Tariff Passthrough at the Border and at the Store: Evidence from US Trade Policy*

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Abstract

We use micro data collected at the border and the store to characterize the price impact of recent US trade policy on importers, exporters, and consumers. At the border, import tariff passthrough is much higher than exchange rate passthrough. Chinese exporters did not lower their dollar prices by much, despite the recent appreciation of the dollar. By contrast, US exporters significantly lowered prices affected by foreign retaliatory tariffs. In US stores, the price impact is more limited, suggesting that retail margins have fallen. Our results imply that, so far, the tariffs' incidence has fallen in large part on US firms.

JEL Codes: F01, F13, F14, F04.
Keywords: trade policy, tariffs, exchange rate passthrough.

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1 Introduction

Since 2018, the United States has initiated a large number of significant changes to its trade policies. Most notably, it has imposed import tariffs ranging from 10 to 50 percent on goods including washing machines, solar panels, aluminum, steel, and roughly $362 billion of goods from China. In response, Canada, China, the European Union (EU), and Mexico have imposed retaliatory tariffs. On a scale not seen since the 1920s, the world's largest economies have passed measures making it far more costly to buy goods from each other.[1]

This paper uses good-level data to assess the impact of these policy changes on US prices. We extend the results in the literature by comparing the degrees of tariff and exchange rate passthrough into border prices and by providing detailed information about the impact on consumer prices. The combination of border and retail prices is crucial to determine the incidence of the tariffs. If foreign exporters reduce their ex-tariff US dollar prices by an amount close to the scale of the tariffs, the tariff's incidence will fall primarily on foreign countries. If not, the US importer (who pays the ex-tariff price plus the tariff) faces higher costs to buy the foreign goods, and the response of retail prices is essential to know if that additional cost is ultimately borne by US consumers.

We start by studying US import prices using product-level data from the Bureau of Labor Statistics (BLS). We compare import (ex-tariff) price indices constructed for otherwise equivalent goods that are affected and not affected by tariffs and, as of the end of February 2020, find essentially no difference, consistent with the results obtained using Census unit values in Amiti, Redding, and Weinstein (2019) and Fajgelbaum, Goldberg, Kennedy, and Khandelwal (2019). Controlling for sectoral inflation rates, our regressions suggest that a 20 percent tariff, for example, would be associated with a 1.1 percent decline in the ex-tariff price and an 18.9 percent increase in the total price paid by the US importer.

Given that these data track the prices of individual goods and are immune to possible changes in the composition of import categories, the BLS micro data are particularly useful for comparing the passthrough rates of tariffs with those of exchange rate shocks. We estimate that the exchange rate passthrough is 22 percent in the first 12 months, implying that a 20 percent dollar

[1] See Amiti, Redding, and Weinstein (2019) and Bown and Kolb (2020) for helpful overviews of the policy setting and timelines of the policy changes made.

appreciation would only decrease the dollar price of imports by 4.4 percent, far less than the 18.9 percent discussed above for an equivalent-sized tariff.[2] Our estimated asymmetry in the passthrough rates of exchange rates and tariffs is consistent with the results in Fitzgerald and Haller (2018) and may reflect the role of imported intermediate inputs in production and the perceived difference in the persistence of tariffs versus exchange rate changes. It also carries important implications for the consequences of policies such as fiscal devaluations and border adjustment taxes, as discussed in Farhi, Gopinath, and Itskhoki (2014) and Barbiero, Farhi, Gopinath, and Itskhoki (2019). Furthermore, it suggests that the depreciation of the Chinese renminbi against the US dollar during the summer of 2019 did little to offset the impact of the tariffs in terms of the prices paid by US importers, implying that the price incidence of the import tariffs falls largely on the United States.[3]

We then turn to BLS export prices, which we use to gauge whether US exporters maintained their prices in the face of retaliatory tariffs impacting their foreign sales. These tariffs were applied by many different governments and vary more than the US import tariffs in terms of their timing, scope, and scale. Simple comparisons of export price indices of affected and unaffected products, however, suggest that affected exporters have dropped their (pre-tariff) prices by about 5 percent in response to retaliatory tariffs that average about 15 percent. We estimate regressions for exports that are equivalent to what we did for imports and find that, controlling for sectoral inflation rates, ex-tariff export prices declined by 32.9 percent of the tariff rate after one year.

Why did US exporters choose to drop their prices so much more in the face of retaliatory tariffs than did Chinese exporters in the face of the US import tariffs? We find that the decline in the relative export price of retaliated-upon products is almost entirely driven by US shipments of non-differentiated and agricultural goods to China. A far larger share of the affected goods imported by the United States from China are differentiated goods that may be more difficult to source elsewhere in large quantities or may be produced with imported inputs in more complex supply chains.

[2]The low exchange rate pass-through estimate for the United States is in line with previous estimates such as those in Gopinath, Itskhoki, and Rigobon (2010) and is consistent with the high levels of dollar invoicing for US imports, as discussed in Gopinath, Boz, Casas, Díez, Gourinchas, and Plagborg-Møller (2010).

[3]This result does not imply that China benefits from the policy. Even if Chinese exporters earned the same price and profit margin per unit exported to the United States, the tariffs can reduce the number of units sold.

We then study the extent to which the import price increases were passed through into retail prices. We first consider aggregated categories such as washing machines, handbags, tires, refrigerators, and bicycles, and find mixed results. Some sectors exhibit clear price increases due to the tariffs (such as washing machines, consistent with the results in Flaaen, Hortaçsu, and Tintelnot (2019)) but others have stable price dynamics despite the tariffs. We note that it is difficult to study the impact of tariffs using such retail price indices because they are at a level of aggregation that combines meaningful shares of goods that are both affected and not affected by the tariffs.

To get around this problem, we collect millions of online prices from two large multi-channel retailers for which we have detailed information on the country of origin and HTS code classifications at the individual product level. Surprisingly, despite observing a stark increase in the overall cost paid by US importers for certain Chinese goods, we detect only a minor increase in the prices set by the two retailers for these goods relative to those unaffected by tariffs. Our estimates imply that a 20 percent tariff is associated with a 0.7 percent increase in the relative retail prices of affected goods. This suggests that retailers are absorbing a significant share of the increase in the cost of affected imports by earning lower profit margins.

Another possibility—discussed in Amiti, Redding, and Weinstein (2019)—is that in response to the tariffs, domestic producers raise their prices to retailers on goods that compete with the imports. Or alternatively, retailers may simply be increasing the prices of goods not directly exposed to the tariffs, compensating with higher margins on these goods. These responses would be consistent with our finding that the retail prices of goods affected by import tariffs have evolved similarly to those for goods unaffected by tariffs. However, they would also imply different price behavior for US and non-US retail prices, and we do not find strong evidence consistent with this prediction. In particular, we compare the pricing behavior of identical goods sold by one of the retailers used in our baseline analysis in both the United States and Canada, and complement the analysis with official indices and prices from other large retailers in the Appendix. We find that, so far, the tariffs only brought about moderately higher retail inflation in the United States compared to Canada.

Instead, we find clearer evidence of other margins of adjustment that may limit retail price increases. First, we use US customs micro data to show that these retailers increased their import shipments from China, significantly expanding their inventories before the tariffs were implemented. This inventory "front-running" may have moderated the extent to which retail profit margins have declined in financial reports. Second, we document that China's share of the tonnage imported by these two retailers dropped from 80 or 90 percent before the tariffs to 60 or 70 percent afterward, implying that at least some pressure was eased by moving supply chains away from China.

Does it matter whether the higher import prices result in lower retailer margins or higher consumer prices? Among many other implications, we argue that it implies this first 18 months of data only reveals the short-run impact of the global tariffs. We speculate that if the tariffs remain in place for much longer, pressure on these retailers will likely rise. We would expect this to result in some future combination of a larger reduction in US ex-tariff import prices or greater passthrough into consumer prices. Our work supports the idea, developed theoretically in Cole and Eckel (2018), that a more complete understanding of the full supply chain, from at-the-dock importers through to final retailers, is required to understand the full implications of any trade policy.

2 US Border Prices

We start with our analysis of US import price data collected by the International Pricing Program at the BLS. Prices are collected monthly by survey and are used to construct import price indices. As a result, one strength of working with the BLS data relative to the Census data is the ability to trace the import price of an identical good over time.[4] Gopinath and Rigobon (2008) provides additional detail on the BLS dataset and its construction.

The data include many observations deemed "unusable" for BLS price indices, generally due to the lack of an actual transaction for a given good in a given month. Our baseline treatment fills forward the most recent usable price in the place of unusable or otherwise missing observations. We further weight all analyses using expenditures at the "classification group" level, and begin all our analyses in 2005, the year when these weights become available. We drop all price changes that exceed 2.3 log points in magnitude and focus only on market transactions. We conduct the analysis only using prices of trades invoiced in US dollars, a group which represents over 94

[4] Some weaknesses of the BLS data are that these prices are sampled and purchase quantities are not available at the product level.

percent of US trade occurring over our sample, and also exclude petroleum products. We only use data involving partner countries for which we have data on aggregate prices and exchange rates (our data on these macro variables cover 182 countries).

2.1 US Imports from China

Import tariffs were initially enacted on Chinese goods in three waves during 2018. First, in July, the United States imposed a 25 percent ad-valorem tariff on roughly $34 billion of imports. Second, in August, the 25 percent tariff was extended to cover another $16 billion in shipments. Third, in September, a 10 percent tariff was applied to roughly $200 billion in goods. In May of 2019, the tariff on that third wave of goods was increased from 10 to 25 percent. In September of 2019, a 15 percent tariff was imposed on $112 billion of imports.[5] Since goods in the BLS data can be concorded with harmonized system (HS) codes and we know the provenance of each shipment, we can easily associate each good with the tariff rate that should have been applied to it in each month.

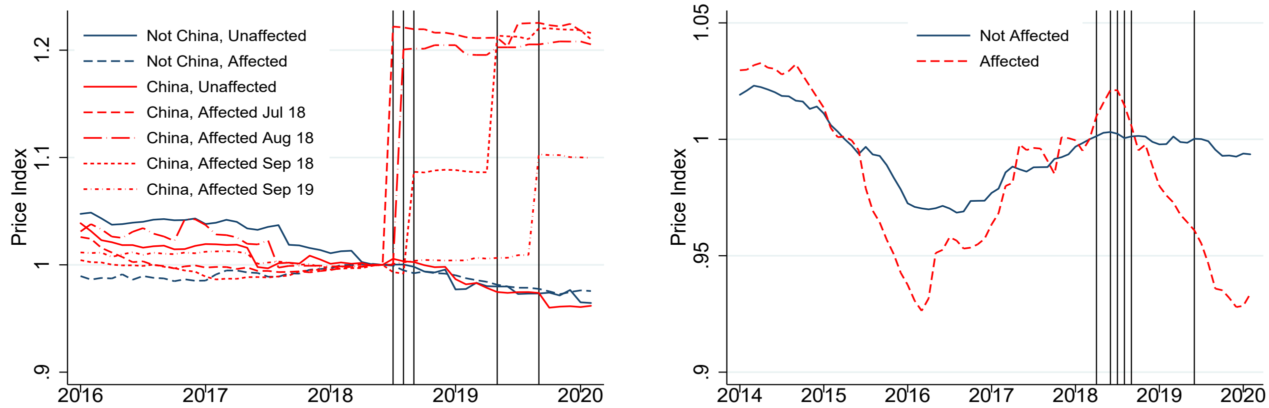
Figure 1(a) plots log price indices—inclusive of tariffs—constructed for seven mutually exclusive groups of US imports.[6] The first two groups include the set of products that are unaffected by the 2018-2019 tariff policy changes, divided into those exported by China and those exported by other countries. The third group includes products with HS codes that are affected, but which do not face the tariffs because they are not imported from China.[7] The remaining groups capture imports from China that are affected by the different tariff changes. The price indices are normalized to 1 in June 2018. The plots include three vertical lines in 2018 corresponding to the three waves of tariffs starting that summer. We plot a fourth line in May 2019, when the tariffs on the third wave of goods increased from 10 to 25 percent, and a fifth line in September 2019, when a 15 percent tariff was applied to roughly another $112 billion in goods.

All seven categories exhibit very similar and mildly deflationary trends for the four years prior

[5] Additional tariffs had been announced that would have applied to nearly all of the currently unaffected imports from China. These tariffs were then indefinitely delayed and were not implemented during the period covered by our data. The additional tariff rate on this last tranche of goods that was affected in May of 2019 was reduced to 7.5 percent in mid-February 2019, also outside of the period covered by our data.

[6] These categories are not collectively exhaustive of all US imports because we exclude a small number of goods that have been recently subjected to other categories of tariffs.

[7] Throughout the paper, we match goods to their 6-digit HS codes and assume that the associated tariff is the highest value among the corresponding 8-digit HS codes, which is the level at which the tariff code is written. Though imperfect, this assumption holds exactly for over 95 percent of the 6-digit codes.



