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Trade and trade diversion effects of United States tariffs on China

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Abstract

Since mid-2018 the United States of America and China have been locked in a trade confrontation which has resulted in several rounds of retaliatory tariffs. This paper investigates the impact the United States tariffs on China on United States imports. This paper finds that United States tariffs against China have resulted in a reduction in imports of the tariffed products by more than 25 percent. The analysis finds that China's export losses in the United States have resulted in trade diversion effects to the advantage of Taiwan Province of China, Mexico, the European Union and Viet Nam among others. The analysis also finds that those effects have increased over time. The analysis finds some preliminary evidence that Chinese exporters may have started to bear part of the costs of the tariffs in the form of lower export prices. Overall, the results indicate that the United States tariffs on China are economically hurting both countries. United States losses are largely related to the higher prices for consumers, while China's losses are related to significant export losses.

Key words: Trade War, Trade Diversion, Tariffs

Contents

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1. Introduction

Over the course of 2018, the United States administration started implementing a series of trade measures aimed to curtail imports, first targeting specific products (steel, aluminum, solar panels and washing machines) and then specifically targeting imports from China.[1] The first phase of the United States-China trade confrontation occurred in the early summer of 2018 when the United States and China raised tariffs on about US$ 50 billion of each other's goods. The impossibility of finding common ground to resolve the issues of trade balances and intellectual property rights resulted in the further deterioration of United States-China trade relationship. The United States administration introduced additional tariffs in September 2018 to cover US$ 200 billion of Chinese imports, to which China retaliated by imposing tariffs on imports from the United States worth an additional US$ 60 billion. While these tariffs were initially due to rise from 10 to 25 percent in January 2019, in early December 2018 the parties agreed to hold off any retaliatory actions until March 2019. This truce held until June 2019 when the United States went ahead with the planned increase in tariffs from 10 percent to 25 percent, to which China responded by raising the tariffs on a subset of the products which were already subject to tariffs. The retaliation further escalated in September 2019 when the United States imposed 15 percent tariffs on a large subset of the remaining US$ 300 billion of imports from China not yet subject to tariffs. Further escalation is expected to take place in December 2019. This series of events and retaliatory actions is known as the United States-China trade war.

The sudden change in United States trade policy vis-à-vis China during the second half of 2018 provides an opportunity to investigate the impact of tariff changes on international trade. The fact that tariffs were implemented in different phases, on a single country, and on very specific products allows us to discern their effects using conventional and well tested methods. This paper uses updated and finely disaggregated data to investigate the impact of such tariffs on United States imports and to answer three related questions: first, to what extent and when United States tariffs have reduced imports from China; second, whether United States tariffs have had any effect on China export prices; and third, to what extent United States tariffs on China have resulted in a surge of United States imports from elsewhere. This paper analyzes the impact of the two initial phases of the United States-China trade war. Phase one covers the products for which United States tariffs were initially raised in July 2018. Phase two covers the products for which United States tariffs were initially raised at the end of September 2018. Phase one of United States tariff escalation involves about US$ 60 billion worth of imports from China, comprising about 1,100 HS 8-digit codes. Phase two of United States tariffs on China covers about US$ 200 billion worth of imports from China, comprising about 6,000 HS 8-digit codes. The United States tariff schedule comprises close to 11,000 HS8 tariff codes, thus phase one and two collectively cover about two thirds of United States HS8 lines[2].

The analysis of this paper finds that the additional United States tariffs against China have resulted in a reduction in imports of the tariffed products by more than 25 percent during the first half of 2019. Importantly, the analysis indicates that China's export losses have increased over time, with losses in the second quarter of 2019 relatively higher than in previous quarters. Regarding prices, the analysis finds some indications that Chinese exporters may have started in the second quarter of 2019 to bear part of the costs of the tariffs in the form of lower export prices. The analysis also finds that China's export losses in the United States market have resulted in trade diversion effects, but only partially so. United States imports from Taiwan Province of China, Mexico, the European Union and Viet Nam among others, have all substantially increased because of the United States tariffs on China. At the sectoral level, office machinery and communication equipment were the sectors most affected by the tariffs.

[1] Bown (2019) provides a clear summary and a detailed timeline of the United States- China trade war.

[2] Because trade data is not yet available, the analysis of this paper does not cover the last phase of the trade war: the products for which tariffs were raised in September 2019. Moreover, this paper focuses only on the impact of United States tariff escalation on United States imports because the sufficiently disaggregated data on the Chinese imports that is required for the analysis is not yet publicly available. The methods of this paper can be used to infer the impact of the trade war on Chinese imports once the data become available.

This paper continues as follows. Section 2 provides a brief overview on the general effects of tariffs on international trade. Section 3 describes recent statistics on United States imports. Section 4 provides econometric evidence on the impact of tariffs on United States imports, import prices, and trade diversion. Section 5 presents trade diversion effects by country. Section 6 concludes.

2. Tariffs and international trade

Conventional trade models provide a framework for understanding the impact of tariffs on trade: tariffs raise the prices of foreign goods with the result of reducing demand for imports.[3] Moreover, in the case of tariffs applied only to specific countries, as in the United States-China trade war, tariffs can lead to trade diversion effects as importers can avoid the tariffs by sourcing the goods from elsewhere. Trade diversion effects do not necessarily happen, and generally are not complete, meaning that third countries are generally able to capture only part of the trade, with the rest being lost or internalized by the country imposing the tariff.

