total = -(B+D)
(Losses from tariff))

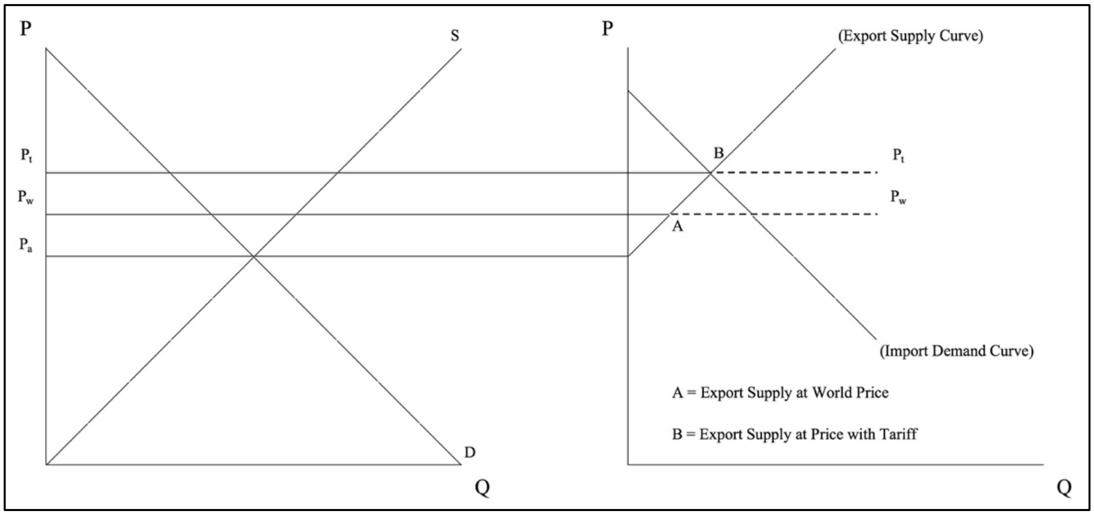
This dead weight loss caused by limiting free trade is realized by the home country if the home country is a small country and therefore has an insignificant market demand. With an insignificant market demand, the home country will have a relatively minor import demand and therefore is unable to influence world prices. Without this ability, the foreign country's export supply curve is flat at the world's price, as shown by line "$P_{w\ (Export\ Supply)}$" in the foreign market graph in Figure 1 above. In this small sized home country setting, once the home country enacts a tariff, it will cause the price of the good or goods to increase for the producers of the home country, as shown by the increase from "P_w" to "P_{w+t}" in the domestic market graph in Figure 1. With the foreign country's export supply curve flat and unchanged, the home country will in turn reduce the amount of goods it imports from "M_1" to "M_2" as shown in the foreign market graph in Figure 1. In conclusion, a small home country, with a relatively minor import demand and the inability to influence world prices, will end up paying for its own tariffs.

However, President Trump has made the claim that this economic theory does not hold true for the United States (Trump, 2018). He asserts that the United States is in fact not the country paying for the dead weight loss caused by these tariffs, but rather, that China is paying for the trade war, leaving the United States and its people unharmed due to unchanging domestic prices of imports after the tariffs are enacted.

The large country theory mentioned above, is one possible explanation as to why the United States would be able to force China to pay for its tariffs. This theory states that when the home country is large it has a significant market demand and therefore a major import demand. With this major import demand, the home country will have the ability to influence world prices and therefore may not pay for the tariffs it enacts (Krugman et al., 2017).

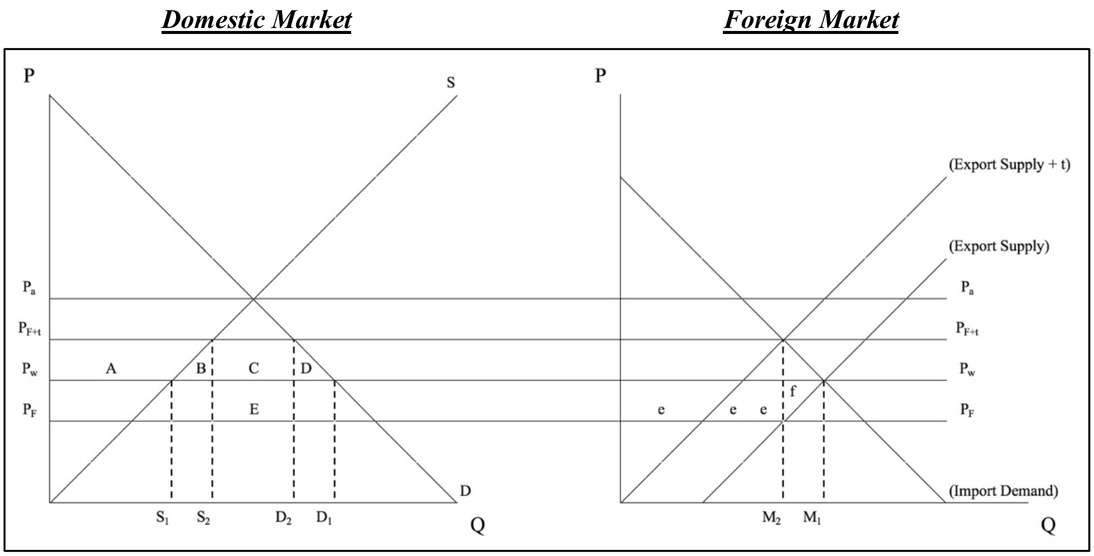
Figure 2 - __Large Home Country = Ability to Control World Prices__