(a) Import Price Indices (including tariffs)

(b) Export Price Indices (excluding tariffs)

Figure 1: US Import and Export Price Indices

Notes: Figure 1(a) shows price indices for US imports inclusive of tariffs. Figure 1(b) shows price indices for US exports excluding retaliatory tariffs. Both figures use price data collected by the International Pricing Program at the BLS. Indices in Figure 1(a) are normalized to equal 1 in June 2018. The vertical lines in Figure 1(a) denote the months when tariffs were introduced or increased: July 2018 (25% on $34bn), August 2018 (25% on $16bn), September 2018 (10% on $200bn), May 2019 (increase the September 2018 wave to 25%), and September 2019 (15% on $112bn). Indices in Figure 1(b) are normalized to equal 1 in March 2018. The vertical lines in Figure 1(b) denote the months when retaliatory export tariffs were introduced or increased: April 2018 (China initiated tariffs on US products), June 2018 (the EU, Mexico, and Turkey initiated tariffs), July 2018 (China expanded tariffs and Canada initiated tariffs), August 2018 (China expanded tariffs and Russia initiated tariffs), September 2018 (China expanded tariffs), and June 2019 (India initiated tariffs).

to the tariffs.[8] The products never targeted by tariffs continue these trends through 2018, 2019, and into early 2020. By contrast, each affected good category from China saw an immediate jump in its price, inclusive of tariffs, during the month that the policy was implemented. The scale of the jumps is only slightly below the scale of the tariff rates, consistent with the fact that the ex-tariff prices did not exhibit meaningful breaks from their trends. Furthermore, in the Appendix, we show that there were no significant changes in the patterns of price stickiness following the imposition of these tariffs.

We continue with a regression analysis capable of controlling for multiple factors other than tariffs and the exporter country that might matter for pricing trends. Furthermore, we can use the framework to compare the passthrough to importer prices of the tariffs with an equivalent-sized movement in the exchange rate. Motivated by the model described in the Appendix, we run a specification with all monthly observations, including periods in which there is no price

[8]See Fajgelbaum, Goldberg, Kennedy, and Khandelwal (2019) for evidence that the US import tariff changes were uncorrelated with supply shocks.

change. We estimate:

$$\Delta \ln \left(P^{\mathcal{I}}_{i,j,k,t}\right) = \delta^{\mathcal{I}}_{k} + \phi^{\mathcal{I},\Omega}_{\text{CN}} + \phi^{\mathcal{I},-\Omega}_{\text{CN}} + \sum_{l=0}^{11} \gamma^{\mathcal{I}}_{\text{CN},l} \Delta\tau_{\text{CN},k,t-l} + \sum_{l=0}^{11} \beta^{\mathcal{I},S}_{l} \Delta \ln \left(S_{j,t-l}\right) + \sum_{l=0}^{11} \beta^{\mathcal{I},X}_{l} \Delta \ln \left(X_{j,t-l}\right) + \epsilon_{i,j,k,t}, \tag{1}$$

where $P^{\mathcal{I}}_{i,j,k,t}$ is the ex-tariff price of item i imported from country j in sector k at month t and where sectors are defined as the BLS's "primary stratum lower", which is a level of disaggregation that lies between the HS4 and HS6 levels.[9] The fixed effect $\delta^{\mathcal{I}}_{k}$ therefore captures an average sectoral inflation rate. We let $k \in \Omega$ denote those sectors that are affected by the tariff, so the fixed effects $\phi^{\mathcal{I},\Omega}_{\text{CN}}$ and $\phi^{\mathcal{I},-\Omega}_{\text{CN}}$ allow for a constant deviation from those sectoral inflation rates for affected and unaffected goods imported from China, respectively.

The term $\Delta\tau_{\text{CN},k,t-l}$ equals the log gross additional tariff rate that is newly applied in a particular month to imports from China in sector k at time $t-l$, and would equal 0.22 ($\approx \ln(1.25)$), say, to correspond with the introduction of a 25 percent tariff. The lag structure allows monthly price changes to differentially reflect changes in tariffs that went into effect recently compared with further in the past. To evaluate the cumulative impact of the tariffs one year after they were applied, we report the point estimate and standard error of $\sum_{l=0}^{11} \gamma^{\mathcal{I}}_{\text{CN},l}$. This gives the estimate of the tariff rate passthrough after the current month plus 11 lags. Finally, $S_{j,t-l}$ is the value of country j's currency in US dollars at time $t-l$ and $X_{j,t-l}$ is the producer price index in j at $t-l$.[10] The point estimate of $\sum_{l=0}^{11} \beta^{\mathcal{I},S}_{l}$ therefore constitutes our estimate of exchange rate passthrough (ERPT) after one year (i.e., the current month plus 11 lags).[11]

The first three columns in Table 1 report the results using monthly import price data from January 2005 to February 2020. Column (1) reports the cumulative impact of 12 months of tariffs in a specification that includes sectoral fixed effects and the China-specific fixed effects ϕ. The estimated coefficient of -0.057 means, for example, that a 10 percent tariff would be associated with a 0.6 percent lower ex-tariff price and a 9.4 percent higher overall price faced by the importer. Column (2) estimates the tariff impact using a specification that also controls for exchange rates and the foreign producer price index. The tariff response drops to a value that

[9] This is the lowest level of aggregation for which the BLS deems indices to be publishable.

[10] We use consumer price indices when producer price indices are not available. We also linearly interpolate quarterly inflation rates for a few countries that do not publish monthly rates.

[11] Additional results, including a specification using only non-zero price changes, are shown in the Appendix.

		US Imports			US Exports			US Retail
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tariffs 1 yr.	$\left(\sum_{l=0}^{11} \gamma_l\right)$	-0.057	0.005		-0.329	-0.259		0.035
		(0.023)	(0.025)		(0.089)	(0.089)		(0.020)
Differentiated	$\left(\sum_{l=0}^{11} \gamma_l\right)$			-0.035			-0.087	
				(0.034)			(0.096)	
Undifferentiated	$\left(\sum_{l=0}^{11} \gamma_l\right)$			-0.272			-0.383	
				(0.103)			(0.151)	
ERPT 1 yr.	$\left(\sum_{l=0}^{11} \beta_l^S\right)$		0.218	0.288		0.195	0.213	
			(0.023)	(0.026)		(0.018)	(0.023)	
PPI PT 1 yr.	$\left(\sum_{l=0}^{11} \beta_l^X\right)$		0.047	0.091		0.250	0.274	
			(0.033)	(0.037)		(0.038)	(0.045)	
Adj. R^2		0.002	0.003	0.004	0.001	0.002	0.003	0.001
Obs.		835,722	835,722	583,391	446,527	446,527	295,179	1,118,870
Sector FEs		Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 1: Regression Analysis of Chinese Import Tariffs Using Monthly Data

Notes: Fixed effects $(\phi_{\text{CN}}^{\Omega})$ and $(\phi_{\text{CN}}^{-\Omega})$ are included in all regressions but we do not report the coefficients in the table because they are not economically significant in all cases. Robust standard errors shown in parentheses.

is statistically indistinguishable from zero, while the exchange rate passthrough estimate shows that when the dollar depreciates by about 10 percent, import prices rise by about 2.18 percent.

These results suggest that ex-tariff prices do not behave differently for goods affected by trade policy compared to those that were not affected, implying the tariffs exhibited nearly complete passthrough into the total import cost and that the incidence of the tariffs lies largely with the United States. Furthermore, as a practical matter, our findings suggest that the recent depreciation of the Chinese renminbi did not offset the impact of the tariffs for US importers. In the Appendix, we show similar results when focusing on the US steel import tariffs that affected multiple countries.

Column (3) explores heterogeneity in the tariff passthrough rates across differentiated and undifferentiated goods, identified using the Rauch (1999) classification. Differentiated goods, for which substitutes are likely more difficult to locate, had no statistically significant decline in their pre-tariff export prices to the United States. The ex-tariff price of undifferentiated goods, such as agricultural goods or commodities, by contrast, dropped by more than 25 percent of the tariff rate. These undifferentiated goods, however, account for less than 10 percent of affected US imports. As a result, their influence on the coefficients for overall imports is limited.

2.2 US Exports

In response to the US trade policies enacted in 2018, many countries imposed retaliatory measures on the United States. We now use data collected from sources gathered on the International Trade Administration website to study the stability of ex-tariff prices set by US exporters to foreign destinations. Interestingly, unlike the case of foreign exporters, we do find evidence that US exporters have on average significantly reduced their prices in response to foreign tariffs. This suggests that the retaliatory tariffs have meaningful incidence in the United States.

Figure 1(b) plots the ex-tariff prices of US exports. The vertical lines correspond to the dates on which different countries either initiated or increased their retaliatory tariffs.[12] Of course, the affected goods are different types of goods, and exhibit greater price volatility even before the trade wars began. Nonetheless, the post-tariff period represents the first time when the price indices for the two types of goods move so differently, with the prices of unaffected goods highly stable and the prices of affected goods dropping by about 9 percent.

To elaborate on these findings, Columns (4) and (5) in Table 1 report the results from estimating equation (1) on exports. We exclude the China-specific fixed effects because the sample includes exports to many other countries. Column (4) shows that there is about a 33 percent passthrough of the retaliatory tariff into ex-tariff US export prices after 12 months. That is, a 10 percent tariff imposed on US exports reduces US ex-tariff export prices by about 3.3 percent, while the cumulative one-year ERPT estimates are close to 20 percent.[13]

Why did US exporters drop their prices so much more when faced with foreign tariffs than foreign exporters did when faced with US tariffs? The answer is that undifferentiated goods represent more than half of US exports affected by the trade policies, much larger than their share of affected US imports. Column (6) parallels the exercise reported in Column (3) and splits the export data into prices of differentiated and undifferentiated goods. Consistent with the results for imports, whereas the ex-tariff price of exports of differentiated goods did not change in a statistically significant way (and with a point estimate of only 8.7 percent), these

[12] China was the first to initiate retaliatory tariffs in April 2018 and expanded them in July, August, and September. The European Union, Mexico, and Turkey initiated retaliatory tariffs in June 2018, followed by Canada in July 2018, Russia in August 2018, and India in June 2019.

[13] Retaliation from China accounts for about three-quarters of our observations. In the Appendix, we separately estimate the effect of the retaliatory tariffs for US goods exported to China and elsewhere. Whereas shipments to countries other than China show no statistically significant decline in the ex-tariff export price, the effect is strong for exports to China, with an estimated one-year ex-tariff export price decline of about 45 percent.

prices dropped by a statistically significant 38 percent for undifferentiated goods. As elaborated in the Appendix, these undifferentiated goods, many of which are agricultural products, are in an accounting sense driving the decline in US export prices in response to the retaliatory tariff.

3 US Retail Prices

Having established the behavior of US import prices, we now ask how the tariffs impacted prices further downstream in the US economy, such as by retailers to final consumers. Overall, while we find some evidence that the tariffs have passed through into higher retail prices, the effects are clearly more muted than what we demonstrated for total import prices, implying that—at least so far—retailers have absorbed much of the higher costs associated with the tariffs by earning lower margins on their sales.

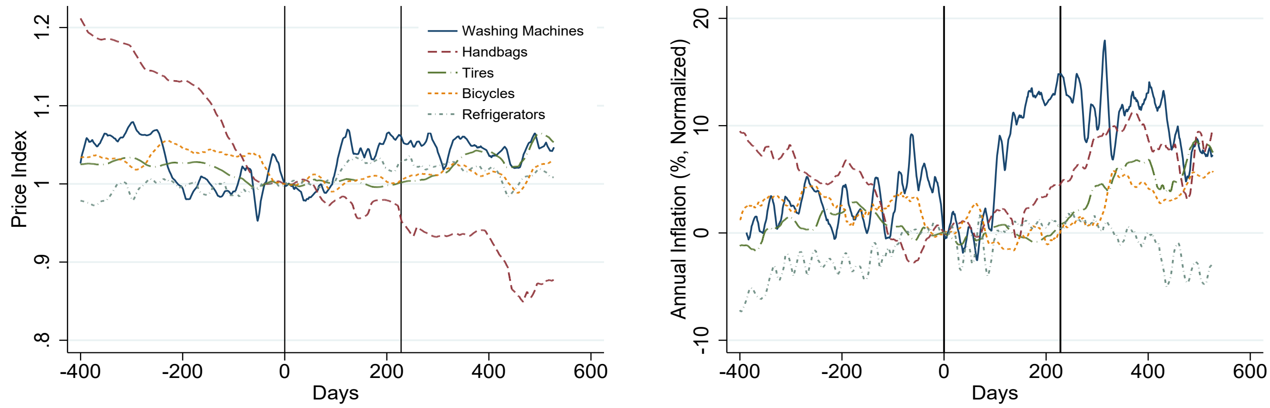
3.1 Data from the Largest US Retailers

We start our retail-level analyses by studying daily prices for washing machines, handbags, tires, refrigerators, and bicycles, all product categories that were significantly impacted by the tariffs.[14] We obtain the data from the private firm PriceStats as well as from the Billion Prices Project (BPP), which collected them by scraping, at a daily frequency, the online web pages of over 30 large multi-channel retailers in the United States. See Cavallo and Rigobon (2016) and Cavallo (2017) for a full description of these and closely-related data.

Figure 2 shows price indices and inflation rates for these five types of goods, with both normalized on the date of the first tariff increase. The plot includes two vertical lines corresponding to the dates of tariff changes. All these goods, except for washing machines, were affected by the third round of Chinese tariffs.

In the case of washing machine prices, the impact of tariffs is clear-cut, with high and rapid passthrough to retail prices. These results are consistent with Flaaen, Hortaçsu, and Tintelnot (2019). In the Appendix, we find similar results with the sectoral "Laundry Equipment" consumer price index (CPI) provided by the BLS, and show that the basic pricing patterns look the same for US brands, which likely are not directly affected by the tariffs, and for imported

[14] We chose these products because they are relatively easy to identify in lists of harmonized codes affected by the tariffs. We study 700 washing machines from 16 retailers, 300 handbags from 12 retailers, 400 tires from 7 retailers, 5,000 refrigerators from 18 retailers, and 200 bicycles from 11 retailers.