There are various reasons for which trade diversion effects are generally not complete. For example, other countries may not have enough untapped supply capacity, exporters subject to tariffs may retain trade by reducing their prices; and trade frictions may make it very difficult to find other competitive suppliers, such as high transportation costs due to inadequate trade infrastructures. In practice, the various effects of tariffs are not mutually exclusive and often happen in concert: bilateral tariffs lead to higher prices for consumers, to lower profits for exporting firms, and are accompanied by trade diversion effects that favour third countries. Trade models capture these effects with parameters measuring the degree to which prices and quantities imported from different countries react to tariffs.

While trade models provide a framework for understanding the dynamics of the ongoing trade war, data is required to validate the models. The United States Census Bureau provides very comprehensive and updated official statistics which can be used to provide some insights on the effects to date of United States tariffs on imports from China. [4]

To investigate the effect of United States tariffs on China this paper uses trade data at the 8-digit level of the HS classification, representing more than 10,000 tariff lines. The analysis makes use of data from the first quarter of 2017 to the second quarter of 2019. The use of quarterly data reduces the noise and improves accuracy over monthly level data. The data utilized for this study is comprised of import values and prices (computed from unit values by dividing values by quantities). Unit values are to be intended as export prices as they do not include any tariffs imposed by the United States.[5]

3. Descriptive statistics

Before formally examining the impact of United States tariffs on imports from China it is useful to provide some descriptive statistics to put the subsequent analysis in context. In 2018, United States imported from China

[3] Amiti, Redding and Weinstein (2019) provide a more exhaustive discussion how tariffs affect demand and prices in the context of the United States-China trade war. Amiti, Itskhoki, and Konings (2019) more formally discuss the mechanisms through which international shocks affect domestic prices.

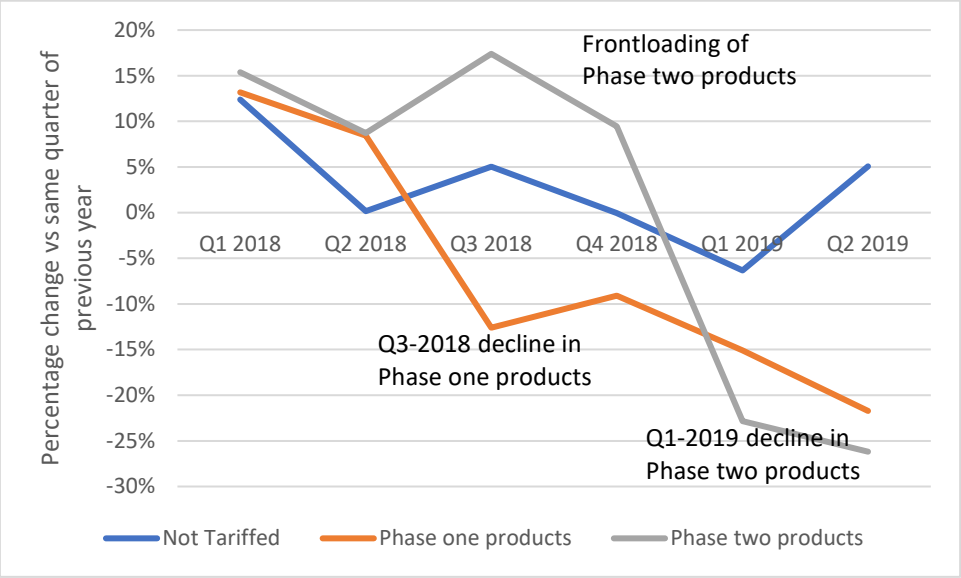
[4] The long-term effects of bilateral tariffs on international trade are more complex. Trade flows depend not only on supply, demand, and substitution effects but also on reliable infrastructure and logistics. While the effect of tariffs on prices and imports may be immediate, their effect will only gradually converge towards a new equilibrium. Firms need to enter new markets, production processes need to be shifted, and logistic infrastructure needs to be built.

[5] It is important to emphasized that the available data on import prices is generally less reliable and does not account for quality or varieties of goods within the same tariff line (e.g. standard LED monitors vs Ultra HD monitors), so the comparison of import prices across time is often more problematic as it would need to assume away changes in quality and varieties. For this reason, the unit values data in the analysis is accurately screened for outliers.

about US$ 550 billion worth of goods, US$ 255 billion of which in the first half of 2018. By comparison, the value of United States imports from China in the first half of 2019 was less than US$ 230 billion, corresponding to a decline of about 10 percent. A key question is therefore to what extent the United States-China tariffs contributed to such a decline.

Preliminary evidence of the impact of tariffs on United States imports from China can be drawn by comparing the changes in the values of goods imported from China subject to United States tariffs vis-à-vis those not affected. Figure 1 presents percentage changes in United States imports from China in 2019 vs the same quarter of 2018 to control for seasonal patterns. Figure 1 further differentiates between goods which were subject to phase one tariffs and those of subject to phase two.