__Domestic Market__ ***__Foreign Market__***



As shown in Figure 2 above, if the home country is large, it then has a significant market demand. This significant market demands gives the large home country a major import demand. A tariff enacted by the large home country will reduce this quantity demand for imports. Since the import demand represents a great proportion of the world demand for imports, the world demand for the product will also decrease. This reduction in demand will force foreign producers to lower the price of the exported good affected by the tariff. This now means that the large home country will have the ability to influence world prices. With this ability to influence world prices, rather than a flat export supply curve at the world price, the foreign country will now have an upward sloping export supply curve as shown by "Export Supply Curve" in the foreign market graph in Figure 2. Overall, this means that with a tariff enacted, the home country could actually increase its quantity of imports received more than its price paid for the imports, decreasing the unit value ratio of imports. This depends on the elasticities of the export supply curve and the import demand curve and their intercepts with "P_W" and "P_t" as shown by points "A" and "B" in the foreign market graph in Figure 2.

*Figure 3 - **Large Home Country = Ability to Control World Prices + Enacts a Tariff***



Home Welfare:
Δ cs = - (A+B+C+D)
Δ ps = +A
Δ revenue = +C+E
Δ total = -(B+D)+**e**
*(possible to gain from tariff if **e**>(B+D))*

Foreign Welfare:
Δ foreign = -(e+f)
Δ total = -(e+f)
(losses from tariff)

World Welfare:
Δ home total = -(B+D)+e
Δ foreign total = -(e+f)
Δ world Total = -(B+D+f)
(overall losses from tariff)

With the possibility of the unit value ratio decreasing after enacting a tariff, it is in theory possible that the foreign producers will lower their prices adequately enough that domestic consumers will pay the same price for the good after the tariff is enacted. Foreign producers do this in order to still have access to the world market. Overall, in a case in which the large home country enacts a tariff and the foreign country lowers its price of the exported good sufficient enough to cover the full cost of the tariff, the home country now has the same price to quantity ratio of imports, while gaining greatly from government revenues, represented by “C” and “E” in the domestic market graph in Figure 3 above, collected through the imposed tariffs. In this scenario, the standard transaction, in which the consumer within the home country will lose while producers within the home country will gain, will not occur. In total, the home country may only experience an overall gain due to this increase in revenue to the government, while leaving consumers and producers unchanged. This possible gain is represented by “e” in the foreign market graph above. This depends on both the size of the tariff, the amount that the foreign producers are willing to lower their prices and the elasticities of both the home country's import demand curve and the foreign country's export supply curve.

In conclusion, based off of the large country theory it is indeed possible that the United States has a significant enough import demand to influence world prices and force Chinese producers to lower the price of their exported goods, in effect paying for the costs of the tariffs.

Empirical Model

I next turn to the empirical assessment. First, I present the main regression that is used and then the framework that links my theory to the empirics. Finally, I discuss the data used for the empirical model.

With theory asserting that it is possible for a large home country not to pay for its own tariffs, I use a fixed effects regression model along with data from President Trump's first steel tariff to test whether this large country theory is validated in the current trade war.

$$\textit{UnitValueRatio}_i = B_0 + \beta_1 \textit{SteelTariffDummy} + \beta_2 \text{UnemploymentRate} + \beta_3 \text{IndustrialProductionIndex} + \beta_4 \text{ExchangeRate} + \beta_5 \text{ComsumerPriceIndex} + \varepsilon_i$$

In my fixed effects regression model, I have two primary variables. The first is the dependent variable: unit value ratio. This unit value ratio is the total value of imported goods in United States dollars, not including the cost of the tariff, divided by the total weight of imported goods in kilograms, for each commodity. With the unit value ratio, it is possible to see if the producers of the United States are paying for President Trump's steel tariff by viewing the estimated change of this unit value ratio before and after the tariff is enacted. This allows me to test the theoretical model because it is expected that if the unit value ratio remains the same after the enactment of the steel tariff, the producers of China did not lower the prices of their exported steel. Overall, the unit value ratio would actually increase once the cost of the tariff is added. This means that after President Trump's steel tariff, the producers of the United States would be paying more for the same amount of steel, effectively paying for the cost of the tariff. In the contrary, if the unit value ratio decreases, the producers of China lowered the prices of their exported steel after the enactment of the steel tariff. This possibility would validate the large country theory and imply that China is paying for all or part of the steel tariff.

The second primary variable is the main independent variable: steel tariff dummy. This independent variable is a dummy variable for the steel tariff. This variable will indicate either a "0" or a "1," with "0" meaning that President Trump's steel tariff is not in effect and "1" meaning that the steel tariff is in effect. This variable provides a coefficient that explains the effects that the steel tariff is having on the dependent unit value ratio. All three possible outcomes of the steel tariff dummy coefficient are described below.

My analysis will produce one of the three possible outcomes. In the first possible outcome, if the coefficient of the steel tariff dummy variable is positive and statistically significant, then the producers of the United States must be paying more for the same amount of imported steel or paying the same for a lesser amount of imported steel after the steel tariff is in effect. In either situation, producers of the United States are paying higher prices for imported steel after the enactment of the steel tariff. In this outcome, producers of the United States are not only paying for an increase in the price of steel, but also the full costs of the steel tariff once they are added. This outcome would suggest that the producers of the United States are paying for the cost of the tariff and trade war. This in turn would disprove the large country theory that states the United States has a significant enough import demand to influence the world price of steel imports.