(a) Price Indices

(b) Annual Inflation

Figure 2: Retail Price Impact for Selected Consumer Goods

Notes: Figure 2 compares price indices for washing machines and four other goods categories affected by the Chinese tariffs. The x-axis shows the number of days since the tariffs were imposed on each good category: January 22nd 2018 for washing machines and September 24th 2018 for all other goods. All price indices are normalized to 1 on day 0. The vertical line on day 228 marks the time when the tariff rates for the non-washing machine categories were increased from 10% to 25%, as reported by Bown and Kolb (2020) .

brands, which likely are affected. But how representative is this sector? Should we expect the same response in other sectors with large shares of products that are affected by the tariffs?

Unlike washing machines, none of the other goods exhibited sharp price increases relative to trend, even nine months after the first tariffs were imposed. By the time the tariffs were increased to 25 percent, however, handbags, tires, and bicycles were experiencing unusually rapid price increases.

This simple visual evidence suggests that tariffs passthrough is heterogeneous across goods. To try to reach more precise conclusions, we now move to a retail dataset that contains the country of origin and trade classification for individual goods, allowing us to know precisely which goods are affected by the tariffs.

3.2 Two Retailers with Country of Origin Information

We now turn to data collected daily from two large US retailers, both in the top 10 in the United States in terms of revenues. For "Retailer 1", our data entirely reflects what could be obtained from scraping its website, including a description of each product as well as its country of origin. For "Retailer 2", we combine pricing data scraped online with the country of origin and a text product description that the retailer directly provided to us.

Given these data, the key challenge is to associate each product with an HS code so we can determine which are in categories affected by each wave of tariffs placed on China. We do this with a service provided by 3CE Technologies, a private company that specializes in automated commodity classifications for trade purposes.[15] In some cases, the algorithm can generate a mapping directly from the product description without any additional information. In other cases, we asked a group of research assistants to respond manually to the additional questions required by the 3CE algorithm to help refine its match, such as whether a product is made of wood or plastic. Roughly three-quarters of the total products then were classified automatically, with the remainder being done manually.

Our data includes more than 90,000 products covering nearly 2,000 different 6-digit HS categories. Roughly two-thirds of the products, about 60,000, are imported from one of more than 80 countries. About 44,000 products are imported from China, with 36,000 of those—or 38 percent of the total—in categories affected by the tariffs.[16]

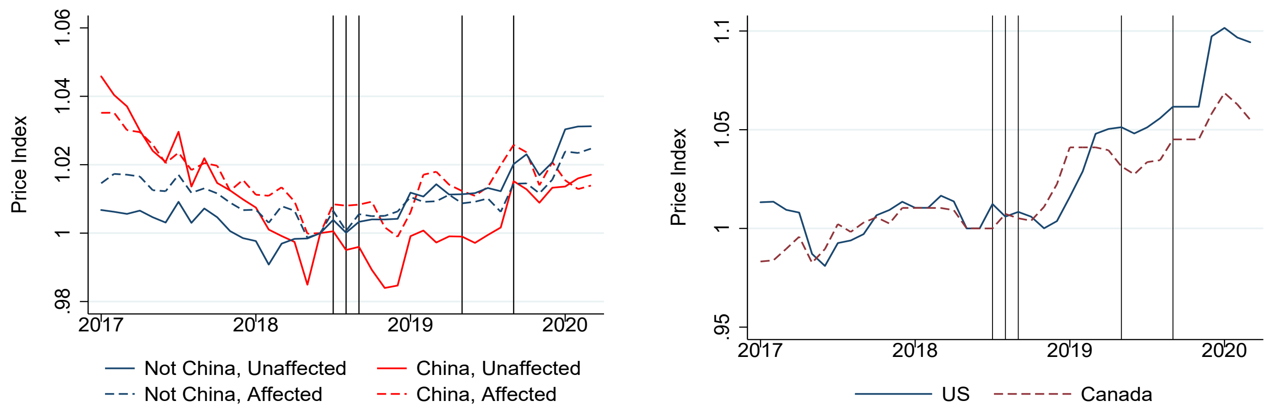
We start by plotting the daily retail price indices separately for those products imported from China that were affected by the tariffs, products imported from China that were unaffected, products not imported from China but in categories that were affected, and products not imported from China and in categories that were not affected. Looking at the inflation rates in Figure 3(a), it is difficult to discern any quantitatively important price differences brought about by the tariffs. The inflation rates in all groups behave similarly.

We then estimate a monthly regression specification similar to equation (1). We regress the change in retail prices on current and lagged tariff changes, plus fixed effects allowing for different price trends per sector and additionally different trends for the total sets of Chinese products that are and are not affected by the tariffs, where now the sectors k are defined as 3-digit COICOP codes and where we no longer include information on producer prices nor on exchange rates. The results, reported in Column (7) of Table 1, imply that in response to a 10 percent tariff, the price of a typical affected import from China has only increased by about 0.35 percent relative to unaffected products in the same sector after one year.[17]

[15] 3CE provides similar online classification tools for the US Census (https://uscensus.prod.3ceonline.com/).

[16] Additional details about the data are provided in the Appendix. We cannot calculate the share of sales accounted for by the 38 percent of goods that are affected by tariffs because we do not have data on quantities or revenues.

[17] As elaborated in the Appendix, we find some evidence for nonlinearities in the response to the imposition of tariffs. Splitting retail goods into those affected by tariffs of each size, we find that the price response to the 25



(a) All Products from Two US Retailers

(b) Identical Products in US and Canada

Figure 3: Retail Price Index Response to Chinese Import Tariffs

Notes: Figure 3(a) shows price indices using price data collected from the websites of two large US retailers. Country of origin details for each goods are either collected from the same websites or provided by the retailers. All individual goods are classified into import HS categories using either the product descriptions or information provided by the retailers. Figure 3(b) compares the price indices for the same goods sold by a large retailer in both the US and Canada. The goods in both countries were matched using model numbers. The vertical lines denote the months when tariffs were introduced or increased: July 2018 (25% on \$34bn), August 2018 (25% on \$16bn), September 2018 (10% on \$200bn), May 2019 (increase the September 2018 wave to 25%), and September 2019 (15% on \$112bn).

One might reasonably worry that measurement error in the sectoral classification algorithm is limiting our ability to identify larger differences in the retail price dynamics between products affected and unaffected by the tariffs. Incorrectly classifying affected products as belonging to HS codes that are not affected by the tariffs, or the reverse, would by construction bias the analysis by making the groups more similar. To look for evidence of this, in the Appendix we consider two subsets of our data that are the least likely to contain sectoral classification errors. As expected, the regression coefficients rise, but their magnitude is still low, with a 10 percent tariff increase associated with an prices that are between 0.8 percent to 1.6 percent higher.[18]

An alternative possibility is that retailers increased their margins on unaffected goods to partially offset the margin reduction on affected goods, muting any changes in their overall margins. Indeed, some large US retailers have publicly stated that they are "spreading price increases" across good categories in response to the tariffs.[19] This would stabilize the relative

percent rate far exceeded that to the 10 percent rate. We do not emphasize this result, however, as the measurement must be made with only 8 months of data and likely conflates compositional differences in the types of goods targeted by each tariff wave. The Appendix contains tables which report the distribution of affected types of retail goods affected by each tariff wave as well as the associated passthrough rate for that type.

[18]See Table A8 in the Appendix.

[19]See https://www.wsj.com/articles/sales-fall-at-kohls-and-j-c-penney-11558443281.

prices of affected and unaffected products within narrowly defined sectors, and could explain the similar inflation patterns across goods shown in Figure 3(a) after the imposition of the tariffs. However, if this were the case, we would also expect to see the prices in affected US sectors rise relative to the prices in countries that did not impose tariffs on these goods. To find evidence, we therefore compare the prices for identical goods sold by Retailer 2 in the United States and in Canada. We identify 2,436 products that are sold by Retailer 2 in both locations and plot the price indices separately for each country, using only the retail prices for those common goods in Figure 3(b).

These price indices do not suggest any particularly unusual dynamics in the US prices for these goods relative to the Canadian goods over the period when the tariffs were imposed.[20] In the Appendix, we find similar results when using CPIs for affected and unaffected sectors in both countries, as well as price indices for the same categories in six additional multi-national retailers. We therefore conclude that retailer profit margins must be absorbing a significant amount of the adjustment to the US import tariffs.

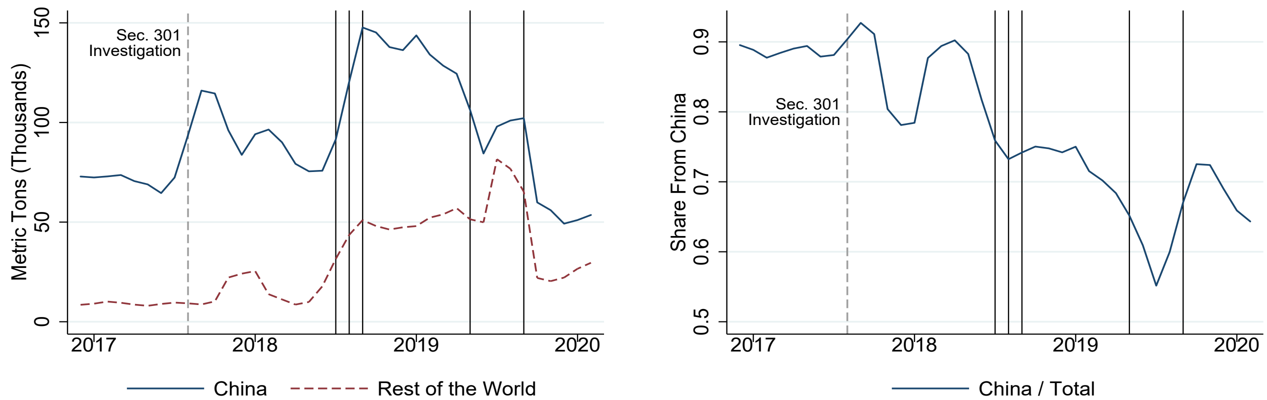
3.3 Other Adjustment Margins: Front-Running and Trade Diversion

Given the nearly-complete passthrough of tariffs to the prices of US imports from China and the relatively modest impact of those goods on consumer prices, retailer profit margins likely declined. In this subsection, we demonstrate two other margins along which retailers adjusted in response to the tariffs. First, we demonstrate that after the tariffs were announced, our two US retailers increased their volume of imports from China, perhaps in efforts to front-run the tariffs and build inventories of key products impacted by the tariffs before prices went up. Second, we show that whereas they imported almost entirely from China before the tariffs, they started diverting some of their orders to other countries once the tariffs were put in place.

In order to study the importing behavior of our two retailers, we make use of data provided by Datamyne, a private vendor of trade intelligence that collects maritime bills of lading.[21] We add together the tonnage imported each month by these companies and plot, in Figure 4(a), a 3-month moving average of the tonnage ordered from China and from the Rest of the World.

[20] The exchange rate between the US and Canada barely moved in this period.

[21] We can query keywords in the data and identify our two retailers by searching for bills of lading containing their names in any field.



(a) Tons Imported, Thousands

(b) Share of Tons Imported from China

Figure 4: Front-Running and Trade Diversion by Two Major US Retailers

Notes: Figure 4(a) shows the total metric tons imported by two large US retailers identified in bill of lading data collected by Datamyne. The vertical lines denote the months when tariffs were introduced or increased: July 2018 (25% on $34bn), August 2018 (25% on $16bn), September 2018 (10% on $200bn), May 2019 (increase the September 2018 wave to 25%), and September 2019 (15% on $112bn). Figure 4(b) show the share of total metric tons imported from China.

The solid blue line, showing tonnage (in thousands) imported from China, is around 70,000 tons and remains relatively flat from the third quarter of 2016 through the second quarter of 2017, but appears to jump in August 2017, the date indicated with the dashed vertical line. The vertical line is dashed rather than solid to indicate that the US Trade Representative was directed at that date to determine whether to initiate a Section 301 investigation against China (and shortly thereafter did initiate the investigation). Imports appear to have increased rapidly at that point, presumably as firms wished to import supplies prior to the actual imposition of any tariffs. When tariffs were in fact announced, imports jumped further, before declining thereafter. Many of these goods were likely affected by the 10 percent tariff rate, and the importers may have wanted to stockpile them before the announced 25 percent tariffs on those same goods were instituted.

Figure 4(a) also shows that when the tariffs were introduced, these retailers first started importing non-trivial quantities from countries other than China. From a near-zero level, the red dashed line rises to 50,000 tons per month. As summarized in Figure 4(b), China's share of these firms' total imports was about 80-90 percent prior to the tariffs, then declined to about 60-70 percent since the late summer of 2018. Interestingly, this change took place quickly after the tariffs we imposed in mid-2018, but the level of trade diversion has not increased since early

2019. This suggests that it might take longer for these firms to make larger changes to their supply chains.

4 Conclusion

A rich literature theoretically characterizes the motivations behind enacting tariff policies and the potential implications they carry. Relatively little is known, however, about how economies in practice respond to tariffs, particularly when these trade policies involve large countries that have the potential to influence prices. Will the response of exporters be symmetric across countries and types of goods? How quickly will prices adjust? Will prices at the store adjust similarly to prices at the border? To answer these questions, we collect and analyze micro data on prices and characterize the reaction of importers, retailers, and exporters to US trade policy since 2018.

