

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

Alberto Cavallo

Harvard Business School

Gita Gopinath

Harvard & IMF

Brent Neiman

Univ. of Chicago

Jenny Tang

Boston Fed

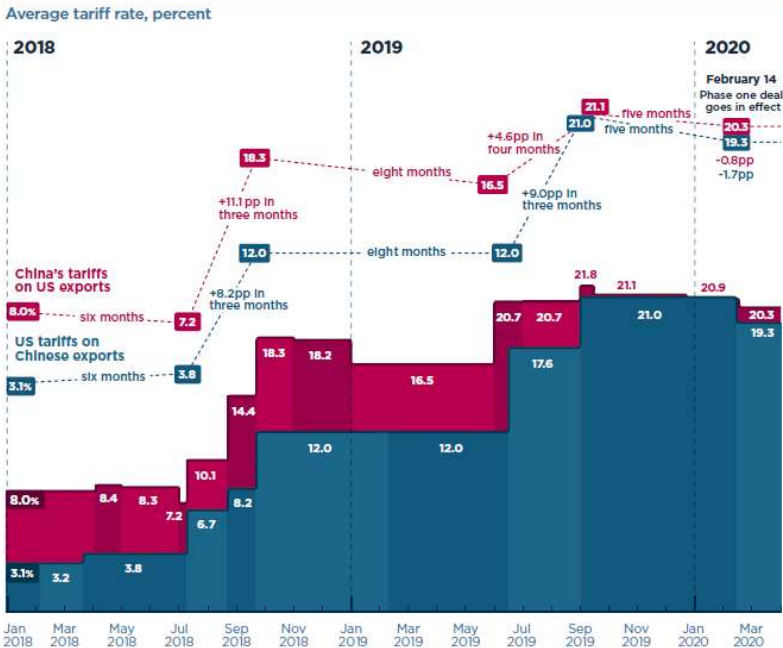
September 11, 2020

NBER International Trade Policy and Institutions Conference

The views expressed in this presentation are those of the authors and do not necessarily reflect the views of the BLS, the Federal Reserve Bank of Boston, the Federal Reserve System, or those of the IMF, its Executive Board, or Management.

The US Trade War

Updated on February 14, 2020
US-China Trade War Tariffs: An Up-to-Date Chart



Timeline - 2018-2020 U.S. Tariffs and Retaliations

| DATE | U.S. | CHINA |
|---------------------|--|--|
| January -March 2018 | Safeguard tariffs <ul style="list-style-type: none">Solar Panels (+30%, \$8.5 bn)Washing Machines (+20% to +50%, \$1.8 bn) | Files WTO dispute |
| March – April 2018 | National Security Tariffs <ul style="list-style-type: none">Steel (+25%, \$10.2 bn)Aluminum (+10%, \$ 7.7 bn) | Retaliation <ul style="list-style-type: none">Tariffs on \$3 bn of U.S. imports (aluminum waste, pork, fruits, nuts, and other U.S. products) |
| July 2018 | China Tariffs – Stage 1 +25% on \$34 bn | Retaliation +25% on \$34 bn |
| August 2018 | China Tariffs – Stage 2 +25% on \$16 bn | Retaliation +25% on \$16 bn |
| September 2018 | China Tariffs – Stage 3 +10% on \$200 bn ½ are intermediate goods, ¼ are consumer goods. | Retaliation +10% on \$60 bn |
| December 2018 | US and China agree to postpone other tariff increases while they negotiate | |
| June 2019 | Stage 3 tariffs increased to +25% | Stage 3 retaliation tariffs increased to +25% |
| September 2019 | China Tariffs – Stage 4 +15% on \$300 bn | Retaliation +15% on \$75 bn |
| January 2020 | Phase One Deal | |
| February 2020 | Stage 4 tariffs reduced to +7.5% | Stage 4 retaliation tariffs reduced to +7.5% |

Source: Casewriter, based on Bown, Chad, and Melina Kolb. 2020. "Trump's Trade War Timeline: An Up-to-Date Guide." <https://piie.com/blogs/trade-investment-policy-watch/trump-trade-war-china-date-guide>.

This Paper

Estimate tariff effect on prices and compare with exchange rate passthrough.

At the Border

- Product-level import and export prices
- Imports from China
- Retaliatory tariffs on US exports

At the Store

- Product-level data from largest US retailers with country of origin information for two specific retailers
- Imports from China

Jointly examining border and retail prices allows us to determine the incidence of the tariffs.

Our paper is largely silent on quantities and welfare. See Amiti, Redding, and Weinstein (2019) and Fajgelbaum et al. (2020).