In the second possible outcome, the coefficient of the steel tariff dummy variable is zero and/or statistically insignificant after President Trump's steel tariff is imposed. In this case, the producers of the United States would be paying the same amount for the same amount of imported steel. It is also possible that producers of the United Sates would be paying more for a greater amount of imported steel or less for a lesser amount of imported steel, however, in either case, the ratio would remain unchanged, meaning the increase or decrease of value to quantity also is unchanged. Since the additional cost of the tariff is not included within this data, once the cost of the tariff is added, the producers of the United States would once again be facing higher prices on imported steel after the steel tariff. Under this outcome, the United States would be paying for the cost of the tariff, again disproving the theory stating that in this trade war, the United States has the ability to force China to pay for its tariff.

The final possible outcome is that the coefficient of the steel tariff dummy variable is negative and statistically significant after President Trump's steel tariff. This would be possible for two different reasons; the producers of the United States are paying less for the same amount of imported steel or paying the same for a greater amount of imported steel. In either situation, the producers of the United States would be facing a lower price to quantity ratio after the tariff is imposed. A lower price to quantity ratio before the costs of the steel tariff has been included would imply that Chinese producers lowered their prices of exported steel. This would imply that the United States does have the ability to influence the price of steel produced by China. Having established the ability of the United States to influence China's prices, this outcome would prove the large country theory for this trade war and ultimately validate that the United States does have the ability to force China to pay for some or all of the steel tariff.

In addition to my primary dependent and independent variable, I also include macroeconomic trend control variables. I first add the unemployment rate of the United States. This variable allows me to control for economic booms and busts within the United States over time. Second, I include the monthly industrial production index. This industrial production index allows me to control for differences in economic growth overtime by viewing monthly industrial output of goods into the United States. Third, I add the monthly exchange rate between the Chinese yuan and the United States dollar. This trend allows me to control for inefficiencies in the market due to imperfect monetary exchange. Finally, I add the consumer price index (CPI), controlling for adjustments in monthly inflation in the United States.

Data

I work with data gathered from primary sources. First, I gather all trade data reported in the United States Census Bureau U.S.A. Trade Online division (United States Census Bureau, 2020). The United States Census Bureau U.S.A. Trade Online division is the official source of the United States for all trade statistics. From the United States Census Bureau, I first view all import data from the country of China. I next sort all the Chinese import data monthly from January 2003 to December 2019. I then sort the data by measure. The first measure is “vessel SWT (Gen) (kg)” or the total weight in kilograms of all imported goods by means of vessels. The second is “vessel customs value (Gen) ($U.S.)” or the value in United States dollars of all imported goods again by means of vessels. I use both of these measures to create my dependent unit value ratio mentioned above. Sorting import data by vessel, I exclude all imports by air and land. Although this may be a possible limitation in attempting to view imports from all countries, it is unlikely to be a real limitation when viewing imports from China, due to its distance and geographical separation by an ocean from the United States.

Now, with the import data sorted by country, date and measure, I next sort the data of imported goods by commodity. Commodities are categorized by harmonized system codes, or HS codes (UN Trade Statistics, 2017). These HS codes are available in two-digit, four-digit, six-digit and so on codes, providing information with each two-digit combination. For example, HS code 72 stands for steel and iron, HS code 7207 represents semi-finished products of iron or non-alloy steel and 720711 gives the exact percent of carbon within the steel (UN Trade Statistics, 2017). Given that President Trump’s steel tariff is enacted on all steel, the imported goods data is sorted to the two-digit level, such as HS code 72. HS code 72 “steel and iron” has hundreds of subcategories holding thousands of different items, it is likely that not all items listed under HS code 72 will be affected by the steel tariff as is assumed in this study. However, the majority of these items will be affected by the steel tariff, allowing for the overall impact of the tariff to be observed. It is important to note that all observed impacts will be underestimations of the true affect. This is because although all items under HS code 72 are included in the data, while not all are affected by the steel tariff, dampening the true impact on the tariff.

Sorting the data by commodity, I include two main commodities affected by the steel tariff, commodity 72 "steel and iron" and commodity 73 "articles of iron or steel." Next, I include eight other commodities as controls. All commodities are label with both number and type in Figure 5.

Second, I gather all data for the macroeconomic trend control variables from the Federal Reserve Economic Data of the St. Louis Federal Reserve ("FRED"), as FRED specializes in economic research data for the United States (Federal Reserve Economic Data, 2020). The control variables of the unemployment rate, the industrial production index, the exchange rate, and the CPI index, as mentioned above, are gathered and sorted monthly from January 2003 to December 2019 in order to mirror the import data.

Finally, I gather the date the first steel tariff is enacted from Peterson's Institute for International Economics ("PIIE") (Peterson Institute for International Economics, 2020).