Figure 1. Percentage changes in the value of United States imports from China



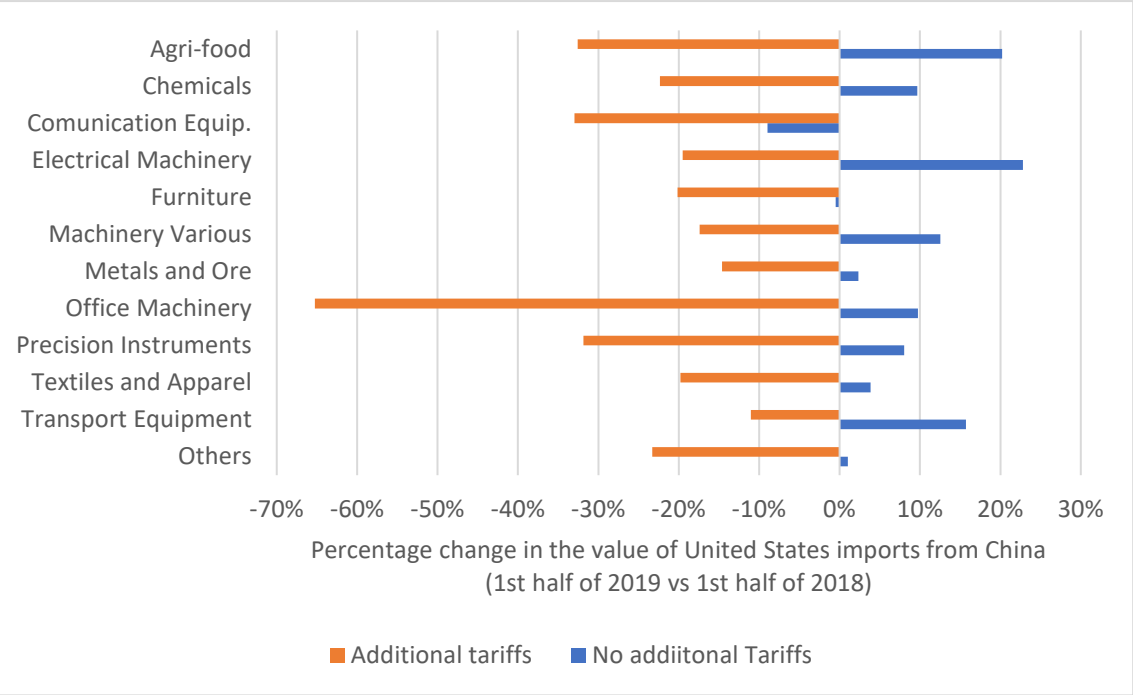
Source: Author's calculation based on United States Census Bureau data.

Figure 1 indicates that Chinese exports to the United States started to decline soon after the imposition of tariffs, especially for those products covered under phase one. For the products covered under phase two the effects started to be evident from the first quarter of 2019. Figure 1 also shows some frontloading regarding goods under phase two (i.e. the increase in imports just before the tariffs take effect). By comparison, imports of goods not subject to tariffs have been relatively more stable and increased during Q2 2019. One possible reason for such an increase is United States importers stockpiling due to the possibility of additional tariffs on the remaining products (which indeed happened in September 2019). Another possible explanation is that Chinese exporters were trying to maintain profit margins by increasing exports in non-tariffed goods. Another possibility relates to mis-invoicing products to avoid the tariffs (Buehn and Eichler, 2011).

The overall effect of United States tariffs on imports from China is also evident by disaggregating the data by economic sectors. Figure 2 reports the change in the value of imports between the first half of 2018 vs the first half of 2019 across sectors. In most of the sectors, imports declined in the case of tariffed products (those under phase one and two combined), while imports increased for those products not subject to tariffs. The exception is lower imports for communication equipment not subject to additional tariffs, but even so imports fell to a relatively lower extent (in percentage terms the value of non-tariffed goods dropped by about 10 percent vs a drop of about 30 percent for tariffed goods).[6]

[6] This could be the results from the United States-China highly integrated value chains in the ICT sectors.

Figure 2. Percentage change in United States imports from China in tariffed and non-tariffed products, by sector



Source: Author's calculation based on United States Census Bureau data.

Office machinery has been the hardest hit sector in the trade war. In this category, the imports of products subject to additional tariffs dropped by 65 percent. For other sectors, such as agri-food, communication equipment, and precision instruments, trade in the tariffed goods fell by more than 30 percent. Although the descriptive statistics of Figures 1 and 2 suggest considerable effects of United States tariffs on imports from China, there could also be other factors confounding the results. The next section provides more formal evidence of the impact of tariffs on United States imports.

4. Assessing the impact of United States tariffs on imports from China, on United States import prices and on United States imports from other countries

This section more formally examines whether the general predictions of trade models are reflected in the data. The analysis specifically examines three related questions: first, to what extent United States tariffs have reduced imports from China, and when; second, whether United States tariffs have had any effect on United States import prices; and third, to what extent tariffs have resulted in a surge of United States imports from third countries.

The identification strategy relies on simple methods: the change in the variable of interest is regressed on a dichotomous variable indicating the presence of additional tariffs. Such approach identifies the impact of tariffs by comparing the imports of tariffed goods with that of products not affected by tariffs. The econometric estimation provides a more robust analysis than simple descriptive statistics as it further controls for demand effects and sectoral specific shifts. The analysis is based on a set of regressions where the percentage change

in the variable of interest in a given quarter (measured on a year to year basis). The econometric setup therefore consists of cross-section regressions where the identification is between tariffed and non-tariffed products. In formal terms:

$$\Delta X_k = \beta^1 + \beta^2 \Delta C_k + \beta^3 T_k^1 + \beta^4 T_k^2 + \phi_z + \varepsilon_k \qquad (1)$$

In this specification ΔX_k is the percentage change of the variable of interest, either the value of trade in US dollars or the price (unit value), for product k at the 8-digit level of disaggregation, and ΔC_k controls for changes in the variable of interest in relation to the rest of the world (ROW). T_k^1 and T_k^2 are dichotomous variables indicating whether product k was subject to tariffs in phase one or phase two. The term ϕ_z denotes sectoral fixed effects (HS 4-digit) and ε_k is the error term. Standard errors are clustered at the HS 4-digit level. Equation 1 is estimated separately for the six quarters from Q1 2018 to Q2 2019. Values and prices are constructed as percentage change vis a vis the same quarter of the previous year to control for seasonal patterns. The presence of HS 4-digit fixed effects is essential in providing evidence as it restricts the identification within similar products.