Main Findings

US bearing the burden

- Chinese import tariffs passed through fully to US importers
 - Stark contrast to modest degree of exchange rate passthrough (also documented in Gopinath, Itskhoki, and Rigobon (2010) and Gopinath et al. (2010))
 - Contrary to some claims, RMB depreciation did little to offset the impact of tariffs
 - Has implications for analysis of fiscal devaluations and border adjustment taxes
- Retaliatory tariffs on US exports saw significantly lower passthrough
- Difference in import vs export tariff passthrough explained by composition of goods and lower passthrough rates for undifferentiated goods

Uneven passthrough to consumers

- Differences across goods, but overall passthrough is low
- Using other margins of adjustment: avoiding tariffs by front-running and then diverting trade to other countries

Micro Data Sources

Trade prices: BLS International Price Program

- Transactional prices for imports and exports at the good level; used in construction of import and export price indices
- Sample used: Monthly data over 2005–2020 period
- Avoid compositional effects

Retail prices: The Billion Prices Project

- Posted prices from websites of large multi-channel retailers in the US
- Sample used: Daily data from 30 largest retailers over 2017–2020 period
- For 2 individual retailers we additionally have
 - Country of origin and HS code classifications for each good
 - Total quantities directly imported (Customs Bills of Lading, Datamyne)

At the Border: Imports from China

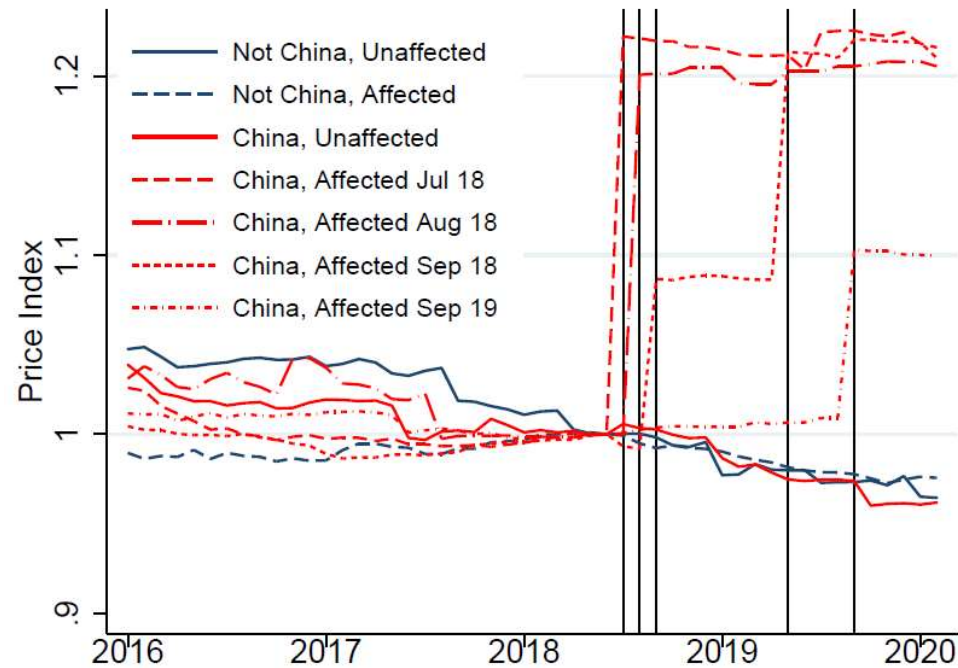


Figure 1(a): Import Price Indices (including tariffs)

Prices paid by US importers jumped up by about the full amount of the tariffs and did not meaningfully decline afterwards

At the Border: Export Prices

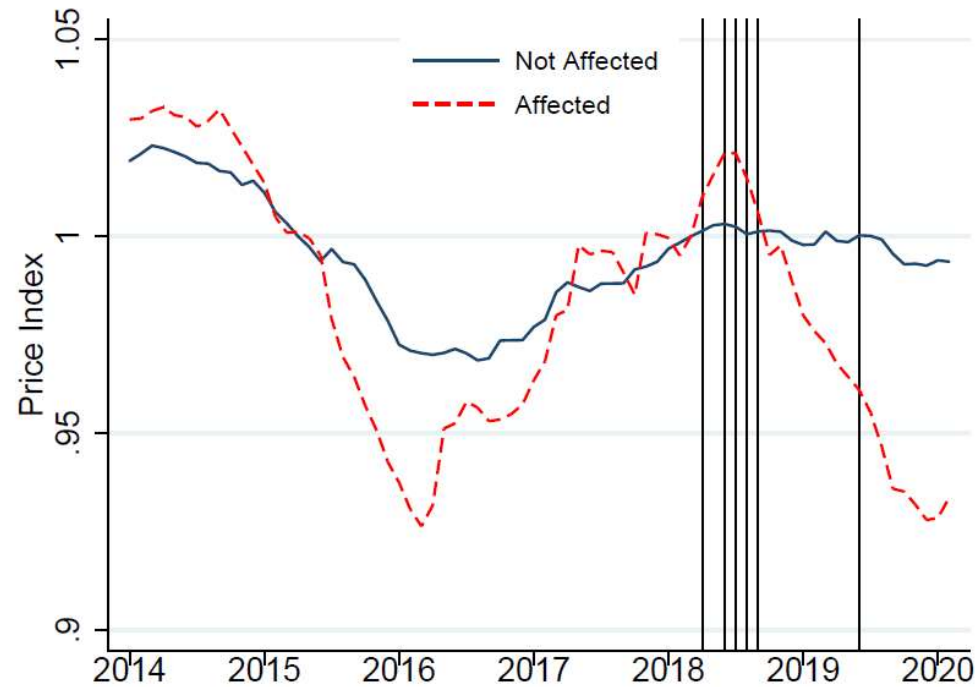


Figure 1(b): Export Price Indices (excluding tariffs)

In contrast, prices charged by US exporters fell by nearly 9% soon after the introduction of tariffs.