Figure 4 - <u>Summary Statistics Table</u>

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	mean	sd	min	max
VesselCustomsValue	2,040	865.60 mil	627.90 mil	9.95 mil	3649.00 mil
VesselSWT	2,040	201.30 mil	162.90 mil	6.93 mil	995.70 mil
UnitValueRatio	2,040	5.93	4.53	0.37	17.09
ConsumerPriceIndex	2,040	222.20	21.03	182.60	258.40
ExchangeRate	2,040	7.01	0.74	6.05	8.28
IndustrialProductionIndex	2,040	100.80	5.35	87.07	110.60
UnemploymentRate	2,040	6.07	1.87	3.50	10
TariffDummySteel	2,040	0.02	0.14	0	1

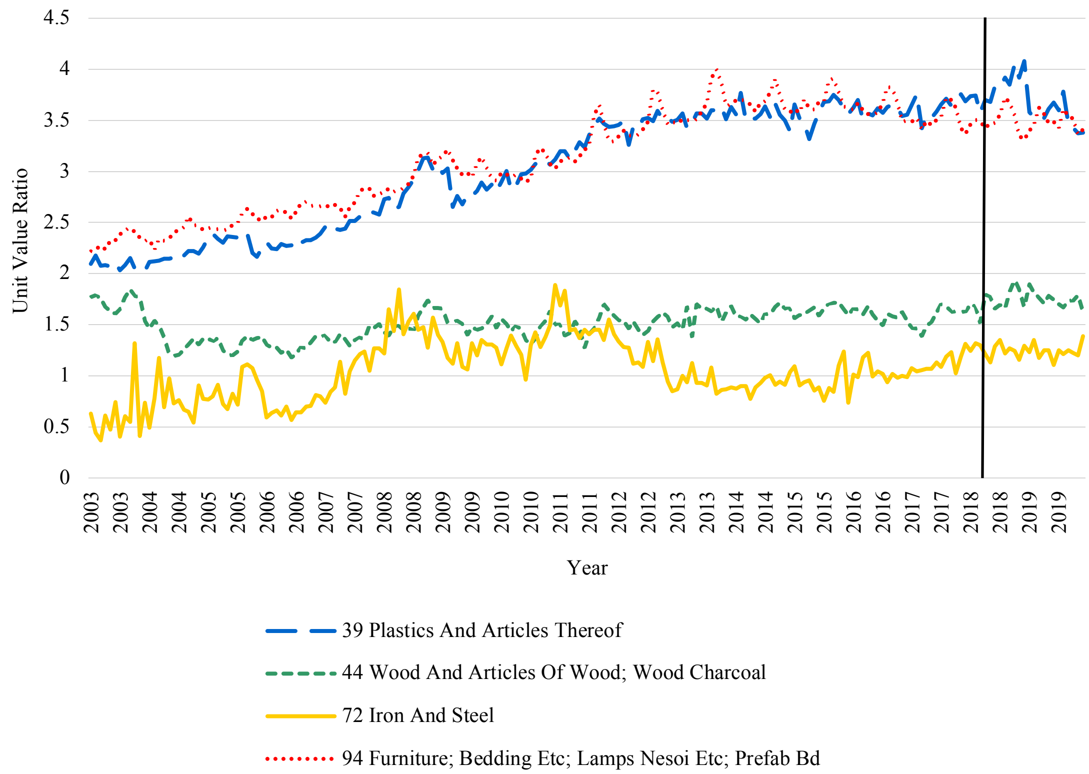
Figure 4 is a correlation table of my data. All variables have 2,040 observations (N) or 12 months for each of the 17 years for all 10 commodities. The mean unit value ratio across all commodities is $5.93 per kilogram of imported goods, however the unit value ratio differs across individual commodities. The standard deviation of $4.53 per kilogram of imported goods shows this differentiation by its large magnitude in aspect to the mean. The steel tariff dummy has a minimum of zero, indicating that the steel tariff is not in effect, and a maximum of 1, indicating that the steel tariff is in effect. Overall, viewing the unit value ratio by commodity will allow for more correlation to be observed.

Figure 5 - Unit Value Ratio Summary Statistics Table

	(1)	(2)	(3)	(4)	(5)
Commodity	N	mean	sd	min	max
39 Plastics And Articles Thereof	204	3.07	0.588	2.026	4.08
44 Wood And Articles Of Wood	204	1.533	0.161	1.179	1.94
61 Apparel Articles, Knit Etc.	204	12.77	1.393	9.326	16.12
62 Apparel Articles, Not Knit Etc.	204	13.44	1.385	10.11	17.09
63 Textile Art Nesoi; Worn Text.	204	5.327	0.45	4.364	6.386
64 Footwear, Gaiters Etc.	204	10.23	1.613	6.716	12.62
72 Iron And Steel	204	1.066	0.29	0.368	1.889
73 Articles Of Iron Or Steel	204	2.101	0.494	1.241	2.777
94 Furniture; Bedding Etc.	204	3.149	0.485	2.218	3.999
95 Toys, Games & Sport Equ.	204	6.635	1.234	4.305	9.687

Figure 5 above shows the unit value ratio now sorted by commodity. Large differences in the unit value ratio across commodities can be viewed. Iron and steel, commodity 72, has a unit value ratio mean of 1.066 whereas apparel articles, not knit, commodity 62, has a unit value ratio mean of 13.44. These large differences will possibly create biases within estimates and results if not controlled for by a fixed effects regression model.

Figure 6 - <u>Unit Value Ratio by Commodity over Time Graph</u>



Graphing the numerical values of the unit value ratio calculated above over time allows viewing of the trend of imports per kilogram of weight from China before and after the tariff has been applied. The vertical line on the graph represent March 2018, the month and year in which the steel tariff is first imposed. To the left of this vertical line shows the unit value ratio before President Trump's steel tariff and trade war with China. To the right of this vertical line shows the unit value ratio after the tariff and trade war. Each series of data represents a separate commodity of imports from China. Commodity HS codes 39 "plastics and articles thereof," 44 "wood and articles of wood," and 94 "furniture and bedding, etc.," act as untreated controls, as these commodities are not affected by President Trump's steel Tariff. Commodity HS code 72 acts as the treated commodity as iron and steel is affected by the tariff.