We find that tariffs passed through almost fully to US import prices, implying that much of the tariffs' incidence rests with the United States. In these same data, we find far lower rates of passthrough from exchange rate shocks into import prices, suggesting that the depreciation of the Chinese renminbi against the US dollar during the summer of 2019 did little to offset the impact of the tariffs. Furthermore, we show how the response of US exporters to foreign retaliatory tariffs was not symmetric. Foreign tariffs targeted undifferentiated goods exported by the United States, and US exporters significantly reduced their ex-tariff export prices on these goods, particularly on shipments to China. Finally, despite the rapid increase in the total cost of importing goods, we find more mixed evidence regarding retail price increases, which suggests that many US retailers reduced the profit margin on their sales of the affected goods.

Should we expect these same patterns to hold for the medium or longer term if the recently installed tariffs remain in place? We offer some evidence that importers to some extent front-ran the recent changes in trade policy and document an incipient trade diversion away from China. These non-price margins of adjustment suggest that, so far, we may have only seen the short-run response to tariffs.

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Online Appendix
"Tariff Passthrough at the Border and at the Store: Evidence from US Trade Policy"

By Alberto Cavallo, Gita Gopinath, Brent Neiman and Jenny Tang

This Appendix has four sections. First, we detail our data sources. Second, we sketch an economic environment and use it to derive estimating equations consistent with our empirical approach. Third, we provide additional details and results related to our analysis of import and export prices. Fourth, we provide additional details and results related to our analysis of retail prices.

A Data Sources

In this Appendix section, we describe the data sources used, as summarized in Table A1. With the exception of the data marked as restricted or proprietary, all other data used in the paper can be downloaded from the Harvard Dataverse (https://doi.org/10.7910/DVN/JV7FCH). Information on how to access the BLS restricted micro data is available at www.bls.gov/rda/, and access to the Datamyne can be obtained at www.datamyne.com.

For the retail results, we obtained prices from the private firm PriceStats, which scraped them on a daily basis from the online web pages of over 30 large multi-channel retailers in the United States. We carry forward all missing prices in the middle of a price spell, and drop all price changes that exceed 2.3 log points in magnitude. We transform the data from daily to monthly frequency by keeping the last day of each calendar month. These prices are then combined with country of origin information for individual goods scraped by the Billion Prices Project (BPP) from the websites of the two large retailers used in the paper. We further merge the data with the HS codes obtained with the 3CE classification tool using the product descriptions available in the raw data. The merged dataset, which includes all products used in the paper, is available as part of the data replication package. Information on how to access additional data from PriceStats is available at www.pricestats.com. Other databases from the BPP can be downloaded at www.thebillionpricesproject.com/datasets/.

Data	Source	Access
Import Prices - IPP Microdata	Bureau of Labor Statistics (2005)	Restricted Access - www.bls.gov/rda
Export Prices - IPP Microdata	Bureau of Labor Statistics (2005)	Restricted Access - www.bls.gov/rda
Exchange Rates, Aggregate Price Indices	IMF, OECD, BIS, Government statistical agencies [obtained from Haver Analytics]	https://doi.org/10.7910/DVN/JV7FCH
Import and Export Tariffs	Government announcements; Bown, Jung, and Lu (2018a,b,c); Bown (2019); Brew, Hadfield, Toubia, Goetz, Walterman, Condorio, and Boone (2020)	https://doi.org/10.7910/DVN/JV7FCH
Differentiated good classifications	Rauch (1999)	https://doi.org/10.7910/DVN/JV7FCH
Agricultural good classifications	USDA Foreign Agricultural Service Global Agricultural Trade System	https://doi.org/10.7910/DVN/JV7FCH
Retail Prices	PriceStats (2020)	https://doi.org/10.7910/DVN/JV7FCH
Country of Origin Retailer 1	Cavallo, Gopinath, Neiman, and Tang (2020)	https://doi.org/10.7910/DVN/JV7FCH
Country of Origin Retailer 2	Retailer 2	Proprietary
HS code classification	3CE (2019)	https://doi.org/10.7910/DVN/JV7FCH
Customs Bills of Lading	Datamyne (2020)	https://doi.org/10.7910/DVN/JV7FCH

Table A1: Data and Sources

B Environment

In this Appendix section, we present a simple static framework to motivate our regression specifications. Consider a supply chain with the following sequence. A firm located in country j exports good i at time t to a US importer at a US dollar price $P^{\mathcal{I}}_{i,j,t}$. The importer then pays an ad-valorem tariff $\tau_{i,j,t}$ to the government, resulting in a total import cost of $P^{\mathcal{I}}_{i,j,t}(1+\tau_{i,j,t})$. Finally, the importer combines this input with proportional marketing and distribution costs before selling that good to consumers at a retail price $P^{\mathcal{R}}_{i,j,t}$ (also in dollars).

We assume the foreign exporter manufactures the good using a Cobb-Douglas technology with constant returns to scale that uses some inputs (like labor) whose prices are sticky in the local currency and others (like imported inputs) whose prices are not. We therefore write the exporter's marginal cost, translated to US dollars, as $C^{\mathcal{I}}_{i,j,t} = A_{i,j,t}(W_{j,t}S_{j,t})^{\phi}$, where $A_{i,j,t}$

captures the combined effect of the firm's productivity and the cost of inputs with prices sticky in the foreign currency, $W_{j,t}$ represents the price of the sticky local currency input (such as the wage), $S_{j,t}$ is the number of US dollars purchased by each unit of country j's currency, and ϕ is the elasticity of the exporter's production function with respect to that local currency input.

The exporter's price equals a markup over this marginal cost: $P^{\mathcal{I}}_{i,j,t} = \mu^{\mathcal{I}}_{i,j,t} C^{\mathcal{I}}_{i,j,t}$. The exporter incurs a cost when it changes its price for the good, so will only do so when the resulting increase in operating profits exceeds this cost. When the exporter changes the price, its markup $\mu^{\mathcal{I}}_{i,j,t}$ is assumed to be a function of its market share, which we assume depends on its own price relative to an industry price level $P^{\mathcal{I}}_{t}$, multiplied by the tariff, since import demand for the good depends on its price inclusive of tariffs. We therefore write: $\mu^{\mathcal{I}}_{i,j,t} = \mu^{\mathcal{I}}\left(\left(1+\tau_{i,j,t}\right) P^{\mathcal{I}}_{i,j,t}/P^{\mathcal{I}}_{t}; \boldsymbol{\theta}^{\mathcal{I}}\right)$, where $\theta^{\mathcal{I}}$ collects parameters governing the shape of import demand and use $\Gamma^{\mathcal{I}} \equiv -\frac{\partial \ln \mu^{\mathcal{I}}(x)}{\partial \ln x}$ to denote the opposite of the elasticity of the markup.[1] We take logs, differentiate, and substitute these relationship to write:

$$d\ln\left(P^{\mathcal{I}}_{i,j,t}\right) = \gamma^{\mathcal{I}} d\ln\left(1+\tau_{i,j,t}\right) - \gamma^{\mathcal{I}} d\ln\left(P^{\mathcal{I}}_{t}\right) + \beta^{\mathcal{I}} d\ln\left(W_{j,t}\right) + \beta^{\mathcal{I}} d\ln\left(S_{j,t}\right), \tag{A1}$$

where $\gamma^{\mathcal{I}} \equiv -\frac{\Gamma^{\mathcal{I}}}{1+\Gamma^{\mathcal{I}}}$ is the passthrough of tariffs to the ex-tariff import price and $\beta^{\mathcal{I}} \equiv \frac{\phi}{1+\Gamma^{\mathcal{I}}}$ is the passthrough of local costs and exchange rates to the import price. Since $\gamma^{\mathcal{I}}$ equals tariff passthrough to ex-tariff import prices, $1+\gamma^{\mathcal{I}}$ equals the rate of passthrough from tariffs to total (i.e., inclusive of tariff) import prices.

Equation (A1) forms the basis for our empirical strategy. Because some exporters may choose not to change prices, some of our estimates using trade data are conditional on observing a price change. In the extreme case with $\gamma^{\mathcal{I}} = -1$, it would imply that ex-tariff import prices fell proportionately with tariffs and the total price of imports remained constant. This hypothetical would reveal that the passthrough of tariffs to the total import cost was zero (i.e., $1+\gamma^{\mathcal{I}} = 0$) and that the tariff's cost fell entirely on the exporter. Alternatively, if $\gamma^{\mathcal{I}}$ were estimated to equal 0, it would imply that ex-tariff import prices did not change with the tariffs, but rather, that the tariffs were fully passed through to the total import price (i.e., $1+\gamma^{\mathcal{I}} = 1$). The importer, in this case, bears much of the tariff's cost. We estimate a closely related specification in our analysis of passthrough to retail prices.

[1] We assume the exporter is too small to internalize any impact on the final retail price charged by the importer.

C More Import and Export Results

In this Appendix section, we offer a number of additional details and results from our analyses of import and exports prices, many of which are referenced from the main text.

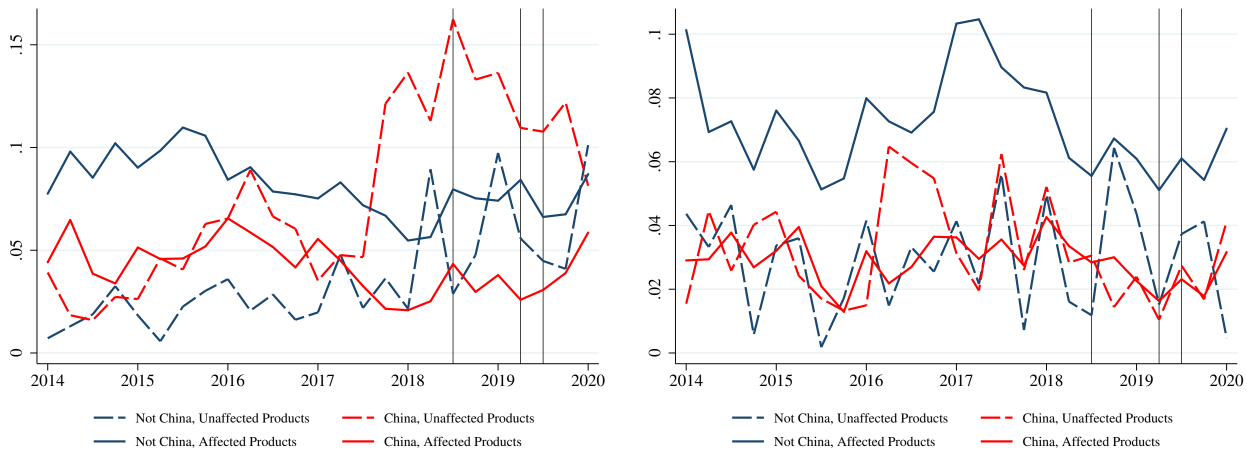
C.1 More Details on Import Price Data

In the main text, we mention that we focus only on market transactions in the BLS import data. More than one-third of the BLS import prices are non-market transactions such as intrafirm trade or shipments among related parties. Neiman (2010) studies the differences in these market and related party prices. In our analyses of the tariff on Chinese imports, we also exclude a small number of goods that are impacted both by a China tariff and another product-based tariff (such as steel and aluminum products, lumber, washing machines, and solar panels). We additionally exclude data on imports from India because in June 2019 the United States ended India's developing country exemption, which had given it access to US most favored nation tariff rates.

C.2 Frequency and Size of Imports

The price indices in Figure 1(a) reflect the frequency of import price changes as well as the size of any non-zero price changes. Since the BLS data are at the level of individual goods, we can observe if the stability of ex-tariff prices reflects "wait and see" behavior or any other important changes in the patterns of price stickiness.

Figure A1(a) plots the share of prices each month which decrease, averaged across the three months in each quarter to smooth the otherwise volatile series. It does this separately for four categories of goods: those of the type unaffected by the tariffs and imported from countries other than China, those unaffected even though they are imported from China, those affected but imported from outside of China, and those affected and imported from China, where only this latter group includes goods where the importer must actually pay a tariff. There are no obvious differences across the four groups and, if anything, the prices of products in that last set of goods appear to be the most stable. Figure A1(b) plots the equivalent statistics for price increases and, again, finds little evidence of important changes in pricing behavior brought about by the tariffs.



(a) Price Decreases

(b) Price Increases

Figure A1: Frequency of Monthly Price Changes (Quarterly Averages)

Notes: Figure A1 shows the quarterly averages of the proportion of US imports with ex-tariff price decreases and increases in each month. These price change frequencies use price data collected by the International Pricing Program at the BLS. The vertical lines denote the quarters when tariffs were introduced or raised: 2018:Q3 (25% on \$34bn in July 2018, 25% on \$16bn in August 2018, and 10% on \$200bn in September 2018), 2019:Q2 (increase the September 2018 wave to 25% in May 2019), and 2019:Q3 (15% on \$112bn in September 2019).

C.3 Additional Regression Results for Import Prices

Table A2 reports some additional results from estimating Equation (1) in the paper using monthly data from January 2005 to February 2020. Column (1) reports the cumulative impact of 12 months of tariffs in a specification that does not condition on any other variables. The estimated coefficient of -0.065 means, for example, that a 10 percent tariff would be associated with a 0.65 percent lower ex-tariff price and a 9.35 percent higher overall price faced by the importer. Column (2), reported also in the paper, adds sectoral fixed effects plus the China-specific fixed effects ϕ and the magnitude of this estimate is roughly preserved. Column (3) removes the tariff and China-specific covariates and estimates a relatively standard passthrough regression, showing that when the dollar depreciates by about 10 percent, import prices rise by about 2.17 percent. Column (4) estimates the tariff impact using a specification that also controls for sectoral effects and exchange rates. Our exchange rate passthrough estimate is largely unchanged but the tariff response drops to a value that is statistically indistinguishable from zero. Column (5) estimates the same specification as column (4), but looks for nonlinearity in the tariff passthrough rate by estimating a separate passthrough rate for goods initially subject to 10 percent or 25 percent tariffs. Goods that were subject to different tariff rates are excluded from this regression, and we can only estimate an 8-month passthrough rate.[2] The results are difficult to interpret, not only due to the change in sample and timing, but also as both coefficients are positive, though neither is economically large. Column (6) reports results from the specification in column (4) with standard errors clustered at the sector level. We again obtain a fairly tight confidence interval around zero for the import tariff passthrough rate.