Estimating Passthrough

Based on a standard model with variable markups, we estimate 1-year import passthrough rates with:

$$\begin{aligned}\Delta \ln \left(P_{i,j,k,t}^{\mathcal{I}} \right) &= \delta_k^{\mathcal{I}} + \phi_{\text{CN}}^{\mathcal{I},\Omega} + \phi_{\text{CN}}^{\mathcal{I},-\Omega} + \sum_{l=0}^{11} \gamma_l^{\mathcal{I}} \Delta \tau_{i,t-l} \\ &+ \sum_{l=0}^{11} \beta_l^{\mathcal{I},S} \Delta \ln (S_{j,t-l}) + \sum_{l=0}^{11} \beta_l^{\mathcal{I},X} \Delta \ln (X_{j,t-l}) + \epsilon_{i,j,k,t}\end{aligned}$$

- ▶ $P_{i,j,k,t}^{\mathcal{I}}$: Price of item i in sector k from country j at time t
- ▶ $\delta_k^{\mathcal{I}}$: Average sectoral inflation (Sectors: BLS “primary stratum” or 3-digit COICOP)
- ▶ $\{\phi_{\text{CN}}^{\mathcal{I},\Omega}, \phi_{\text{CN}}^{\mathcal{I},-\Omega}\}$: Average differential inflation in affected and unaffected Chinese imports (only in imports specification)
- ▶ $\Delta \tau_{k,t}$: Log newly imposed additional tariff rate (defined at the HS6 level)
- ▶ $S_{j,t}$: Value of country j currency against the dollar
- ▶ $X_{j,t}$: Country j aggregate price index

At the Border: Passthrough Rates

Border Price Regression Analysis Using Monthly Data

| | | US Imports from China | | | US Exports | | |
|------------------|-------------------------------|-----------------------|------------------|-----|------------|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) | (6) |
| Tariffs 1 yr. | $(\sum_{l=0}^{11} \gamma_l)$ | -0.057 (0.023) | 0.005 (0.025) | | | | |
| Differentiated | $(\sum_{l=0}^{11} \gamma_l)$ | | | | | | |
| Undifferentiated | $(\sum_{l=0}^{11} \gamma_l)$ | | | | | | |
| ERPT 1 yr. | $(\sum_{l=0}^{11} \beta_l^S)$ | | 0.218 (0.023) | | | | |
| PPI PT 1 yr. | $(\sum_{l=0}^{11} \beta_l^X)$ | | 0.047 (0.033) | | | | |
| Adj. R^2 | | 0.002 | 0.003 | | | | |
| Obs. | | 835,722 | 835,722 | | | | |

- Prices of affected imports dropped slightly relative to trend, but this seems to be more strongly associated with the RMB's depreciation rather than the tariffs.
- Exchange rate pass-through is low, as documented in previous literature.