In equation (1) the coefficients β^3 and β^4 measure the average impact of tariffs, in phase one and phase two. For example, a coefficient of minus 0.1 would imply that on average the value of goods subject to tariffs have declined by 10 percent relative to the value of similar goods not subject to tariffs. In this setup, the constant measures the changes in the variable of interest for goods not subject to tariffs. Note that by running a series of cross-section regression it is possible to better identify the timing for the tariffs to have an impact on the variable of interest.

Table 1. Impact of United States tariffs on imports from China

	(1) Q1 2018	(2) Q2 2018	(3) Q3 2018	(4) Q4 2018	(5) Q1 2019	(6) Q2 2019
Percentage change in imports from the ROW	-0.00051	-0.00506***	-0.00187	0.001000	-0.00161	-0.00116
	(0.0004)	(0.0019)	(0.0013)	(0.0006)	(0.0014)	(0.001)
Phase 1 tariffs	0.0204	0.0505	-0.220***	-0.392***	-0.374***	-0.491***
	(0.0408)	(0.0396)	(0.0383)	(0.0429)	(0.0393)	(0.0390)
Phase 2 tariffs	0.00546	0.0620**	0.0169	-0.0337	-0.203***	-0.293***
	(0.0315)	(0.0303)	(0.0292)	(0.0339)	(0.0307)	(0.0305)
Constant	-0.00999	-0.0873***	0.0584***	0.0396*	-0.0255	0.0425**
	(0.0213)	(0.0205)	(0.0201)	(0.0229)	(0.0212)	(0.0213)
Observations	6,012	6,224	5,890	6,059	6,327	6,351
R-squared	0.224	0.219	0.215	0.259	0.253	0.274

Note: The dependent variable is the percentage change in United States imports from China. All specifications include HS 4-digit fixed effects. Top and bottom 1 percent of observations are dropped. Clustered standard errors are shown in parenthesis, *** p<0.01, ** p<0.05, * <0.1.

Table 1 reports the results of the estimation on the percentage change in the value of United States imports from China across six quarters. The results of Table 1 indicate that tariffs started to significantly affect United States imports from China in Q3 2018 for the products under phase one, and in Q1 2019 for products under phase two. Also note that the average impact of tariffs on United States imports from China appear to increase over time. For example, while the differential impact in the value of goods subject to phase one tariffs versus

these not affected was about 22 percent, it increased to about 45 percent in Q2 2019.[7] For products subject to phase two it increased from 20 in Q1 2019 to 25 percent in Q2 2019. Also note that there was no systematic difference across product groups before tariffs took effect in Q3 2018. This provides further evidence that tariffs have been the main factor behind the fall in United States imports from China.

The second question of interest is how much of the tariffs are reflected in consumers' prices or whether the tariffs lower export prices. While the established literature (Feenstra, 1989; Goldberg and Knetter, 1997; Broda, Limao and Weinstein, 2008) generally finds that both consumers and exporters prices are affected by the imposition of tariffs, the few studies examining this question in relation to the United States-China trade war have so far found an almost full pass-through of tariffs to United States consumers' prices, with very little change in Chinese export prices (Amiti, Redding and Weinstein, 2019; Fajgelbaum, Goldberg, Kennedy and Khandelwal, 2019). However, there are reasons for which the tariffs pass-through to prices may initially be complete but then become incomplete over time. Notably, import prices may be sticky due to long contractual terms. In the medium-term, exporters could counteract the effect of the tariffs by lowering their prices to preserve market share. Preservation of market share is a good strategy when increases in trade costs are perceived as temporary, as it will deter foreign competitors from contesting the markets (Froot and Klemperer, 1986).

As with values and market share, the analysis uses differences in the changes of prices between goods subject to tariffs and those not subject to tariffs within the same narrowly defined sector. China's export prices are calculated from United States unit values of the goods originating from China and therefore do not account for costs related to the tariffs.[8] In this setup, a decline in prices would suggest that Chinese exporters were bearing some of cost of the United States tariffs. Table 2 presents the econometric results.

Table 2. Impact of United States tariffs on China export prices

	(1) Q1 2018	(2) Q2 2018	(3) Q3 2018	(4) Q4 2018	(5) Q1 2019	(6) Q2 2019
Percent change in import prices from ROW	0.0686*	0.0177	0.108*	0.177***	0.162***	0.104***
	(0.0398)	(0.0172)	(0.0614)	(0.0320)	(0.0415)	(0.0359)
Phase 1 tariffs	0.00781	0.0472	0.0358	0.0214	0.00772	-0.0723**
	(0.0269)	(0.0293)	(0.0325)	(0.0326)	(0.0309)	(0.0298)
Phase 2 tariffs	0.0307	0.0116	-0.0212	-0.0166	-0.0467	-0.0877**
	(0.0383)	(0.0386)	(0.0475)	(0.0449)	(0.0456)	(0.0374)
Constant	-0.0138	-0.0160	-0.0153	-0.0342	-0.0324	-0.00155
	(0.0179)	(0.0199)	(0.0218)	(0.0208)	(0.0201)	(0.0186)
Observations	4,261	4,297	4,217	4,289	4,226	4,283
R-squared	0.271	0.230	0.285	0.283	0.274	0.284

[7] This by considering also the intercept which measures the effects on non-tariffed goods.