		(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Tariffs 1 yr.	$\left(\sum_{l=0}^{11} \gamma_{\text{CN},l}^{\mathcal{I}}\right)$	-0.065	-0.057		-0.005		-0.005
		(0.021)	(0.023)		(0.025)		(0.035)
ERPT 1 yr.	$\left(\sum_{l=0}^{11} \beta_l^{\mathcal{I},S}\right)$			0.217	0.218	0.217	0.218
				(0.022)	(0.023)	(0.028)	(0.048)
PPI PT 1 yr.	$\left(\sum_{l=0}^{11} \beta_l^{\mathcal{I},X}\right)$			0.047	0.047	0.050	0.047
				(0.031)	(0.033)	(0.034)	(0.042)
10% Tariffs 8 mo.	$\left(\sum_{l=0}^{7} \gamma_{\text{CN},l}^{\mathcal{I}}\right)$					0.084	
						(0.035)	
25% Tariffs 8 mo.	$\left(\sum_{l=0}^{7} \gamma_{\text{CN},l}^{\mathcal{I}}\right)$					0.038	
						(0.036)	
	Adj. R^2	0.000	0.002	0.003	0.004	0.003	0.003
	Obs.	835,722	835,722	835,722	835,722	827,061	835,722
	Sector FEs?	No	Yes	Yes	Yes	Yes	Yes
	Clustered SEs?	No	No	No	No	No	Yes

Table A2: Regression Analysis of Chinese Import Tariffs Using Monthly Data

Notes: Fixed effects $\left(\phi_{\text{CN}}^{\Omega}\right)$ and $\left(\phi_{\text{CN}}^{-\Omega}\right)$ are included in all regressions but we do not report the coefficients in the table because they are not economically significant in all cases. Robust standard errors shown in parentheses unless otherwise specified.

We now consider a second type of regression in which we only include non-zero price changes. In particular, for each price spell of good i, we define t_1 as the first month of the spell and t_0 as

[2] The goods initially taxed at 10 percent in September 2018 then experienced another tariff increase to 25 percent in May 2019. In order to estimate only the passthrough of this initial 10 percent tariff, we also exclude observations for these goods in or after May 2019.

the first month of the previous spell. We then estimate:

$$\begin{aligned}\frac{1}{t_1-t_0}\ln\left(\frac{P^{\mathcal{I}}_{i,j,k,t_1}}{P^{\mathcal{I}}_{i,j,k,t_0}}\right) &= \delta^{\mathcal{I}}_k+\phi^{\mathcal{I},\Omega}_{\text{CN}}+\phi^{\mathcal{I},-\Omega}_{\text{CN}}+\gamma^{\mathcal{I}}\tau_{\text{CN},k,t_1}\\ &+\ \beta^{\mathcal{I},S}\frac{1}{t_1-t_0}\ln\left(\frac{S_{j,t_1}}{S_{j,t_0}}\right)+\beta^{\mathcal{I},X}\frac{1}{t_1-t_0}\ln\left(\frac{X_{j,t_1}}{X_{j,t_0}}\right)+\epsilon_{i,j,k,t_1,t_0},\quad \text{(A2)}\end{aligned}$$

where the term (t_1-t_0) serves to scale the changes so all correspond to a monthly rate. In this specification, τ_{CN,k,t_1} equals the tariff level for goods from China in sector k at t_1 and is meant to allow estimates of γ to capture differential inflation rates for goods impacted by the tariffs.[3] Since the changes in the price, exchange rate, and producer price index are all scaled to represent monthly changes, we report the estimate of $\gamma^{\mathcal{I}}$ multiplied by 12 to capture the annualized equivalent of the change in inflation associated with goods affected by the tariffs. Given this, plus the fact that these regressions drop any observations where the left-hand-side equals zero, these estimates would be expected to be larger in magnitude than what was found in Table A2.

Table A3 reports the estimates of Equation (A2). The results are qualitatively consistent with those from the monthly specifications shown in Table A2 and are similarly robust to clustering standard errors at the sector level. The import tariffs on Chinese goods are associated with changes in the ex-tariff import price that are economically or statistically insignificant, depending on the specification. By contrast, exchange rate passthrough in these estimates rises to roughly 37 percent.

C.4 Tariffs on Steel Imports

Prior to the tariffs placed on Chinese imports in July 2018, the United States placed a 25 percent tariff on steel imports from all countries in March 2018. At the time, exemptions were made for imports from Argentina, Australia, Brazil, Canada, Mexico, the European Union (EU), and South Korea. By June, the exemptions were lifted for Canada, the EU, and Mexico, so June 2018 effectively brought a second wave of steel tariffs. The exemptions for the remaining countries were made permanent. Equivalent to our analysis in Figure 1(a), therefore, we can compare import price indices—inclusive of tariffs—for steel imports from these three groups of countries.

[3] This specification may not be well-suited for thinking about changes where t_0 is after the tariff was imposed, but our results appear qualitatively robust to dropping such observations.

		(1)	(2)	(3)	(4)	(5)
Tariffs (Annualized)	$12 \times \gamma^{\mathcal{I}}$	-0.305 (0.129)	-0.193 (0.138)		-0.094 (0.147)	-0.094 (0.194)
ERPT	$\beta^{\mathcal{I},S}$			0.365 (0.052)	0.365 (0.052)	0.365 (0.068)
PPI PT	$\beta_l^{\mathcal{I},X}$			0.637 (0.098)	0.651 (0.098)	0.651 (0.173)
	Adj. R^2	0.000	0.006	0.015	0.016	0.016
	Obs.	99,687	99,687	99,687	99,687	99,687
	Sector FEs?	No	Yes	Yes	Yes	Yes
	Clustered SEs?	No	No	No	No	Yes

Table A3: Regression Analysis of Chinese Import Tariffs, Conditional on Price Changes

Notes: Fixed effects $(\phi_{\text{CN}}^{\Omega})$ and $(\phi_{\text{CN}}^{-\Omega})$ are included in all regressions but we do not report the coefficients in the table because they are not economically significant in all cases. Robust standard errors shown in parentheses unless otherwise specified.

Figure A2 shows the evolution of steel prices, which had been quite volatile during the preceding four years. The first two vertical lines indicate the initiation of steel tariffs for two groups of countries in March and June 2018. The third line indicates an increase in the tariff rate applied to steel from Turkey. Steel prices from all three groups tracked each other relatively closely until the steel tariffs were introduced. After that point, prices on imports from all countries rose, but imports from the affected countries (shown in red) jumped to roughly 20 percent above those from unaffected countries.[4]

We summarize our import findings by noting that, whether looking at imports from China or imports of steel products, and whether looking at aggregated price indices or regression estimates that use variation across individual products, our analyses paint a similar picture of the 12-month price response to US import tariffs imposed in 2018 and 2019. Ex-tariff prices do not obviously behave differently for goods affected by trade policy compared to those that were not affected, implying the tariffs exhibited nearly complete passthrough into the total import cost and that

[4]For Figure A2, we allocate products into these three groupings statically, so the red dashed line drops in May 2019 simply because the US steel tariffs were dropped then for imports from Canada and Mexico. Steel imports from the EU, which were also imposed in June of 2018 and are included in that dashed red line, remain affected. Regression analyses suggest similar conclusions but estimates are imprecise given the small number of imported steel products in our import prices dataset.

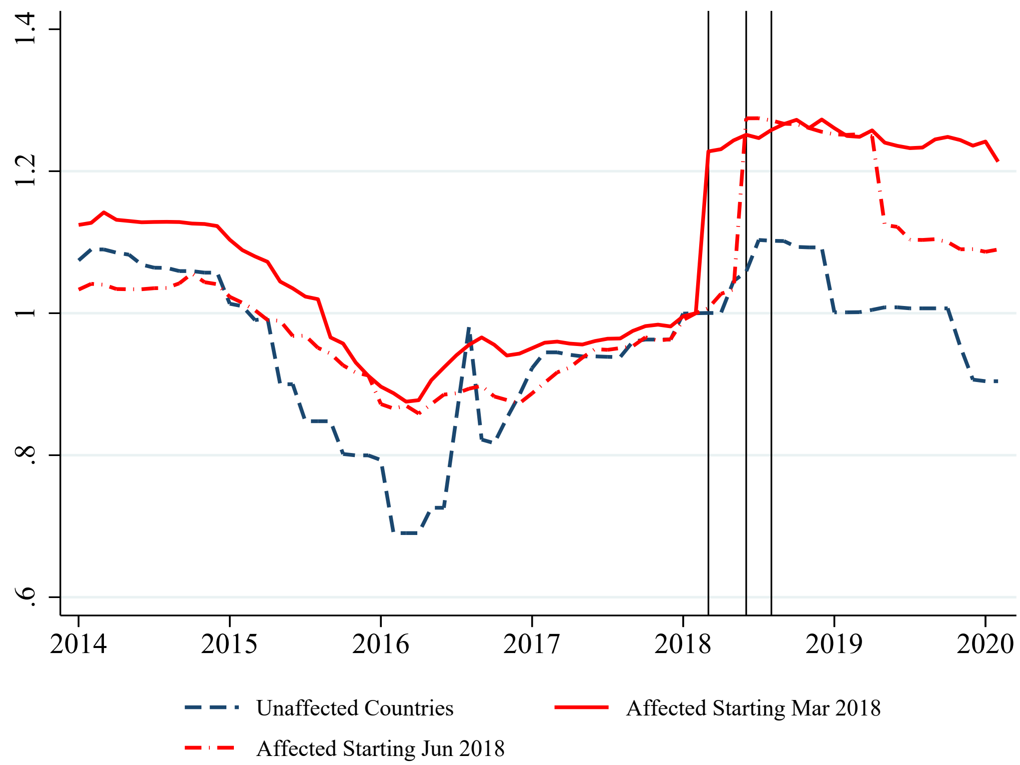


Figure A2: Steel Import Price Indices, by Tariff Wave

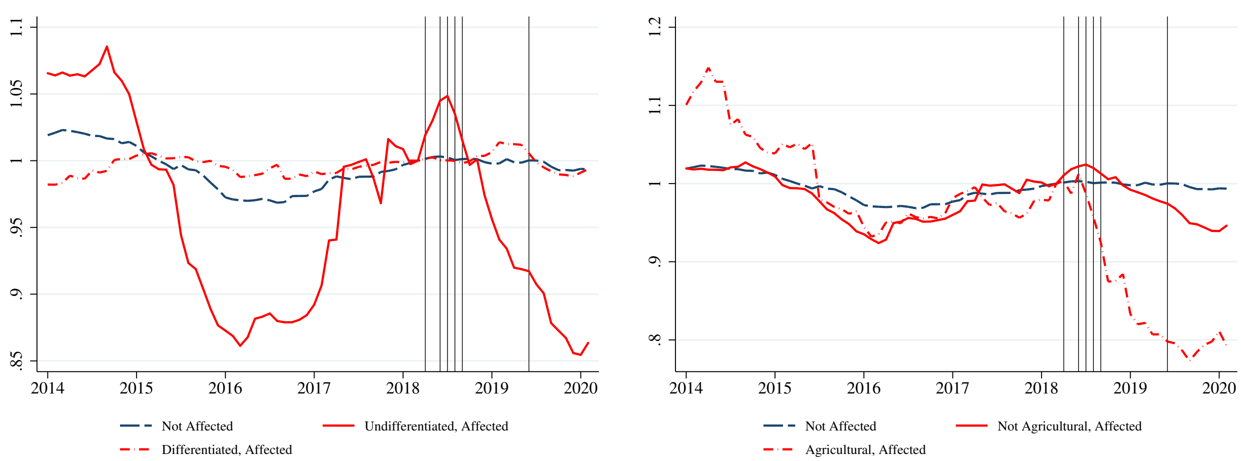
Notes: Figure A2 shows price indices for US steel imports inclusive of tariffs. All indices are normalized to equal 1 in February 2018 and use price data collected by the International Pricing Program at the BLS. The vertical lines denote the months when tariffs were introduced or increased: March 2018 (25% on all countries except the EU, Canada, Mexico, Australia, Argentina, Brazil and South Korea), June 2018 (ending of the exemption for the EU, Canada, Mexico), August 2018 (doubling of the rate on steel from Turkey to 50%).

the incidence of the tariffs lies largely with the United States.

Using the same data, methods, and time period, we estimate that the passthrough of exchange rate changes into import prices are in the range of 20 to 40 percent after one year, consistent with estimates found in a large literature, a rate much lower than the passthrough rate of tariffs into total import prices. This finding suggests being cautious when interpreting results obtained from using standard models in trade and international macroeconomics that assume a symmetric response to these two types of shocks. For example, the implications from these standard models might be more appropriately applied to longer-run outcomes, or they might be amended to allow for more uncertainty or mean-reversion in the shocks, features that might naturally explain our findings. Furthermore, as a practical matter, our result suggests that the recent depreciation of the Chinese renminbi did not offset the impact of the tariffs for US importers.