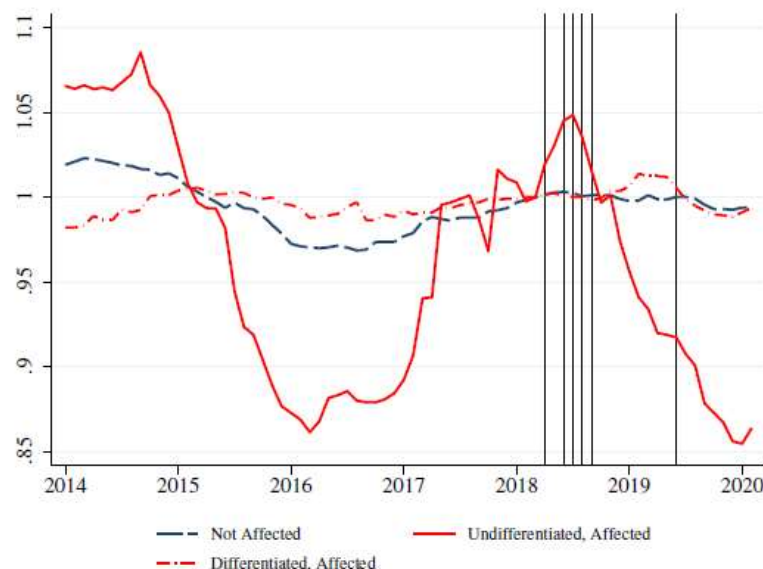
At the Border: Passthrough Rates

Border Price Regression Analysis Using Monthly Data

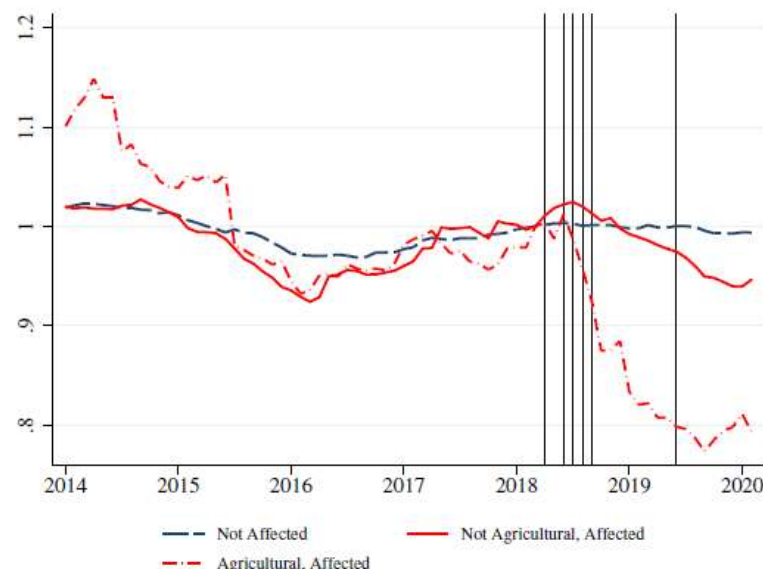
| | | US Imports from China | | | US Exports | | |
|------------------|-------------------------------|-----------------------|------------------|-----|-------------------|-------------------|-----|
| | | (1) | (2) | (3) | (4) | (5) | (6) |
| Tariffs 1 yr. | $(\sum_{l=0}^{11} \gamma_l)$ | -0.057 (0.023) | 0.005 (0.025) | | -0.329 (0.089) | -0.259 (0.089) | |
| Differentiated | $(\sum_{l=0}^{11} \gamma_l)$ | | | | | | |
| Undifferentiated | $(\sum_{l=0}^{11} \gamma_l)$ | | | | | | |
| ERPT 1 yr. | $(\sum_{l=0}^{11} \beta_l^S)$ | | 0.218 (0.023) | | | 0.195 (0.018) | |
| PPI PT 1 yr. | $(\sum_{l=0}^{11} \beta_l^X)$ | | 0.047 (0.033) | | | 0.250 (0.038) | |
| Adj. R^2 | | 0.002 | 0.003 | | 0.001 | 0.002 | |
| Obs. | | 835,722 | 835,722 | | 446,527 | 446,527 | |

- Tariff passthrough to pre-tariff export prices is about 30% (i.e., 70% to foreign importers).
- Robust to using only data on (non-zero) price changes

At the Border: Passthrough Rates



(a) Differentiated and Non-Differentiated Goods



(b) Agricultural and Non-Agricultural Goods

Figure A3: Decomposition of US Export Price Indices

- Price declines for affected exports are concentrated in undifferentiated goods.

At the Border: Passthrough Rates

Border Price Regression Analysis Using Monthly Data

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

- Substitutability plays a role in explaining the different export & import tariff passthroughs.
- Prices of undifferentiated imports and exports drop by over 27% of the tariff rate.
- However, these goods make up only 10% of affected imports and over half of affected exports.

Discussion of Border Results

Back-of-the-envelope calculations:

- A 20% import tariff is estimated to result in a 18.9% increase in US importers' prices paid.
 - Consistent with Amiti, Redding, and Weinstein (2019) and Fajgelbaum et al. (2020).
- The 10% depreciation in the RMB since June 2018 lowered import prices by 2.2%, not nearly making up for the 10–25% in additional tariffs.
- In contrast, a 20% export tariff resulted in US exporters earning a 6.6% lower price on their exports, on average.
 - Prices of undifferentiated exports fell by much more in response to the tariff.

Discussion of Border Results

Broader implications:

- Evidence against assumption of symmetric tariff and exchange rate passthrough rates often used in analyses of border adjustment taxes or fiscal devaluation. (For example, in Farhi, Gopinath, and Itskhoki (2014) and Barbiero et al. (2019).)
- Higher passthrough for undifferentiated goods puts US at a disadvantage.
 - Undifferentiated goods make up 25% of total US exports to China and only 2% of total US imports from China.