[8] Prices are computed as unit values by dividing the import values by the corresponding quantity. One issue with unit values is that they are only a proxy for prices. Quantity data is generally less accurate than data reflecting unit values. Furthermore, unit values depend on other factors that may change across time (e.g. quality). In many cases unit values show unreasonable variance and therefore need to be scrutinized for outliers. For this reason, the estimation drops observations for which changes in the unit value are larger than 50%, and observations where the standard deviation of unit values between Q1 2017 and Q2 2019 larger than 3. While this drops about 25 percent of observations, it makes the estimating sample more reliable.

Note: Dependent variable: percentage change in China export prices. All specifications include HS 4-digit fixed effects. Clustered standard errors are shown in parenthesis, *** p<0.01, ** p<0.05, * <0.1.

The results of Table 2 do not show any impact of the tariffs on Chinese export prices until the very last period of analysis. For the second quarter of 2019 prices appear to have declined significantly more for product subject to tariffs. In magnitude, the results for Q2 2019 indicate lower Chinese export prices by about 8 percent on goods subject to tariffs. However, because of the uncertain reliability of data on unit values, the finding of lower Chinese export prices would need to be validated with further analysis based on additional data, once it becomes available.

One of the effects of United States tariffs on China is to make Chinese exporters less competitive and therefore these tariffs should favour the replacement of United States imports from China with imports from elsewhere. This is what is generally referred to as the trade diversion effect of a tariff. The following analysis tests for trade diversion effects by estimating a regression model in differences, where the change in the value of United States imports from China are regressed on United States imports from the rest of the world. The identification relies on comparing the change in imports for products subject to tariffs against products that are not subject to additional tariffs within the same narrowly defined sector. More formally the estimating equation takes the form:

$$\Delta ROW_{kt} = \beta^{1+}\beta^{2}\Delta X_{kt} + \beta^{3}T_{kt}^{1} + \beta^{4}T_{kt}^{2} + \beta^{5}T_{kt}^{1}\Delta X_{kt} + \beta^{6}T_{kt}^{2}\Delta X_{kt} + \phi_{z} + \theta_{t} + \varepsilon_{kt} \quad (2)$$

In this setup ΔROW_{kt} is the change in United States imports from the rest of the world vis-à-vis the same quarter of the previous year for product *k* at the 8-digit level of disaggregation, and where *t* denotes the quarter. $T_{kt}^{1}\ and\ T_{kt}^{2}$ are dichotomous variables indicating whether product *k* was subject to United States tariffs on China in each quarter. The term ϕ_{z} denotes sectoral fixed effects (HS 4-digit), θ_{t} denotes the time fixed effect (quarter), and ε_{k} is the error term. The coefficient on the change in imports from China (ΔX_{kt}) provides an indication of the correlation between United States imports from China and United States imports from the rest of the world in the absence of tariffs; the overall effect of United States-China tariffs is captured by the tariff dummies, and the interaction terms isolate the trade diversion effects for goods subject to tariffs. The coefficients on the interaction terms represent the substitution of Chinese imports subject to United States tariffs by imports from elsewhere, for every dollar. Note that a negative coefficient would indicate the presence of trade diversion as it shows that imports from China are negatively correlated with imports from the rest of the world.

Table 3 reports the results across different time periods. First across all period of analysis, from Q1 2018 to Q2 2019, then for each of the last three quarters separately. The results are controlled for by sector (HS 4 digits) fixed effects, and by time fixed effects for the first specification.

Table 3. The impact of tariffs on trade diversion

	(1) Q1 2018 - Q2 2019	(2) Q4 2018	(3) Q1 2019	(4) Q2 2019
Change in imports from China (CHN)	0.214***	0.221***	-0.0170	0.0545
	(0.0310)	(0.0811)	(0.113)	(0.0690)
Phase 1 tariffs (P1)	2.674***	3.550***	-0.119	0.397
	(0.443)	(1.099)	(0.974)	(1.000)
Phase 2 tariffs (P2)	0.282	0.196	-0.333	-0.460
	(0.262)	(0.570)	(0.637)	(0.619)
P1*CHN	-0.416***	-0.429*	-0.352**	-0.482***
	(0.0929)	(0.229)	(0.174)	(0.131)
P2*CHN	-0.290***	0.00579	-0.288*	-0.332***
	(0.0527)	(0.107)	(0.149)	(0.0946)

Constant	1.199***	1.627***	2.081***	1.674***
	(0.198)	(0.407)	(0.444)	(0.431)
Observations	47,031	7,914	7,597	7,460
R-squared	0.206	0.304	0.252	0.260

Note: Dependent variable is the change in United States imports from the rest of the world. All specifications include HS 4-digit fixed effects. Specification 1 includes time fixed effects. Clustered standard errors are shown in parenthesis, *** p<0.01, ** p<0.05, * <0.1.

The positive and significant coefficient on the change in United States imports from China indicate that in normal times United States imports from the rest of the world are positively correlated with those from China. This is to be expected as imports generally follows broad economic conditions. However, for Q1 and Q2 of 2019 there is no correlation between United States imports from China and from elsewhere, while the correlation becomes negative when bilateral tariffs are considered. That is, in the first half of 2019 there was substitution for United States imports from China with imports from the rest of the world, but only in the presence of bilateral tariffs. In other words, the presence of the United States tariffs on China is resulting in an increase in imports from the rest of the world, but only when imports from China declined. Considering the specification for Q2 2019, tariffs resulted in trade diversion effects in the order of 48 cents per dollar for goods of phase one and 33 cents per dollar of goods subject to phase two. Trade diversion effects appear to be larger for products subject to phase one relative to products subject to phase two. Moreover, specification (3) and (4) indicate that trade diversion effects have increased over time. Also note that the identification of these effects is within HS 4-digit sectors. Therefore, the numbers presented above are to be interpreted as average differences between tariffed and non-tariffed goods within the same narrowly defined sectors.