C.5 More Findings on US Exports

Why did US exporters drop their prices so much more when faced with foreign tariffs than foreign exporters did when faced with US tariffs? As we noted in the paper, differences in the types of goods affected by the trade policy played a key role. We use the Rauch (1999) classification to identify differentiated goods, for which substitutes are likely more difficult to locate, and find that they account for more than 90 percent of the affected imports to the United States from China but less than half of the US exports to countries that imposed retaliatory tariffs. Relatedly, whereas affected US imports were rarely agricultural goods—goods often thought of as non-differentiated—US agriculture products accounted for roughly 10 percent of affected US exports in our sample. Table 1 showed that undifferentiated goods are those for which import tariffs generate ex-tariff price differences, which explains why US imports saw little or no ex-tariff price declines while US exports suffered moderate ex-tariff price declines. In Figures A3(a) and A3(b) we demonstrate that, in an accounting sense, undifferentiated goods (including most agricultural goods) are those products driving the decline in US export prices.



(a) Differentiated and Non-Differentiated Goods (b) Agricultural and Non-Agricultural Goods

Figure A3: Decomposition of US Export Price Indices

Notes: Figure A3 shows price indices for US exports exclusive of tariffs. All indices are normalized to equal 1 in March 2018 and use price data collected by the International Pricing Program at the BLS. The vertical lines denote the months when tariffs were introduced or increased: April 2018 (China initiated tariffs on US products), June 2018 (the EU, Mexico, and Turkey initiated tariffs), July 2018 (China expanded tariffs and Canada initiated tariffs), August 2018 (China expanded tariffs and Russia initiated tariffs), September 2018 (China expanded tariffs), and June 2019 (India initiated tariffs).

To elaborate on these findings, we now consider two types of regression specifications to study

US exports, analogous to what we did for the case of US imports. Our preliminary regression analysis of the first specification is consistent with the visual conclusion reached from Figure 1(b) in the paper. Specifically, we start by running the following equation with all monthly observations, including periods in which there is no price change:

$$\Delta \ln \left(P^{\mathcal{E}}_{i,j,k,t}\right) \quad = \quad \delta^{\mathcal{E}}_k + \sum_{l=0}^{11} \gamma^{\mathcal{E}}_l \Delta\tau_{k,t-l} + \sum_{l=0}^{11} \beta^{\mathcal{E},S}_l \Delta \ln\left(S_{j,t-l}\right) + \sum_{l=0}^{11} \beta^{\mathcal{E},X}_l \Delta \ln\left(X_{j,t-l}\right) + \epsilon_{i,j,k,t}, \quad \text{(A3)}$$

where we now use the superscript $\mathcal{E}$ to denote that the data and the relationships in equation (A3) correspond to US exports.

Table A4 reports the results from estimating (A3) on monthly data. As shown in column (1) there is about a 35 percent passthrough of the retaliatory tariff into ex-tariff US export prices after 12 months. That is, a 10 percent tariff imposed on US exports reduces US ex-tariff export prices by about 3.5 percent. The estimate reduces to 2.6 percent when controlling for other price-determining factors, as seen in column (4), which is our benchmark specification for exports included in the paper. The cumulative one-year ERPT estimates are close to 20 percent. This estimate is little changed when we simultaneously include tariff measures as a covariate. Retaliation from China accounts for about three-quarters of our observations, so in column (5), we separately estimate the one-year cumulative effect of the retaliatory tariffs for US goods exported to China and for US goods exported elsewhere. Whereas shipments to countries other than China show no statistically significant decline in the ex-tariff export price, the effect is very strong when estimated separately for China, with an estimated one-year ex-tariff export price decline of about 45 percent. Column (6) finds some evidence that larger tariffs produce a larger decline on the ex-tariff price of US exports, though the coefficient on the squared term is statistically insignificant at the 5 percent level. Lastly, column (7) shows that our results are robust to clustering standard errors at the sector level.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tariffs 1 yr.	$\left(\sum_{l=0}^{11} \gamma_l^{\mathcal{E}}\right)$	-0.354	-0.329		-0.259		-0.056	-0.259
		(0.087)	(0.089)		(0.089)		(0.188)	(0.122)
Squared Tariffs 1 yr.	$\left(\sum_{l=0}^{11} \gamma_l^{\mathcal{E},Sq}\right)$						-1.704	
							(1.024)	
China Tariffs 1 yr.	$\left(\sum_{l=0}^{11} \gamma_l^{\mathcal{E},\mathrm{CN}}\right)$					-0.452		
						(0.124)		
Non-China Tariffs 1 yr.	$\left(\sum_{l=0}^{11} \gamma_l^{\mathcal{E},-\mathrm{CN}}\right)$					0.247		
						(0.131)		
ERPT 1 yr.	$\left(\sum_{l=0}^{11} \beta_l^{\mathcal{E},S}\right)$			0.196	0.195	0.194	0.195	0.195
				(0.018)	(0.018)	(0.018)	(0.018)	(0.030)
PPI PT 1 yr.	$\left(\sum_{l=0}^{11} \beta_l^{\mathcal{E},X}\right)$			0.255	0.250	0.245	0.249	0.250
				(0.038)	(0.038)	(0.037)	(0.038)	(0.050)
	Adj. R^2	0.000	0.001	0.002	0.002	0.002	0.002	0.002
	Obs.	446,527	446,527	446,527	446,527	446,527	446,527	446,527
	Sector FEs?	No	Yes	Yes	Yes	Yes	Yes	Yes
	Clustered SEs?	No	No	No	No	No	No	Yes

Table A4: Regression Analysis of Retaliatory US Export Tariffs, Monthly Data

Notes: Robust standard errors in parentheses unless otherwise specified.

As we did in Section C.3 for imports, here we also consider a second specification that only includes non-zero price changes. We define $\{t_0, t_1\}$ as above, estimate the following:

$$\begin{aligned} \frac{1}{t_1 - t_0} \ln\left(\frac{P^{\mathcal{E}}_{i,j,k,t_1}}{P^{\mathcal{E}}_{i,j,k,t_0}}\right) &= \delta^{\mathcal{E}}_k + \gamma^{\mathcal{E}} \tau_{k,t_1} + \beta^{\mathcal{E},S} \frac{1}{t_1 - t_0} \ln\left(\frac{S_{j,t_1}}{S_{j,t_0}}\right) \\ &+ \beta^{\mathcal{E},X} \frac{1}{t_1 - t_0} \ln\left(\frac{X_{j,t_1}}{X_{j,t_0}}\right) + \epsilon_{i,j,k,t_1,t_0}, \end{aligned} \tag{A4}$$

and report our results in Table A5. Here, our estimates of exchange rate passthrough rise to about 33 percent, similar to the results from import regressions conditional on a price change, as reported in Table A3. As in Table A3, we multiply the magnitude of the coefficient on tariff passthrough by 12 in order to annualize the estimates. All the estimated effects of the tariffs shown in the first row are large in magnitude and statistically significant, and column (5) makes it clear that US exports to China underlie the results. Column (6) shows that the results in column (4) are robust to clustering standard errors at the sector level. As before, we note that in comparison to the results presented in Table A4, it is not surprising that the magnitudes of these results are larger since these condition on a price change and exclude observations where the left-hand-side is zero. We conclude from Figures 1(b), Figure A3, and Tables A4-A5 that the retaliatory tariffs applied to US exports exhibited significantly lower passthrough than was the case for the US tariffs on imports, in large part because the US exports that were retaliated against were less differentiated compared to the goods targeted by US import tariffs.

		(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Tariffs (Annualized)	$12 \times \gamma^{\mathcal{E}}$	-0.632 (0.138)	-0.656 (0.144)		-0.505 (0.139)		-0.505 (0.127)
China Tariffs (Annualized)	$12 \times \gamma^{\mathcal{E},\mathrm{CN}}$					-0.605 (0.163)	
Non-China Tariffs (Annualized)	$12 \times \gamma^{\mathcal{E},-\mathrm{CN}}$					0.188 (0.309)	
ERPT	$\beta^{\mathcal{E},S}$			0.335 (0.029)	0.334 (0.029)	0.334 (0.029)	0.334 (0.056)
PPI PT	$\beta^{\mathcal{E},X}$			1.028 (0.079)	1.022 (0.079)	1.020 (0.079)	1.020 (0.164)
	Adj. R^2	0.000	0.001	0.012	0.012	0.012	0.012
	Obs.	68,080	68,080	68,080	68,080	68,080	68,080
	Sector FEs?	No	Yes	Yes	Yes	Yes	Yes
	Clustered SEs?	No	No	No	No	No	Yes

Table A5: Regression Analysis of Retaliatory Export Tariffs, Conditional on Price Change

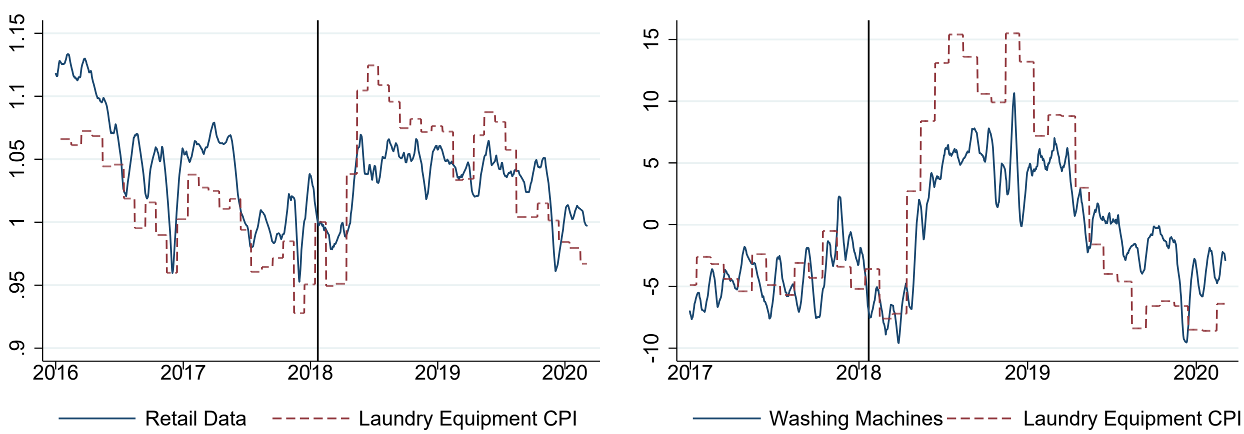
Notes: Robust standard errors in parentheses unless otherwise specified.

D Additional Retail Results

In this Appendix section, we offer a number of additional details and results from our analyses of retail prices, many of which are referenced from the main text.

D.1 Washing Machines

Nearly all washing machine imports (other than the few exceptions mentioned above) faced tariffs, regardless of their provenance, with statutory rates ranging from 20 to 50 percent starting in January 2018. This sector has received significant attention from academics, and is the focus of Flaaen, Hortaçsu, and Tintelnot (2019), as well as from policymakers and journalists, in part because it is one of the few categories of affected goods that coincides closely with a sectoral consumer price index (CPI) provided by the BLS, namely that for "Laundry Equipment." We obtain prices for about 700 washing machines from the private firm PriceStats as well as from the Billion Prices Project (BPP), which collected them by scraping, at a daily or weekly frequency, the online web pages of 16 large multi-channel retailers in the United States.[5] See Cavallo and Rigobon (2016) for a full description of these and closely-related data.



(a) Price Indices

(b) Annual Inflation

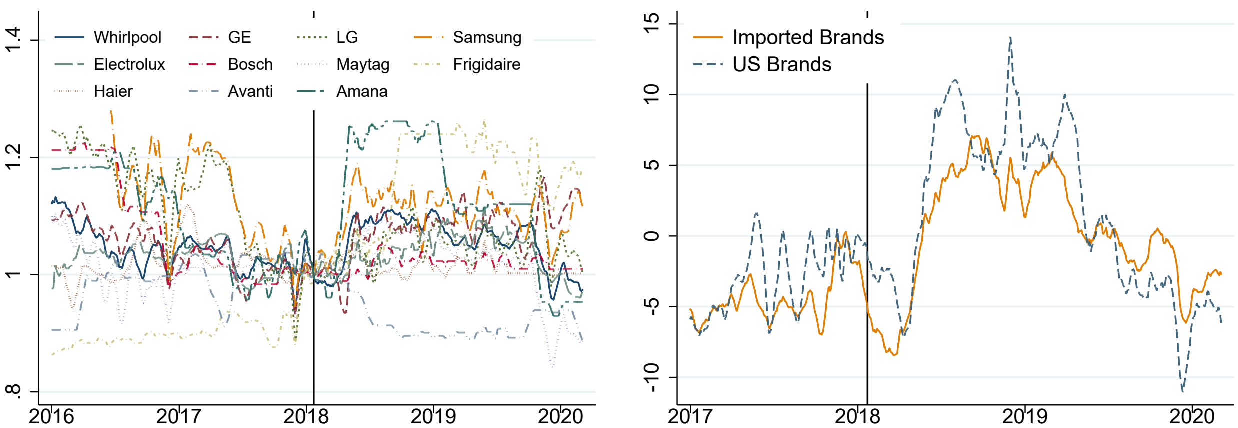
Figure A4: Retail Washing Machine Prices from the BPP and the CPI

Notes: Figure A4(a) compares a price index for washing machines using online prices with the Bureau of Labor Statistic's Consumer Price Index for Laundry Equipment (not seasonally adjusted, all urban consumers, US city average). Both indices are normalized to equal 1 on January 22nd 2018. Figure A4(b) shows the annual inflation rate for the same indices.