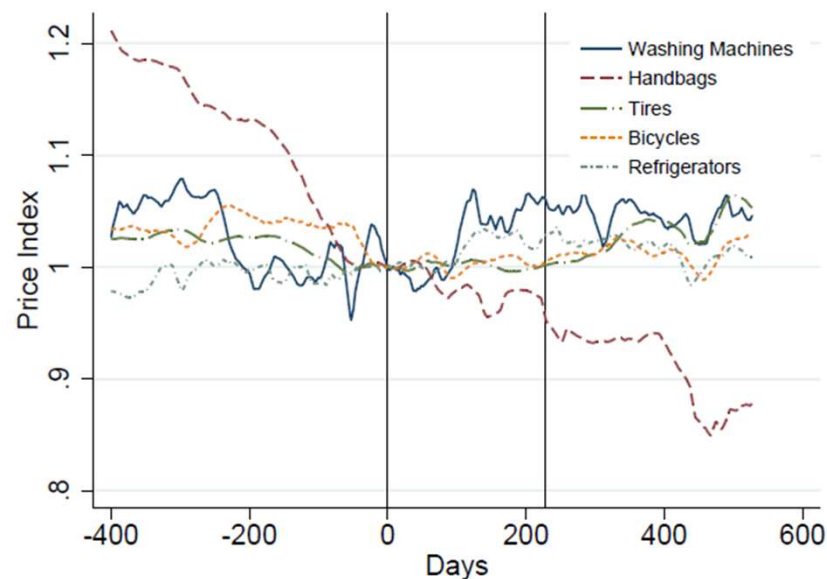
At the Store: Micro Retail Prices

From border price analysis: Assuming a 50% imported goods cost share, full retail passthrough would entail a 9.4% increase in prices.

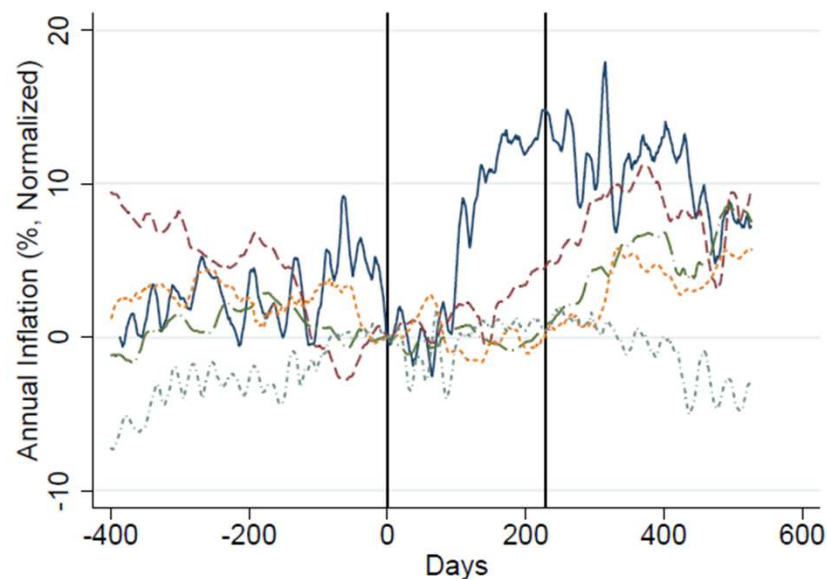
Two exercises:

- Case studies of specific goods using data from largest US retailers that are:
 - Easily identified in the retail price data and tariff harmonized codes
 - Come mostly from China
- Regression analysis using data from two retailers that also contains country-of-origin information

At the Store: Heterogeneous Retail Response



(a) Price Indices



(b) Annual Inflation

Figure 2: Retail Price Impact for Selected Consumer Goods

- As studied in Flaaen, Hortacsu, and Tintelnot (2019) and often cited in the media, there appears to be a high degree of passthrough of washing machine tariffs to retail prices.
- Impacts on handbags, bicycles, and tires were delayed.
- Refrigerator prices have had no tariff-related increase so far.

Products with Country of Origin and HS codes




- Micro data from 2 large retailer with country of origin (COO) and HS code information for individual goods
 - Retailer 1 is a retail hypermarket
 - COO scraped online
 - HS code based on product description
 - Retailer 2 is a home improvement retailer
 - COO provided by the retailer
 - HS codes for direct imports provided by the retailer
 - Other HS codes based on product description

Obtaining HS codes for individual products

<https://uscensus.prod.3ceonline.com/>

United States
Census
Bureau

Schedule B Search Engine

DESCRIBE YOUR PRODUCT  VIZIO 50" Class 4K Ultra HD (2160P) HDR Smart LED TV (D50x-G9)   Classify

Here Is What We Know About Your

Light Emitting Diode (LED) Television
Not Your Item?