5. Trade diversion effects in details

As discussed in the previous section, one consequence of United States bilateral tariffs on China has been to increase United States imports from elsewhere. In this context, a key question is which country has been best able to replace China in the United States market. This section investigates the outcome by identifying which countries have benefitted from the trade war, and by how much. The analysis makes use of the data at the HS 8-digit level by comparing the first two quarters of 2019 with the first two quarters of 2018 and by considering goods subject to phase one and phase two collectively.

To identify the countries that have benefitted from United States tariffs on China the analysis is largely based on observed data rather than estimation. Still, the quantification of these effects needs to rely on a few assumptions. The first assumption is that any observed decline in the value of United States imports from China of products under phase one or two is assumed to be exclusively due to the presence of the tariff. Similarly, the observed increases in United States imports of products from the rest of the world under phase one and two are assumed to be due to the presence of the tariffs on China. Note that the validity of these assumptions was tested in the econometric section which demonstrated that United States imports from China fell only in the presence of tariffs (Table 1) and that United States imports from the rest of the world increased only for the products that have been subject of United States tariffs on China (Table 3).

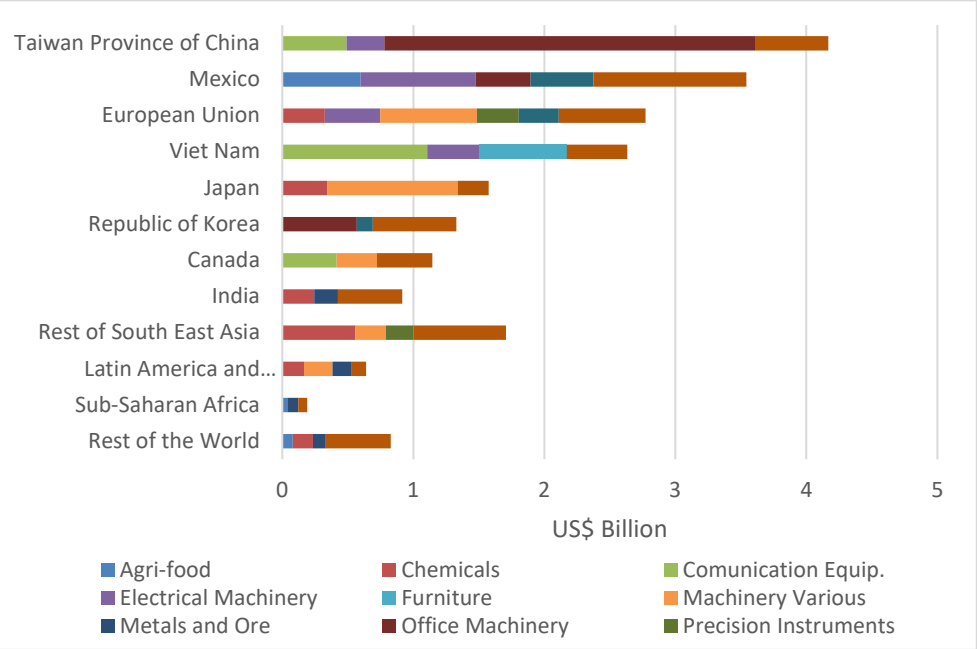
Another set of assumptions concerns the allocation of trade diversion effects. When the observed increase in United States imports from the rest of the world is insufficient to compensate for the loss of United States imports from China, the remainder is accounted as trade loss (i.e. reduced demand in the United States because of higher prices or increase in domestic supply). Note that the econometric results of Table 2 and 3 substantiate this assumption by showing that, on average, prices have increased for United States importers and the imports from the rest of the world were not able to fully substitute for the decline in the imports from China. For consistency, when the observed increase in the imports from the rest of the world is larger than the decline in the imports from China, imports from the rest of the world are rescaled to match the decline in United States imports from China. The rescaling is proportional to the observed increases in imports from each country. This avoids imputing any additional effects to the imposition of tariffs besides the effects of trade diversion.

Finally, countries for which United States import values have not changed, or have declined, have no gains originating from the trade diversion effects of the tariffs. The computations are carried out at the 8-digit level.

Under the assumptions detailed above, the overall trade diversion effects observed in data for the first half of 2019 amount to about US$ 21 billion. To put this figure in context, one needs to consider that the observed United States imports from China in goods under the list of products of phases one and two accounted for about US$ 130 billion in in the first half of 2018, but only to about US$ 95 billion in the first half of 2019, resulting in a decline in United States imports from China of US$ 35 billion (or about 25 percent). Therefore, of the US$ 35 billion import loss, US$ 21 billion (or about 63%) has been replaced by imports originating from other countries, while the remainder of US$ 14 billion was lost due to lower demand in the United States and/or not enough capacity from the rest of the world. Note also that despite the tariffs, China has been able to preserve almost 75% of its trade in the products affected by tariffs.

Looking beyond averages, trade diversion effects show considerable variance both across countries and across sectors. Large countries with spare supply capacity and available trade infrastructure were the ones better positioned to replace China in the United States market. Existing trade agreements as well as geography also appear to be playing a significant role. Figure 3 reports the effects across a few selected economies along with the sectors accounting for most of the gains.[9]

Figure 3. Trade diversion effects, by economies and regional groups (first half of 2019)



Source: Author's calculation based on United States Census Bureau data. Note: "Other Sectors" includes everything else, except the sectors displayed for each economy.