Figure 6 shows two main important patterns. First, the unit value ratio of commodities plastics and articles thereof, wood and articles of wood and furniture and bedding, etc., the commodities from the untreated group, are all decreasing. In March of 2018, commodity plastics and articles thereof has a unit value ratio of 3.69, commodity wood and articles of wood a ratio of 1.79 and commodity furniture and bedding, etc. a ratio of 3.49. In December of 2019, commodity plastics and articles thereof, wood and articles of wood and furniture and bedding, etc. has a unit value ratio of 3.37, 1.62 and 3.41 respectively. All changes show a slight decrease in the unit value ratio. This decrease in the unit value ratio suggests that the overall trend in unit value ratio of Chinese goods is decreasing naturally, as these goods are not affected by the steel tariff. Furthermore, it suggests that any increase in the unit value ratio within the treated commodity 72 “Iron and Steel” is likely due to the steel tariff.

Second, there is an increase in the unit value ratio in the commodity of iron and steel, the commodity subject to the steel tariff, after the steel tariff has been applied. In March 2018, commodity iron and steel has a unit value ratio of 1.21. This unit value ratio increases to 1.38 in December 2019, a 12 percent increase. With an increase in the unit value ratio in the commodity of iron and steel, the graph suggests that Chinese producers increased their prices of steel after the tariff is imposed. This increase in price from Chinese producers is contrary to the large country theory, ultimately suggesting that the United States does not have the ability to influence world prices and therefore is not able to force China to pay for the cost of the steel tariff.

Results and Analysis

In order to determine the effect of the steel tariff on each commodity's unit value ratio, I estimate the following four primary regressions.

Figure 7 - Primary Regression Results

Figure 7 - Primary Regression Results

VARIABLES	(1) Independent/Dependent	(2) Controls Added	(3) Commodity Dummy Variables	(4) Fixed Effects Model
Steel Tariff Dummy	-4.078***	-4.493***	0.589***	0.589
	(-4.369 - -3.787)	(-5.010 - -3.976)	(0.423 - 0.755)	(-0.234 - 1.412)
Unemployment Rate		0.0806	-0.0232	-0.0232
		(-0.198 - 0.359)	(-0.0716 - 0.0252)	(-0.0900 - 0.0436)
Industrial Production Index		0.0238	0.000186	0.000186
		(-0.0689 - 0.117)	(-0.0160 - 0.0164)	(-0.0160 - 0.0163)
Exchange Rate		-0.444	-1.073***	-1.073**
		(-1.205 - 0.318)	(-1.225 - -0.921)	(-1.870 - -0.275)
Consumer Price Index		0.00961	-0.0137***	-0.0137
		(-0.0151 - 0.0343)	(-0.0188 - -0.00860)	(-0.0441 - 0.0167)
Constant	6.017***	4.111	13.75***	16.60***
	(5.817 - 6.216)	(-11.73 - 19.95)	(10.54 - 16.97)	(5.529 - 27.68)
Commodity Dummy Variables	No	No	Yes	Yes
Observations	2,040	2,040	2,040	2,040
Number of Commodities	10	10	10	10
R-squared	0.016	0.033	0.971	0.354^

95 percent confidence intervals in parentheses

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

^ within r-squared value

Calculated standard errors are robust to heteroskedasticity.

I first run an OLS regression consisting of my primary independent and dependent variables (see (1) in Figure 7). This simplest regression of my data provides a steel tariff dummy coefficient of -4.078 statistically significant to the 99 percent confidence level. This coefficient indicates that once the steel tariff is in effect, the unit value ratio on average decreases by $4.08 per kilogram of imported goods. This decrease in the unit value ratio while the steel tariff is in effect would suggest that Chinese producers are lowering the price of their exported goods and therefore paying for the cost of the steel tariff. However, this initial regression does not include other controls potentially inducing biases. The magnitude of this tariff dummy coefficient likely stems from differences in the unit value ratio across all commodities. For example, the average unit value ratio across commodities apparel, not knit etc. and footwear, and parts thereof is 13.442 and 10.232, respectively, whereas the average unit value ratio across commodities iron and steel and articles of iron or steel, the commodities affected by the steel tariff, is 1.066 and 2.101, respectively. Without controlling for such large differences across commodities, this coefficient is likely unable to be applied to the real world.

Model 2 shows OLS estimates when macroeconomic trend controls are included (see (2) in Figure 7). This regression provides a steel tariff dummy coefficient of -4.493, again statistically significant to the 99 percent confidence level. This coefficient suggests that while the steel tariff is in effect, the unit value ratio on average decreases by $4.49 per kilogram of imported goods. While this result also indicates that Chinese producers are likely lowering the price of their exported goods and thus paying for the tariff, similar to the first regression, all commodities are included and not controlled by commodity type. Controlling each commodity by its type allows for the effects of the steel tariff dummy variable to be seen across each commodity group and not all commodity groups at once. This distinction will correct for the large differences in unit value ratio as mentioned above. Without this control, model 2 again leads to a coefficient that is unable to be applied to the real world. With each coefficient for the control variables not statistically different than zero, I must again control each commodity by type to resolve potential biases within the regression.