Assumed Characteristics >

Known Characteristics ▾

broadcast use

Television ▾

not radio-broadcasting, other

construction

Designed To Incorporate A Video Display Or Screen ▾

not other

visual feature

Colour ▾

not other

Schedule B




Legal Notes

Please read all 10-digit descriptions to find the one that best matches your product

U.S. Census Bureau - Foreign Trade Schedule B (2019)

Chapter 85

CHAPTER 85 - ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS THEREOF; SOUND RECORDERS AND REPRODUCERS, TELEVISION IMAGE AND SOUND RECORDERS AND REPRODUCERS, AND PARTS AND ACCESSORIES OF SUCH ARTICLES

| SCHEDULE B NUMBER | DESCRIPTION | UOM |
|-------------------|---|-----|
| 85.28 |  Monitors and projectors, not incorporating television reception apparatus; reception apparatus for television, whether or not incorporating radio-broadcast receivers or sound or video recording or reproducing apparatus: | |
| |  - Reception apparatus for television, whether or not incorporating radio-broadcast receivers or sound or video recording or reproducing apparatus: | |
| 8528.72 |  - - Other, color: | |

Retail micro data with country and HS code information

| | Retailers 1 & 2 | Retailer 1 | Retailer 2 | Imported Products | Manual HS Classification | Direct Imports |
|---|--------------------|---------------|---------------|----------------------|-----------------------------|-------------------|
| <i>Panel A: Products</i> | | | | | | |
| 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 |
| <i>Panel B: Pricing Behavior</i> | | | | | | |
| 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

At the Store: Small Overall Response



Figure 3(a): Retail Price Index (Based on All Products from Two US Retailers)

- For two retailers with country-of-origin, we conduct an analysis like the one for border prices.
- All products have started increasing in price since the tariffs were introduced, but there is no difference in the patterns for affected and unaffected goods.

At the Store: Passthrough Rates

$$\Delta \ln \left(P_{ij,k,t}^{\mathcal{R}} \right) = \delta_k^{\mathcal{R}} + \phi_{\text{CN}}^{\mathcal{R},\Omega} + \phi_{\text{CN}}^{\mathcal{R},-\Omega} + \sum_{l=0}^{11} \gamma_l^{\mathcal{R}} \Delta \tau_{i,t-l} + \epsilon_{ij,k,t}$$

Retail Price Regression Analysis Using Monthly Data

| | | All Goods | Manual HS Classification | Direct Imports |
|--------------|--|------------------|-----------------------------|------------------|
| Tariff 1 yr. | $(\sum_{l=0}^{11} \gamma_{\mathcal{R},l})$ | 0.035 (0.020) | 0.075 (0.025) | 0.158 (0.091) |
| Adj. R^2 | | 0.001 | 0.002 | 0.005 |
| Obs. | | 1,118,870 | 356,151 | 72,762 |

- A 20% import tariff is estimated to only increase retail prices by 0.7%.
- For a subsample with less HS classification error, this value increases to 1.5%.
- For directly imported goods (for which the retailer provides HS codes), this value increases to 3.2%, indicating that firms are still absorbing a large share of the import price increase.

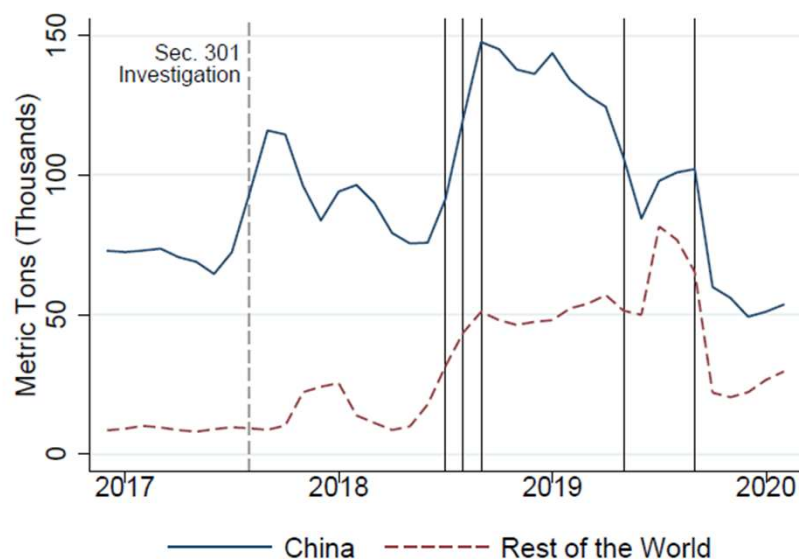
At the Store: Little Evidence of Spreading Price Increases



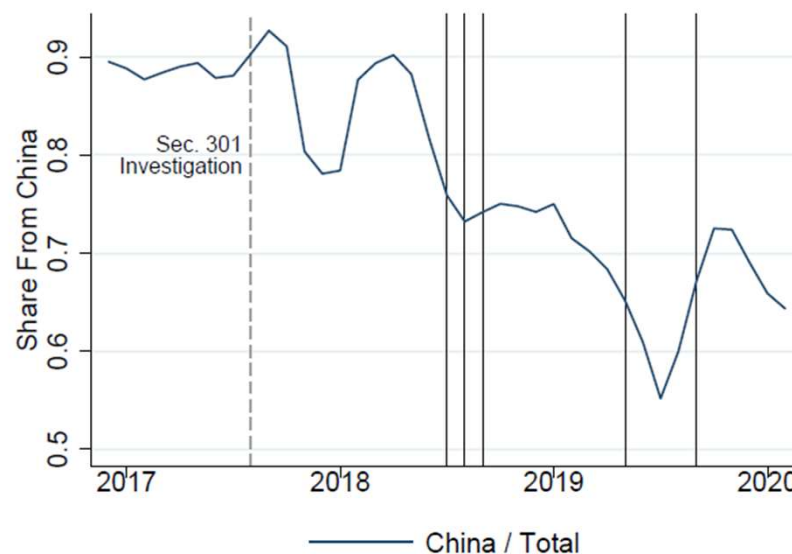
Figure 3(b): Retail Price Indices for Identical Products in US and Canada

- For a single retailer, we compare prices of 2500 identical goods sold in the US and Canada.
- Similar pattern suggests limited tariff passthrough to consumer prices via widespread price hikes that also include unaffected goods.