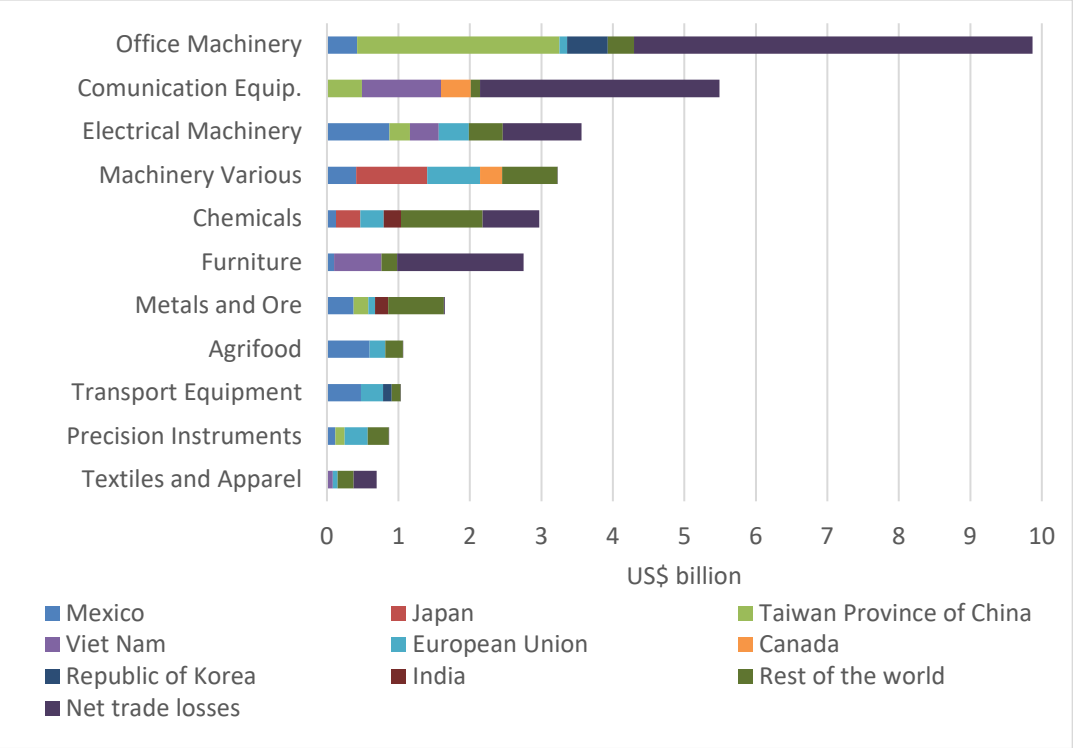
Taiwan Province of China was the largest beneficiary of the trade diversion effects of United States tariffs on China, accounting for additional exports to the United States of almost US$ 4.2 billion in the first half of 2019. For Taiwan Province of China, the benefits are largely related to an increase in exports of office machinery and communication equipment. Mexico's increase in exports to the United States due to tariffs on China are quantified to be about US$ 3.5 billion, mostly in the agri-food, transport equipment and electrical machinery sectors. The European Union benefitted by trade diversion effects of about US$ 2.7 billion, largely due to increases in exports in the machineries sectors. Viet Nam's benefits account to about US$ 2.6 billion and are mostly concentrated in communication equipment and furniture. Trade diversion effects in favour of the

[9] The annex reports the full matrix of beneficiaries by sector.

Republic of Korea, Canada, and India were smaller but still substantial (between US$ 0.9 and 1.5 billion). The remainder of the trade diversion effects was largely to the advantage of other South East Asian countries (US$ 1.7 billion). The rest of Latin America, Sub Saharan Africa and the rest of the world were only marginally able to benefit from trade diversion effects.

United States imports from China have been replaced with imports originating elsewhere to a varying extent, depending on the sector. Figure 4 reports the statistics of Figure 3 but better illustrates trade diversion effects by sector. Moreover, it also provides the distribution of the net trade losses (i.e. the US$ 14 billion of United States imports not replaced by other countries). Figure 4 also indicates the major beneficiaries of the trade diversion effects for each sector.

Figure 4. Trade diversion effects, by sector and major beneficiaries (first half of 2019)



Source: Author's calculation based on United States Census Bureau data.

Office machinery has been the hardest hit sector in the ongoing trade war, with United States imports from China falling by almost US$ 10 billion in the first half of 2019. Trade diversion effects for this sector are quantified to be about US$ 4.5 billion, most of which to the advantage of Taiwan Province of China. This leaves about US$ 5.5 billion of trade losses. Given the magnitude of the decline in United States imports from China, and the world market dominance of Chinese firms in this sector, the fact that other countries were not able to supply for the loss of imports from China is not a surprising outcome. Communication equipment and furniture are two other sectors where the increase in imports from other countries were not sufficient to replace the decline in United States imports from China. In these two sectors Viet Nam exporters benefited the most. Trade diversion effects in the machinery sectors have been more diverse, with a substantial share of the increase in United States imports coming not only from the East Asian region. For these sectors Mexico and the European Union were the major beneficiary of the trade diversion effects, as well as Japan.