Model 3 corrects for previous biases, controlling for each individual commodity (see (3) in Figure 7). In this regression, the steel tariff dummy coefficient is a positive 0.589 and statistically significant at the 99 percent level. At this 99 percent confidence level, I am able to say that this coefficient is positive and different from zero declaring that when the steel tariff is in effect, the unit value ratio is on average $0.59 higher per kilogram of imported goods compared to when the steel tariff is not in effect. The average $0.59 price increase per kilogram of imported goods after the steel tariff is enacted suggests that Chinese producers increased the price of their exported goods within commodities iron and steel and articles of iron or steel. This increase in price suggests that the producers of the United States are paying for an increase in the price of steel and the full increase in cost of steel due to the steel tariff itself.

The unemployment rate coefficient of -0.023 suggests that on average for each additional percent increase in the unemployment rate, the unit value ratio decreases by $0.02 per kilogram of imported goods within commodities iron and steel and articles of iron or steel. Logically, it makes sense that as the unemployment rate increases, an economic trend that suggests economy health is worsening, the unit value ratio of imports decreases because producers are importing less during the economy downturn and losing potential volume discounts. However, this coefficient is only statistically significant at the 66 percent level, with a 95 percent confidence interval of -0.072 to 0.025.

The industrial production index coefficient suggests that on average, with each additional percentage increase of industrial production, the unit value ratio will increase by $0.00 per kilogram of imported goods within commodities iron and steel and articles of iron or steel. With a coefficient not statistically different from zero, the industrial production index does not appear to have an effect on the unit value ratio. This result may be due to the lag between importing goods and the finished production of those goods, as the manufacturing of goods is not instantaneous.

The exchange rate coefficient of -1.073 is statistically significant at the 99 percent level. This suggests that with each $1.00 increase in the exchange rate between the United States dollar and the Chinese yuan, the unit value ratio decreases on average by $1.07 per kilogram of imported goods within commodities iron and steel and articles of iron or steel. This shows that as it becomes less efficient to exchange money the unit value ratio decreases as once again producers are importing less and possibly losing volume discounts, confirming real-world expectations.

The final control variable of consumer price index is also statistically significant at the 99 percent level. With a coefficient of -0.014, it is suggested that with each percentage increase in the consumer price index, the unit value ratio, on average, decreases by $0.01 per kilogram of imported goods within commodities iron and steel and articles of iron or steel. Therefore, this coefficient indicates that as an average basket of consumer goods increases in price, the value of imported goods per weight of imported goods will decrease slightly.

Model 4 is a fixed effects regression controlling for differences in the unit value ratio across commodities (see (4) in Figure 7). Coefficient estimates in model 4 are similar to model 3, however differences exist in confidence levels and intervals.

The steel tariff dummy coefficient, a positive 0.589, again suggests that after the imposition of the steel tariff, the unit value ratio is on average $0.59 higher per kilogram of imported goods compared to before the imposition of the steel tariff. This result indicates that Chinese producers are not lowering the price of their exported goods, meaning the producers of the United States are facing higher prices on imported goods after the steel tariff is enacted. In other words, this result shows that the producers of the United States are paying for the steel tariff. This coefficient is only statistically significant to the 86 percent level of confidence, with a 95 percent confidence interval from -0.234 to 1.412. With a coefficient that is not statistically different from zero, this estimate still rejects the large country theory and indicates that the producers of the United States are paying for the full cost of the steel tariff. This is because with no effective change in the unit value ratio after the steel tariff is imposed, producers of the United States would expect the same cost of imported goods for the same amount of imported goods; however, once the cost of the tariff is added, the cost of goods will increase while the amount of goods will remain the same. This will in turn increase the unit value ratio and total costs for United States producers. Therefore, without a statistically significant negative coefficient, the results show that Chinese producers are not lowering the prices of their exported goods to offset the additional costs created by the steel tariff.

The coefficients of the control variables remain the same from model 3 to model 4; however, the level of significance of each control variable changes. The unemployment rate, industrial production index and consumer price index all are statistically insignificant in the robust fixed effects regression. Due to the many influences within international trade markets, it is possible that these controls are being affected by variables not accounted for within the model or that these controls are not correlated with the unit value ratio evaluated. The exchange rate in the regression results is statistically significant at the 98 percent significance level producing a coefficient of -1.073. The exchange rate, being both a control for the United States and China, may not be subjected to the biases seen in the United States-only control variables. Overall, with each $1.00 increase in the exchange rate between the United States dollar and the Chinese yuan, the unit value ratio decreases by $1.07, again confirming the real-world expectation that as it becomes less efficient to exchange dollars for yuan, the unit value ratio decreases.

Robustness Check

In real world trade markets there are often delays between policy implementation and market reaction. This is true for a number of reasons including, but not limited to imperfect information, menu costs and forward contract obligations. Forward contract obligations especially cause delay in price changes as these contracts generally do not allow for the adjustment of prices before the obligation is complete. Furthermore, it is unrealistic to believe all aspects of the market will react immediately to the steel tariff. These delays between policy implementation and market reaction may impact my models, underestimating the effects of the steel tariff in my regression results above. Not accounting for market delays within my data will dampen the unit value ratio increase of steel imports estimated above. This is true because if the price of only certain steel products is able to increase immediately after the tariff is enacted, while the price of other steel products is unable to increase for 12 months or the term of the forward contract after the tariff is enacted, the overall price increase is effectively held down for some time after the enactment of the steel tariff.