At the Store: Front Running and Trade Diversion



(a) Tons Imported, Thousands



(b) Share of Tons Imported from China

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

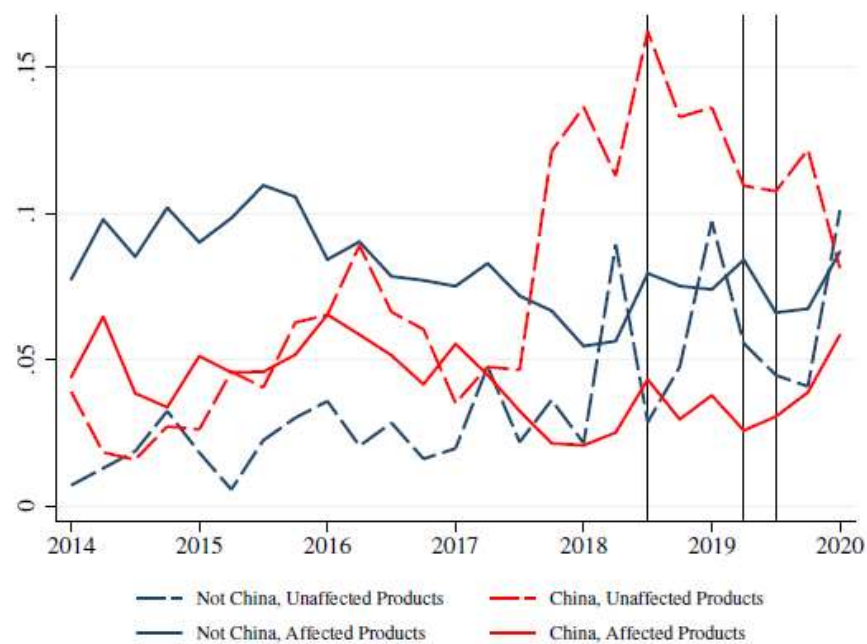
- Data from bills of lading shows that these two retailers increased the fraction of their imports from China in the period just before the tariffs.
- Import sourcing was diverted away from China after tariffs were introduced.

Closing Remarks

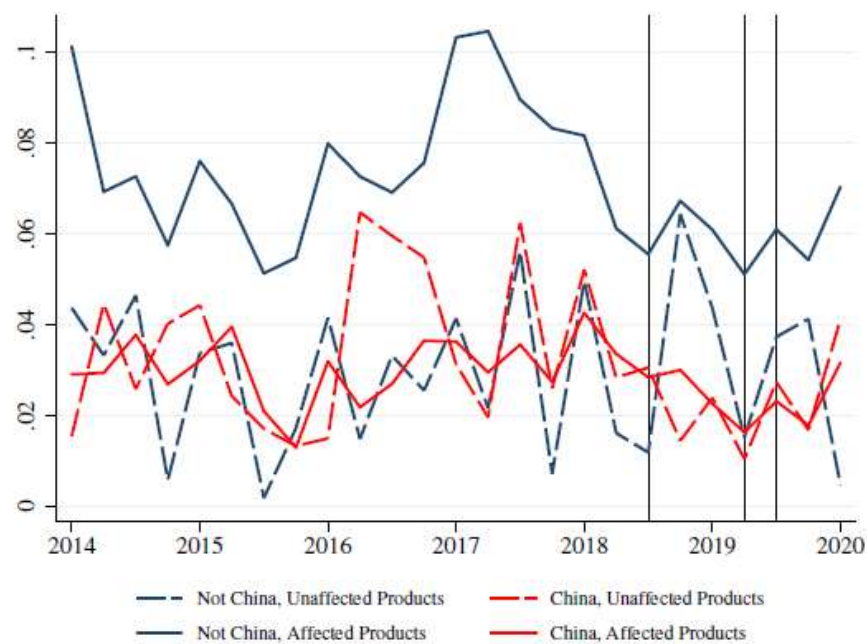
- Our results show that within the first year and a half of the trade war, the tariffs incidence has fallen mostly on US firms
 - Import prices have seen at most a small pre-tariff decline and the low passthrough of exchange rates means that the RMB's depreciation didn't offset these increases.
 - On the contrary, US exporters had to lower their prices as retaliatory tariffs were concentrated in undifferentiated goods.
 - Retailers have yet to pass most of their increased costs through to consumers.
- As the trade tensions continue and the tariffs are perceived to be more permanent, we expect:
 - More pressure on foreign exporters to reduce prices, as more firms are able to shift their supply chains.
 - More retail passthrough, as front-running is no longer possible and lower margins put pressure on firms' profits.