6. Conclusion

Economists generally agree that increases in bilateral trade costs such as those resulting from the ongoing trade war between United States and China will result in lower trade, higher prices for consumers, and trade diversion effects. By using recent import data from the United States census bureau, this paper finds empirical evidence for these arguments. By adopting a simple identification strategy which relies on measuring differences in outcomes between goods that have been subject to additional tariffs versus goods that have not, and controlling for detailed sectoral specific effects, the paper finds substantial evidence that United States tariffs have resulted in a strong decline in United States imports from China. The paper finds that such a decline was partly replaced by a surge in United States imports from elsewhere. The analysis finds implicit evidence that the cost of the tariffs has been generally passed down to United States consumers. However, it also finds some indication that Chinese firms may have only recently started to react to tariffs by reducing their export prices, thus absorbing part of the cost of the tariffs (about 8 percentage points). However, the limited evidence found in this study would need to be substantiated by further data once it becomes available.

In magnitude, the analysis of this paper finds that United States tariffs on China have resulted in a decline in imports of tariffed products by about 25 percent in the first half of 2019. While substantial, this figure also shows the competitiveness of Chinese firms, which despite the substantial tariffs, were still able to maintain 75 percent of their exports to the United States. The paper also quantifies the trade diversion effects for the first half of 2019 to be about US$ 21 billion, implying that the amount of net trade losses corresponds to about US$ 14 billion. Trade diversion effects have brought substantial benefits for Taiwan Province of China, Mexico, the European Union, and Viet Nam. The paper also provides insights of the effects at the sectoral level. The hardest hit sectors have been office machinery and communication equipment with a total reduction of United States imports from China in the order of about US$ 15 billion for the first half of 2019. Trade diversion effects in these sectors have been below average possibly because lack of supply capacity outside China.

More in general the results of this paper point to the fact that the United States tariffs on China are economically hurting both countries. United States losses are largely related to the higher prices for consumers, while China's losses are related to significant export losses. While this paper does not examine the impact of the most recent phase of the trade war, the results are likely to be similar in the sense that the recent escalation is likely to have added to the existing losses. Finally, the analysis in this paper did not consider either the impact of Chinese tariffs on United States imports, but the qualitative results are most likely to be analogous: higher prices for Chinese consumers and losses for United States exporters.

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ANNEX

Table A1. Matrix of trade diversion effects (US$ Million)

	Australia	Argentina	Brazil	Canada	European Union	Indonesia
Agri-food	16	9	4	21	215	0
Chemicals	23	8	129	0	324	0
Comunication Equip.	13	0	9	416	0	42
Electrical Machinery	0	1	27	110	422	27
Furniture	26	3	0	0	0	0
Machinery Various	5	22	191	307	739	29
Metals and Ore	0	27	71	83	96	25
Office Machinery	0	0	0	39	108	0
Precision Instruments	4	0	7	62	371	4
Textiles and Apparel	3	1	4	0	66	2
Transport Equipment	2	0	11	76	285	1
Others	3	3	0	83	55	0
TOTAL	95	75	451	1197	2681	129

	India	Japan	Republic of Korea	Mexico	Malaysia	Pakistan
Agri-food	23	21	19	599	0	3
Chemicals	243	342	95	127	40	5
Comunication Equip.	0	10	13	0	0	0
Electrical Machinery	83	0	68	876	12	0
Furniture	27	0	5	99	58	2
Machinery Various	68	997	99	407	0	0
Metals and Ore	181	62	52	373	50	0
Office Machinery	18	63	568	420	12	0
Precision Instruments	23	0	2	166	76	1
Textiles and Apparel	41	12	48	47	2	25
Transport Equipment	6	1	117	456	1	0
Others	42	32	29	0	1	0
TOTAL	755	1540	1115	3570	251	37

	Russian Federation	Thailand	Turkey	Taiwan Province of China	Viet Nam	South Africa
Agri-food	56	0	13	6	14	13
Chemicals	143	243	17	5	134	30
Comunication Equip.	0	0	31	491	1106	0
Electrical Machinery	19	25	12	287	400	3
Furniture	0	22	11	55	665	5
Machinery Various	0	124	23	122	8	3
Metals and Ore	54	58	89	205	130	0
Office Machinery	0	0	0	2830	60	0
Precision Instruments	0	0	9	183	18	4
Textiles and Apparel	0	4	14	8	4	2
Transport Equipment	1	4	5	14	52	0
Others	74	1	1	11	10	0
TOTAL	347	481	226	4217	2601	60

Table A1 *(continued)*

	Rest of Latin America and Caribbean	Rest of South East Asia	Rest of Sub-Saharan Africa	Rest of the World	Total Trade Diversion
Agri-food	8	0	17	8	1065
Chemicals	0	272	0	0	2179
Comunication Equip.	10	0	0	0	2142
Electrical Machinery	0	74	16	0	2461
Furniture	0	0	3	0	981
Machinery Various	3	78	1	0	3226
Metals and Ore	0	0	22	56	1635
Office Machinery	0	178	0	0	4297
Precision Instruments	6	182	1	72	1190
Textiles and Apparel	3	51	1	529	866
Transport Equipment	0	0	0	0	1032
Others	0	5	0	20	371
TOTAL	30	840	60	685	21443

Table A2. Trade diversion effects and export losses

	Trade Diversion	China Export Loss	Net Losses	Trade Diversion as a Percentage of China Export Loss
Agri-food	1065	-1066	-1	100%
Chemicals	2179	-2970	-791	73%
Comunication Equip.	2142	-5490	-3348	39%
Electrical Machinery	2461	-3560	-1099	69%
Furniture	981	-2750	-1769	36%
Machinery Various	3226	-3320	-94	97%
Metals and Ore	1635	-1648	-13	99%
Office Machinery	4297	-9870	-5573	44%
Precision Instruments	1190	-1190	0	100%
Textiles and Apparel	866	-1189	-323	73%
Transport Equipment	1032	-1033	-1	100%
Others	371	-487	-116	76%
TOTAL	21443	-34573	-13130	62%