Figure A4(a) shows indices for these washing machine prices from the BPP data, calculated as an equally-weighted average of good-level price changes, as well from the CPI data. The price indices are normalized to equal 1 in February 2018, the month that tariffs were imposed, as indicated with a vertical black line. Figure A4(b) shows the annual inflation rates corresponding

[5]Washing machines are defined as goods appearing in the data for at least one year, with product descriptions that include the words "washing machine" or "washer", and which exclude particular disqualifying words such as "washer fluid". As with our analyses of trade data, all our retail price analyses exclude adjacent prices that differ by more than 2.3 log points in absolute value.

to these indices. Prior to the imposition of these tariffs, the BPP and CPI price indices for washing machines behaved similarly and declined by about 5 percent per year. Within a few months of the import tariffs, however, both series exhibit a break, with inflation rates switching from negative to positive values for both series. In the second half of 2018, washing machine inflation was typically between 5 and 10 percent in the BPP data and between 10 and 15 percent in the CPI data. This simple evidence strongly suggests moderate to high passthrough of the washing machine tariffs to retail prices.



(a) Price Indices

(b) Annual Inflation

Figure A5: Retail Washing Machine Prices from the BPP, Variation Across Brands

Notes: Figure A5(a) shows price indices for individual brands of washing machines, normalized to equal 1 on January 22nd 2018. Figure A5(b) shows the annual inflation rate for brands classified as domestic or imported based on publicly available information.

Underlying this high passthrough rate, however, is significant heterogeneity across different washing machine brands. Figure A5(a) plots the annual inflation rates brand-by-brand and shows that while the prices for Samsung washing machines clearly increased in response to the tariffs, the rate of inflation in Haier washers appears unchanged when comparing the pre- and post-tariff periods. It may be tempting to attribute such a heterogeneous response to heterogeneity in the tariff policies. Figure A5(b) demonstrates, however, that the basic pricing patterns look the same for US brands, which likely are not directly affected by the tariffs, and for imported brands, which likely are affected.[6] Consistent with the conclusions in Flaaen, Hortaçsu, and Tintelnot

[6]We split these US brands (GE, Maytag, and Whirlpool) from the imported brands (Amana and Haier from China, Avanti from Denmark, Bosch from Germany, Frigidaire from Sweden, and LG and Samsung from South Korea) using online marketing reports, which may be imprecise for ascertaining the manufacturer's country of origin. This is a useful example of the importance of analyses that use product-level information on the country of origin, which we turn to below.

(2019), tariffs not only caused prices to increase for those washing machines that were affected, but also, led more generally to price hikes, including on products unaffected by the tariffs.

D.2 Micro Data for Two Large US Retailers

Panel A of Table A6 summarizes the resulting dataset. Our data include about 38,000 products from Retailer 1. For Retailer 2, we matched the scraped price data to the top 100,000 products by sales rank, leaving about 56,000 products. Combined, the data include more than 90,000 products covering nearly 2,000 different 6-digit HS categories. Roughly two-thirds of the products, about 61,000, are imported from one of more than 80 countries. About 44,000 products are imported from China, with 36,000 of them in categories affected by the tariffs. Importantly for our purposes, there is significant and somewhat evenly distributed coverage across goods that are or are not in affected categories and that are or are not sourced from China.[7]

	Retailers 1 & 2	Retailer 1	Retailer 2	Imported Products	Manual HS Classification	Direct Imports
Panel A: Products						
Products	94,115	37,840	56,275	59,978	25,319	6984
Exporting Countries	82	65	66	81	70	15
HS6 Categories	1,992	1,651	831	1,498	1,336	212
Products Imported	61,106	21,144	39,962	59,978	21,157	6,966
Products Imported from China	44,423	13,646	30,777	43,490	14,450	6,680
Products in Affected Categories	74,763	34,237	40,526	40,333	23,435	6,276
Products from China Affected	35,969	12,072	23,897	30,101	13,104	5,977
Panel B: Pricing Behavior						
Products Without Price Changes (%)	38	46	33	47	37	25
Mean Product Life (months)	22	20	23	18	25	20
Abs. Val. Price Changes (med., %)	10.4	14.3	9.6	11.4	12.5	25.0
Abs. Val. Price Changes, Ex-Sales (med., %	9.3	11.2	8.3	10.0	24.2	24.7
Implied Duration (med., months)	8.7	9.7	8.1	9.7	10.6	7.0
Implied Duration, Ex-Sales (med., months)	11.0	12.5	8.9	11.2	14.0	10.1

Table A6: Summary Statistics from Two Major US Retailers

Since our analyses focus on price changes in these data, Panel B of Table A6 offers some basic summary statistics characterizing the dynamic pricing behavior of these goods. Retailer 1 has slightly stickier prices, with median price spells lasting 9.7 months, and 46 percent of products

[7]The share of Chinese goods may not be representative of the total sales made by these retailers.

never experiencing a price change compared to corresponding respective values of 8.1 months and 33 percent for Retailer 2. Broadly, however, the two retailers exhibit similar pricing patterns.

Table A7 show the number of products in the data that correspond to the different COICOP categories, further splitting them by the time when their HS categories were first impacted by the Chinese tariffs. These numbers therefore include goods that are not from China but can still be part of an HS category affected by the Chinese tariffs. The majority of our goods (69 percent) are household products, with another 13 percent electronics and 18 percent belonging to other categories. In terms of tariff waves, about 15 percent of our goods were in HS categories impacted by the first two waves of tariffs (at a additional rate of 25 percent), while 64 percent of the goods were affected in the September 2018 tariffs.

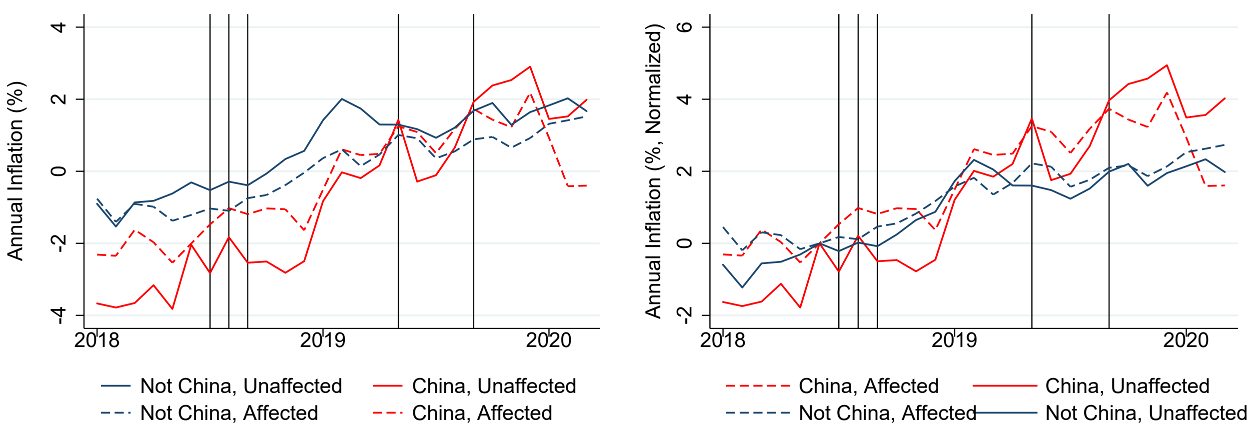
COICOP	Description	By Chinese Tariff					
		Not Affected	Jul-18	Aug-18	Sep-18	Sep-19	Total
100	Food & Beverages	3%	1%	1%	4%	13%	5%
200	Alcoholic Beverages and Tobacco	0%	0%	0%	0%	0%	0%
300	Clothing and Footwear	1%	0%	0%	0%	2%	1%
400	Housing (Maintenance and Repair Materials)	3%	2%	31%	11%	2%	8%
500	Household Goods and Furnishings	69%	79%	55%	72%	56%	69%
600	Health	3%	0%	0%	0%	1%	1%
700	Transport	1%	1%	6%	0%	1%	1%
800	Communications	1%	0%	0%	0%	0%	0%
900	Electronics (Recreation and Culture)	16%	18%	7%	9%	22%	13%
1200	Miscellaneous Goods	3%	0%	0%	2%	3%	2%
	Total	100%	100%	100%	100%	100%	100%

Table A7: Products by COICOP category and Chinese Tariff Wave

Finally, for HS code classification we noted in the paper that in some cases we asked a group of research assistants to respond manually to the additional questions required by the 3CE algorithm to help refine its match. Generally, these questions could easily be answered by looking at each product's page on the website of its retailer. When the requested information was not available online, we attempted to provide the most common or broadly representative answer possible. For example, if we were unable to answer a question about the material used to make a particular screw, we chose "steel" as that was the most common material used for screws when this information was provided. In cases where we could not visit the product's web page because it was no longer offered for sale, we tried to locate the product on other retailer websites and searched for a close substitute. We commonly resorted to the latter strategy. For example, if we could not find a particular 4-pack of batteries, we would look for identical batteries sold by the same retailer in a 6-pack.

D.3 Additional Retail Graphs and Regressions

We start by using these data to plot daily retail price indices and corresponding annual retail inflation rates separately for those products imported from China that were affected by the tariffs, products imported from China that were unaffected, products not imported from China but in categories that were affected, and products not imported from China and in categories that were not affected. Figure A6(a) shows the inflation rates for the four groups of products. Figure A6(b) normalizes this inflation rate on the date of the date of the tariffs. In both cases, it is difficult to discern any quantitatively important price differences brought about by the tariffs. The inflation rates in all groups behave similarly, though the exception may be unaffected products sold by China, as this goods sector exhibited the largest increase in inflation rates over the sample period.



(a) Annual Inflation

(b) Annual Inflation - Normalized

Figure A6: Retail Price Response to Chinese Import Tariffs by Two US Retailers

To more precisely identify the differential retail pricing behavior of products impacted by the tariffs, we use these data to estimate at a monthly frequency a regression specification similar to equation (1) in the paper. We regress the change in retail prices on current and lagged tariff changes, plus fixed effects allowing for different price trends per sector and additionally different trends for the total sets of Chinese products that are and are not affected by the tariffs:

$$\Delta \ln \left(P^{\mathcal{R}}_{i,j,k,t}\right) = \delta^{\mathcal{R}}_{k} + \phi^{\mathcal{R},\Omega}_{\text{CN}} + \phi^{\mathcal{R},-\Omega}_{\text{CN}} + \sum_{l=0}^{11} \gamma^{\mathcal{R}}_{\text{CN},l} \Delta \tau_{\text{CN},k,t-l} + \epsilon_{i,j,k,t}, \quad \text{(A5)}$$

where now the sectors k are defined as 3-digit COICOP codes and where we no longer include information on producer prices nor on exchange rates. The results, reported in Table A9, show that while the prices for products affected by the Chinese import tariffs grow relative to the price of products in the same sector that were not affected, the difference is not stark.

		All Goods (1)	All Goods (2)	Imported Goods (3)	All Goods (4)	Manual HS Classification (5)	Direct Imports (6)
Tariff 1 yr.	$\left(\sum_{l=0}^{11} \gamma_{\text{CN},l}\right)$	0.035 (0.020)	0.035 (0.026)	0.032 (0.021)		0.075 (0.025)	0.158 (0.091)
10% Tariffs 8 mo.	$\left(\sum_{l=0}^{7} \gamma_{l}\right)$				0.050 (0.026)		
25% Tariffs 8 mo.	$\left(\sum_{l=0}^{7} \gamma_{l}\right)$				0.126 (0.021)		
China, Affected	$\left(\phi^{\Omega}_{\text{CN}}\right)$	-0.001 (0.000)	-0.001 (0.000)	-0.001 (0.000)	-0.000 (0.000)	-0.001 (0.001)	-0.003 (0.002)
China, Not-Affected	$\left(\phi^{-\Omega}_{\text{CN}}\right)$	-0.000 (0.000)	-0.000 (0.001)	-0.000 (0.000)	0.001 (0.000)	-0.001 (0.000)	0.000 (0.002)
Adj. R^2		0.001	0.001	0.001	0.001	0.002	0.005
N		1,118,870	1,118,870	711,806	1,159,426	356,151	72,762
Products		70,900	70,900	46,191	76,187	22,046	5,190
Products from China		33,411	33,411	33,411	35,855	12,544	5,032
Sector FEs		Yes	Yes	Yes	Yes	Yes	Yes
Clustered SEs		No	Yes	No	No	No	No

Table A8: Additional Regression Analysis of US Retail Prices

The first column, also shown in the paper, estimates the regression using monthly data from both retailers for the time period running from January 2017 to February 2020. In the top row, the coefficient of 0.035 means that after one year, a 10 percentage point tariff increase on a good is associated with a 0.35 percent increase in that good's price relative to other goods in the same sector. If we use clustered standard errors we lose statistical significance. The benchmark result holds if we limit the sample to imported products (i.e., excluding those with the United States as the country of origin).

Column 4 shows that the coefficients become larger and more significant when we look for non-linearity by estimating a separate passthrough rate for goods initially subject to 10 percent or 25 percent tariffs. As with the import and export results, in this case goods that were subject to different tariff rates are excluded from this regression, and we can only estimate 8-month passthrough rates. The goods affected by the larger tariffs have over twice as much passthrough, with a 10 percentage point tariff increase associated with a 1.3% increase in prices.

As mentioned in the paper, one might reasonably worry that measurement error in the sectoral classification algorithm is limiting our ability to identify larger differences in the retail price dynamics between products affected and unaffected by the tariffs. To look for evidence of this, we consider two subsets of our data that are the least likely to contain sectoral classification errors. First, we exploit the fact that about one-quarter of the products were matched manually, requiring a research assistant to affirmatively check the association of a product's text description with the HS classification. Second, we obtained a list of products that were directly imported by Retailer 2, rather than purchased through an importer or wholesaler, so we can be confident that the retailer's perception of the HS code is the relevant one.