In an attempt to correct for the possible delay in market response, I remove 6, 9 and 12-month periods from the data set directly following the enactment of the steel tariff. These periods are removed from the data set in order to view the full effect the steel tariff has on increasing the unit value ratio of steel imports, originally estimated in model 4. These 6, 9 and 12-month periods are removed to not contaminate the data before the tariff is imposed. These secondary regression results are shown below.

Figure 8 - Secondary Regression Results

Figure 8 - Secondary Regression Results

VARIABLES	(4, from Fig. 7) Fixed Effects Model	(5) 6 Months Removed	(6) 9 Months Removed	(7) 12 Months Removed
Steel Tariff Dummy	0.589	0.712	0.733	0.794*
	(-0.234 - 1.412)	(-0.192 - 1.617)	(-0.182 - 1.649)	(-0.182 - 1.770)
Unemployment Rate	-0.0232	-0.0416	-0.0449	-0.0476
	(-0.0900 - 0.0436)	(-0.114 - 0.0308)	(-0.116 - 0.0262)	(-0.122 - 0.0264)
Industrial Production Index	0.000186	-0.00309	-0.00396	-0.00462
	(-0.0160 - 0.0163)	(-0.0192 - 0.0130)	(-0.0206 - 0.0127)	(-0.0206 - 0.0114)
Exchange Rate	-1.073**	-1.121**	-1.138**	-1.150**
	(-1.870 - -0.275)	(-1.933 - -0.310)	(-1.947 - -0.329)	(-1.968 - -0.332)
Consumer Price Index	-0.0137	-0.0144	-0.015	-0.0154
	(-0.0441 - 0.0167)	(-0.0447 - 0.0159)	(-0.0452 - 0.0153)	(-0.0461 - 0.0153)
Constant	16.60***	17.55***	17.90***	18.15***
	(5.529 - 27.68)	(6.253 - 28.86)	(6.608 - 29.19)	(6.653 - 29.65)
Commodity Dummy Variables	Yes	Yes	Yes	Yes
Observations	2,040	1,980	1,960	1,920
Number of Commodities	10	10	10	10
R-squared	0.354^	0.365^	0.368^	0.372^

95 percent confidence intervals in parentheses

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

^ within r-squared value

Calculated standard errors are robust to heteroskedasticity.

Model 5 accounts for a 6-month price movement delay due to existing contracts by removing the months of March 2018 to August 2018. These estimates show a slightly larger coefficient for the steel tariff dummy, moving from 0.589 in model 4 to 0.712 in model 5 (see (4, from Fig. 7) and (5) in Figure 8). This steel tariff dummy is again statistically significant to the 89 percent level. Overall, this increase in value of the coefficient is true for all control variables as well, suggesting some type of delay or compounding effect from the tariff may now be accounted for.

Model 6 accounts for a 9-month price movement delay due to existing contracts by removing the months of March 2018 to November 2018. This model again shows an increase in value for both the steel tariff dummy variable and all control variables (see (6) in Figure 8). Statistically significant to the 89 percent level, this model estimates a steel tariff dummy coefficient of 0.733. This movement again suggests that model 6 accounts for more delay between the policy enactment date and market reaction, capturing a fuller effect of the steel tariff.

Model 7 accounts for a 12-month price movement delay due to existing contracts by removing the months of March 2018 to February 2019 from the data set. Model 7 estimates a steel tariff dummy coefficient of 0.794, statistically significant to the 90 percent level (see (7) in Figure 8). This result suggests that after the enactment of the steel tariff, the unit value ratio is on average $0.79 higher per kilogram of imported goods when compared to before the steel tariff is imposed, and a $0.20 per kilogram larger increase than the estimate of model 4. Overall, this larger coefficient means that all three models that account for a delay in price movement, estimate a greater effect on the unit value ratio of steel compared to model 4. Although correcting for some, if not all of the delay, the limited number of remaining months after removing the 6, 9 and 12-month periods is a potential limitation as the data range has decreased in the number of available observations.

In addition to a delay in market response, an anticipatory response before the steel tariff is enacted is also possible due to the extensive media coverage surrounding President Trump's pre-tariff trade comments, as well as primary sources directly from the President himself such as Twitter. Accounting for possible anticipation of President Trump's trade war and steel tariff may once again strengthen the estimates and provide an overall fuller effect. The regression, accounting for both a 12-month anticipatory period as well as a 12-month response delay, removing a total of 24 months, shows a fuller effect with a steel tariff dummy coefficient of 0.814, (see (10) in Figure 9 of the attached Appendix 1). This suggests that while accounting for both anticipation and delay, the full effect of the steel tariff increases the price of steel imports on average by $0.81 per kilogram. However, this estimate is only statistically significant to the 89 percent level of confidence and therefore is not discussed further in this section. Overall, the consistency in the steel tariff dummy coefficient across all fixed effects models suggests a successful robustness check. For the full regression estimates accounting for both anticipation and delay in response to the steel tariff, view Appendix 1, attached.

Discussion

The large country theory states that when the home country is large it has a significant market demand and therefore a major import demand. With a major import demand, the home country will have the ability to influence world prices and therefore may not pay for the tariffs it enacts. Testing this theory within the steel market, my results find that Chinese producers do not lower the prices of their exported steel after the steel tariff is imposed. This result concludes that the United States does not have the ability to influence the world price of steel and steel goods and therefore does not have a major import demand of steel. As such, this study rejects the large country theory and estimates that the United States is paying for the full cost of the steel tariff. In total, the United States must consider the economic harm to its own producers and consumers with the enactment of the steel tariff and other similar tariffs.