Columns 5 and 6 in Table A8 show the results for these two smaller datasets. As expected, the regression coefficients rise, particularly for goods that were directly imported by Retailer 2, for which the actual HS code used at the border is known. However, the magnitude of these coefficients is still quite low, so that a 10 percent tariff increase is associated with an increase in prices that ranges from 0.8 percent to 1.6 percent.

Table A9 further splits this sample into COICOP categories. As seen in Table A7, most categories like Food, Clothing, or Health have a small number of affected goods, so we view their large and insignificant point estimates as largely uninformative. Among those that are statistically significant, there appears to be large differences in passthrough rates. For Household goods (COICOP 500), which constitute the bulk of our sample, the coefficient is 0.059. Housing repair products (COICOP 400) have nearly three times as much passthrough, with a coefficient of 0.182. Categories such as "Other Goods" (COICOP 1200) and "Clothing" (COICOP 300) have much higher passthrough rates, but these are obtained from a much smaller sample of goods.

		Manual HS or Direct Import - By Category							
		Food & Beverages	Clothing & Footwear	Housing Materials	Household Goods & Furnishings	Health	Transport	Electronics	Miscellaneous Goods
Tariff 1 yr.	$\left(\sum_{l=0}^{11} \gamma_{\text{CN},l}\right)$	0.643	0.858	0.182	0.059	0.130	0.314	0.062	0.448
		(0.591)	(0.442)	(0.087)	(0.032)	(0.136)	(0.161)	(0.070)	(0.199)
China, Affected	$\left(\phi_{\text{CN}}^{\Omega}\right)$	-0.003	-0.012	0.004	-0.000	-0.001	-0.001	-0.002	-0.005
		(0.007)	(0.006)	(0.001)	(0.000)	(0.002)	(0.003)	(0.001)	(0.005)
China, Not-Affected	$\left(\phi_{\text{CN}}^{-\Omega}\right)$	-	-0.012	0.004	-0.000	-0.001	-0.001	-0.002	-0.004
		-	(0.006)	(0.001)	(0.000)	(0.002)	(0.004)	(0.001)	(0.005)
Adj. R^2		0.001	0.006	0.002	0.001	0.003	0.017	0.001	0.006
N		232,473	1,694	37,824	322,487	1,379	2,136	54,875	3,868
Products		13,945	149	2,240	20,707	104	125	3,429	304
Products from China		3,665	112	828	14,661	83	93	1,581	227
Sector FEs		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A9: Additional Regression Analysis of US Retail Prices

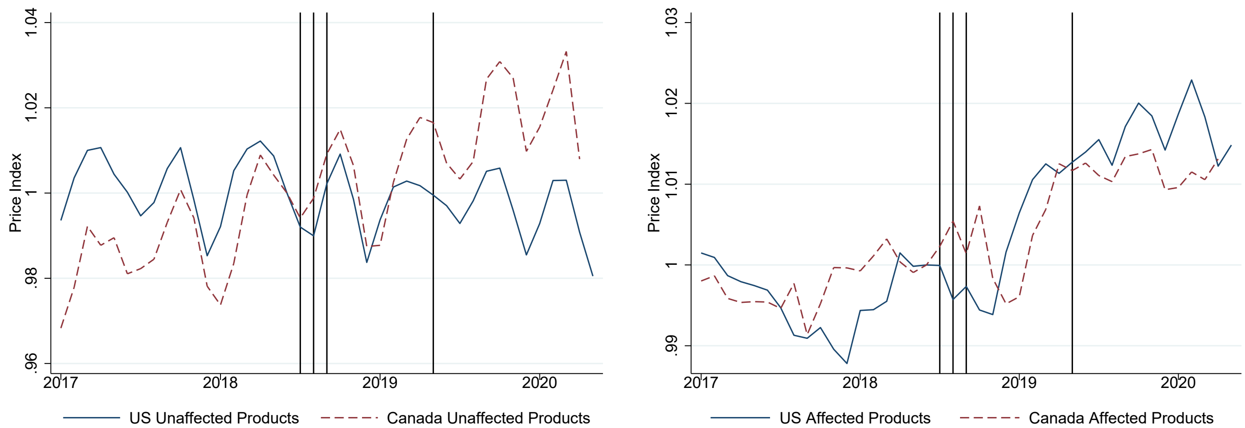
Notes: Our data does not contain enough affected or unaffected products for "Alcoholic Beverages" (COICOP 200) and "Communications" (COICOP 800) to run this regression at the sector level. Fixed effects $\left(\phi_{\text{CN}}^{\Omega}\right)$ and $\left(\phi_{\text{CN}}^{-\Omega}\right)$ are included in all regressions. Robust standard errors shown in parentheses.

D.4 More International Comparisons

As noted in the paper, one possible explanation for our low retail passthrough findings is that retailers increased their margins on unaffected goods to partially offset the margin reduction on affected goods, muting any changes in their overall margins. Or, consistent with the washing machine results in Figure A5(b), perhaps tariffs enabled the producers of unaffected goods to raise their markups. Both of these cases would stabilize the relative prices of affected and unaffected products within narrowly defined sectors. Rather than inferring the impact of tariffs by comparing the prices of affected and unaffected goods within sectors, in these cases we would expect to see the prices in affected US sectors rise (compared to the overall CPI) relative to the prices in countries that did not impose tariffs on these goods.

To consider these possibilities, in Figure A7 we start by comparing the sector-level price indices for affected and unaffected sectors underlying "Commodities less food and energy" in the United States and "Goods excluding food purchased from stores and energy" in Canada, data publicly available from the US Bureau of Labor Statistics and Statistics Canada.[8] Figure

[8]Based on the share of trade in the categories that is covered by the tariffs, we designate the following nine CPI sectors as "affected": Furniture and bedding, Laundry equipment, Miscellaneous personal goods, Motor vehicle parts and equipment, Personal care products, Pets and pet products, Sewing machines, fabric and supplies, Sports vehicles including bicycles, and Tools, hardware, outdoor equipment and supplies. The remaining sectors are designated as "unaffected". We then do our best to manually match these sectors for Canada. We use price indices that are not seasonally adjusted because some of these series for Canada are not available with seasonal adjustments.



(a) Unaffected Sectors

(b) Affected Sectors

Figure A7: Retail Price Indices for the United States and Canada, Data from CPI

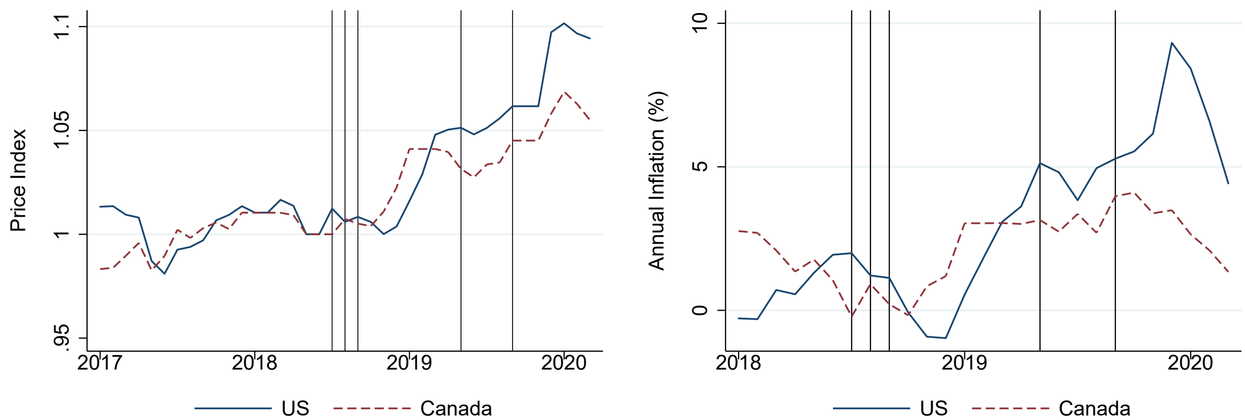
A7(a) shows the price indices for those sectors unaffected by tariffs. Before mid-2018, Canada's unaffected sectors had a higher inflation rate, though the price indices for unaffected sectors in the United States and Canada are both essentially flat after the imposition of the tariffs. Figure A7(b) then compares the price indices constructed for sectors affected by the tariffs. While starting with the imposition of the tariffs, there does appear to be a moderate increase in inflation among affected categories in the United States, interestingly, this also appears to be the case in Canada, though to a lesser degree.[9]

Figure A7 suggests that at least some of the price increases in the affected goods sectors may not truly reflect the tariffs, or may only reflect the general equilibrium effects of tariffs, since Canada has not imposed tariffs on imports from China. We note, however, that this analysis is highly imperfect and has limited power. The affected sectors are not chosen based on trade as a share of expenditures and do not distinguish trade from China and from other countries. Furthermore, the sectors are defined differently across the two countries, and even when the matching of sectors is good in concept, the two countries may consume very different products in practice. To avoid these issues, we next compare the prices for identical goods sold by Retailer 2 in the United States and in Canada.

We identify 2,436 products that are sold by Retailer 2 in both the United States and Canada and plot the price indices and inflation rates separately for each country, using only the retail

[9]This analysis for the United States is reminiscent of, and largely consistent with, a widely distributed report by Goldman Sachs (2019).

prices for those common goods in Figure A8.[10] Given that the overall CPIs for the United States and Canada evolved similarly over this period, the two panels do not suggest any particularly unusual dynamics in the US prices for these goods relative to the Canadian goods over the period when the tariffs were imposed.



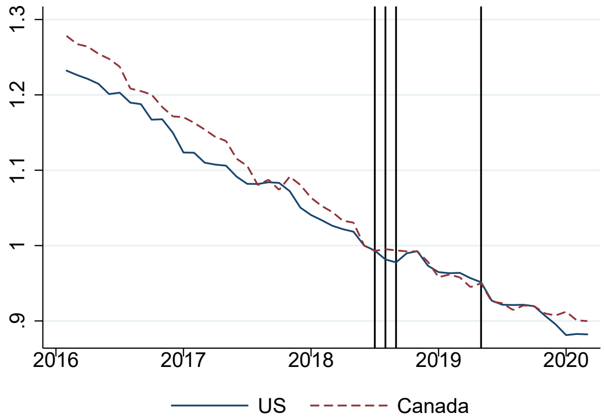
(a) Price Indices (b) Annual Inflation

Figure A8: US and Canadian Retail Prices from Retailer 2

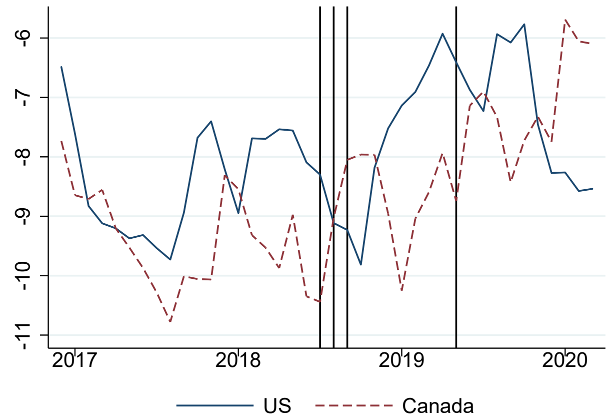
The patterns in Figure A8, of course, only reflect data from a single retailer. While we could not match identical goods sold in the United States and Canada for more retailers, we added pricing data for sales in the two countries for six additional retailers that operate in those two countries and sell home goods, electronics, apparel, and furniture, including two other top-10 US retailers. We selected 43 3-digit product categories and created price indices for each category, country, and retailer. We used prices for about 350,000 products in the United States and about 120,000 in Canada. We then use equal weights for each retailer and the same average sectoral expenditure weights for both countries to generate US and Canadian price indices for these goods, where any differences can be thought of as reflecting within-retailer and within-category differences in inflation across the two countries. The results, plotted in Figure A9, again do not obviously reveal that retailers raised prices for their US customers relative to their Canadian customers, even for the same set of goods, suggesting that retailer profit margins absorbed a

[10] We identify identical products by looking for an exact match in model numbers, requiring that the model numbers have at least five characters. The model numbers are typically determined by the product manufacturers. They often will be identical other than the last two characters, which will be "us" or "ca". We do not consider such cases to be identical products and exclude them. In total, the matched products cover 19 3-digit COICOP categories and are largely furniture products, household appliances, tools and equipment, and home repair items. We note that we did not require these goods to be available during the identical time spans in each country.

significant amount of the adjustment to the import tariffs.



(a) Price Indices



(b) Annual Inflation

Figure A9: US and Canadian Retail Prices, Multiple Retailers

Finally, we note that while we observe very high passthrough of tariffs to the import price at the economy-level, our retail results largely reflect prices set by the largest firms. It is possible that in terms of their negotiating power as buyers, these giant retailers differ from the average retailer and this difference may contribute to our finding of surprisingly modest passthrough to their retail prices. Indeed, when we restrict our analysis of import tariffs on Chinese goods to firms with two or more subdivisions reporting to the BLS—a proxy for large firms—the estimate corresponding to "Tariffs 1 yr." in column (4) of Table A2 decreases to -0.112 and is statistically significant at the 10 percent level.

D.5 Additional Front-Loading Results

The results for Figure 4 in the paper are very similar if we plot shipping containers or USD values instead of metric tons. This is shown in Figure A10, confirming that these two retailers engaged in some front-running behavior ahead of the tariffs and also were able to partially adjust in part by shifting to other countries as suppliers.

(a) Containers Imported, Thousands

(b) USD Value of Imports, Millions

Figure A10: Front-Running and Trade Diversion by Two Major US Retailers - Alternative Metrics

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