With the producers and consumers of the United States facing the full effect of the steel tariff, I return to the studies that examine the total costs of all of President Trump's tariffs. Amiti et al. (2019) find that President Trump's tariffs cost a total of $22.2 billion to the United States in 2018 alone. Fajgelbaum et al. (2020) find that the total cost to the United States throughout both 2018 and 2019 is $51 billion. Even after accounting for the gain of a few producers as well as government gains from an increase in government revenue, the total economic harm to producers and consumers outweighs these gains. Overall, the true motives behind the steel tariff and other similar tariffs must be considered carefully.

In addition to the cost of the steel tariff alone, model 7 estimates that Chinese producers increased the price of their steel exports after the steel tariff went into effect.

This increase in the price of steel imports, even before accounting for the cost of the tariff, suggests that Chinese producers may be retaliating against the United States. One possible explanation is, once the steel tariff is imposed, the producers of the United States import less steel from China, and therefore Chinese producers increase the prices of their steel to compensate for the decrease in volume. This additional cost may cause even greater economic harm to the producers and consumers of the United States.

These findings do come with their limitations. In my study, I examine President Trump's steel tariff. Therefore, these findings are only applicable to steel and steel goods. Due to this, the rejection of the large country theory is only relevant when the United States is trading for steel and steel goods. Additionally, this study examines the current trade war of 2018 and 2019, implying that these estimates are unable to predict the results of future trade wars.

Identifying these limitations, it is important to note that China is currently the largest trade partner of the United States (United States Census Bureau, 2019). In addition, China's economy is growing at a faster rate than the United States' economy (Congressional Research Services, 2019). With the fact that such a large quantity of trade is currently being affected by these tariffs, and the fact that economic inequality between the United States and China is shrinking, it is highly unlikely that the United States will gain the ability to influence the world price of steel in the future.

Further research is needed to understand if the United States has the ability to influence world prices of other imported goods subject to President Trump's trade war including solar panels, washing machines, aluminum and technological and intellectual property. All of these goods allow for further research on this topic.

Conclusion

In order to determine if the United States or China is paying for the current trade war, I test the large country theory to see if Chinese producers are lowering the price of their steel exports after the enactment of the steel tariff by the United States. I do not find evidence supporting this claim. Rather, I find evidence suggesting that the producers of the United States are facing higher prices on imported steel from China before the cost of the tariff is added. Accounting for the additional tariff cost, United States producers will experience an even greater increase in the price of imported steel. With this price increase occurring to the producers of the United States after the enactment of the steel tariff, the evidence suggests that the United States is paying for both the increase in the price of steel and the full cost of the steel tariff. This finding rejects the large country theory and ultimately suggests that the United States does not have a significant enough import demand to influence the world price of steel.

While this study concludes that the producers of the United States are paying for all costs associated with the steel tariff, it does not assess the passthrough rate to end-consumers. Furthermore, this study does not measure the possible effects of retaliatory tariffs from foreign countries such as China. Retaliatory tariffs could lead to even greater costs for the United States, ultimately increasing the total burden of the tariffs further. Finally, it is important to note that this study does not consider the impact that trade war uncertainty creates within the business community. The potential negative effects of uncertainty could magnify the overall impact of the tariffs. In conclusion, future research is likely to calculate the actual monetary costs of the tariffs focusing on these additional influences.

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Appendix 1

Figure 9 - Anticipatory and Delay Response Regression Results

VARIABLES	(4, from Fig. 7) Fixed Effects Model	(8) 12 Months Removed	(9) 18 Months Removed	(10) 24 Months Removed
Steel Tariff Dummy	0.589	0.704	0.733	0.814
	(-0.234 - 1.412)	(-0.210 - 1.618)	(-0.199 - 1.665)	(-0.207 - 1.836)
Unemployment Rate	-0.0232	-0.0511	-0.0525	-0.0527
	(-0.0900 - 0.0436)	(-0.138 - 0.0362)	(-0.140 - 0.0354)	(-0.139 - 0.0337)
Industrial Production Index	0.000186	-0.0054	-0.00563	-0.00508
	(-0.0160 - 0.0163)	(-0.0197 - 0.00886)	(-0.0193 - 0.00800)	(-0.0201 - 0.00994)
Exchange Rate	-1.073**	-1.135**	-1.151**	-1.170**
	(-1.870 - -0.275)	(-1.961 - -0.309)	(-1.972 - -0.331)	(-2.006 - -0.334)
Consumer Price Index	-0.0137	-0.0142	-0.0149	-0.0159
	(-0.0441 - 0.0167)	(-0.0442 - 0.0157)	(-0.0446 - 0.0147)	(-0.0467 - 0.0150)
Constant	16.60***	17.90***	18.20***	18.48***
	(5.529 - 27.68)	(6.265 - 29.54)	(6.598 - 29.81)	(6.695 - 30.27)
Commodity Dummy Variables	Yes	Yes	Yes	Yes
Observations	2,040	1,920	1,870	1,800
Number of Commodities	10	10	10	10
R-squared	0.354^	0.373^	0.38^	0.388^

95 percent confidence intervals in parentheses

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

^ within r-squared value

Calculated standard errors are robust to heteroskedasticity.