Appendix

At the Border: Price Change Frequency



(a) Price Decreases



(b) Price Increases

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

- Price stickiness did not change around introduction of tariffs.

At the Border: Steel Tariffs

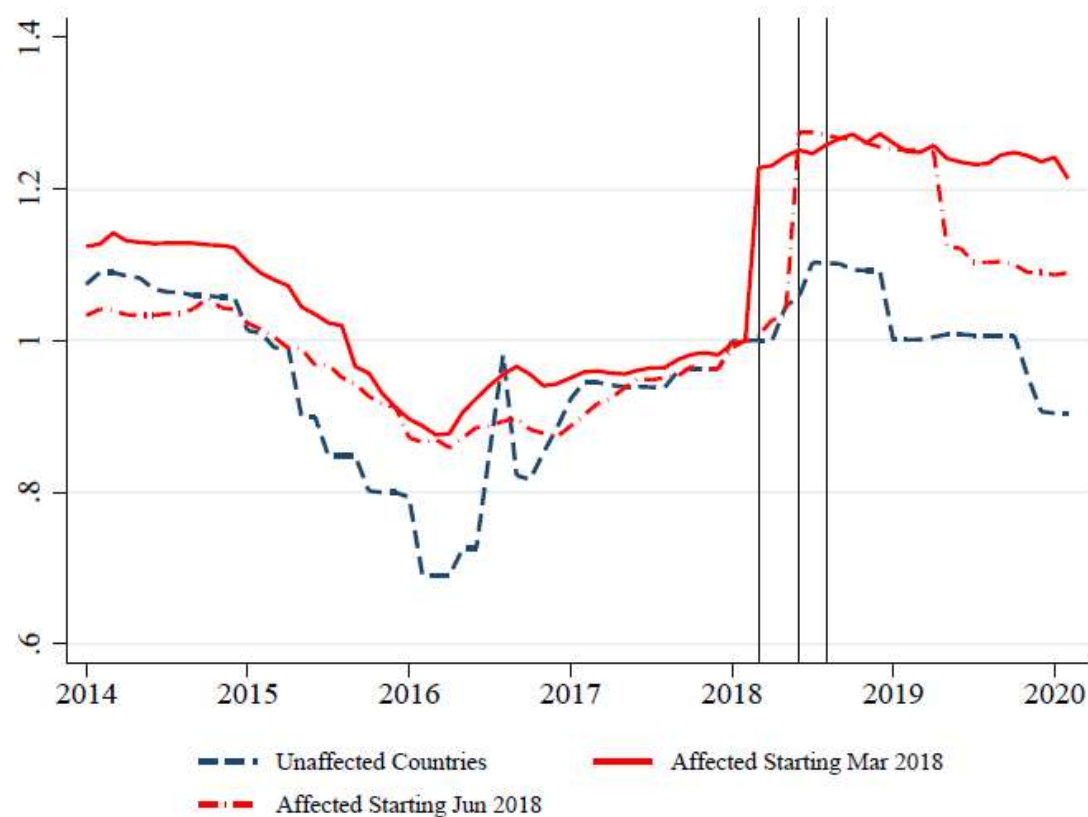


Figure A2: Steel Import Price Indices, by Tariff Wave

- Ex-tariff prices of steel imports similarly did not fall with tariffs introduction.

At the Border: Conditioning on Price Changes

$$\frac{1}{t_1 - t_0} \ln \left(\frac{P_{i,j,k,t_1}^I}{P_{i,j,k,t_0}^I} \right) = \delta_k^I + \phi_{CN}^{I,\Omega} + \phi_{CN}^{I,-\Omega} + \gamma^I \tau_{i,t_1} + \beta^{I,S} \frac{1}{t_1 - t_0} \ln \left(\frac{S_{j,t_1}}{S_{j,t_0}} \right) + \beta^{I,X} \frac{1}{t_1 - t_0} \ln \left(\frac{X_{j,t_1}}{X_{j,t_0}} \right) + \epsilon_{i,j,k,t_1,t_0}$$

| | | US Imports from China | | US Exports | |
|--------------|--------------------|-----------------------|---------|------------|---------|
| | | (1) | (2) | | |
| Tariffs | $12 \times \gamma$ | -0.193 | -0.094 | -0.656 | -0.505 |
| (Annualized) | | (0.138) | (0.147) | (0.144) | (0.139) |
| ERPT | β^S | | 0.365 | | 0.334 |
| | | | (0.052) | | (0.029) |
| PPI PT | β^X | | 0.651 | | 1.022 |
| | | | (0.098) | | (0.079) |
| Adj. R^2 | | 0.006 | 0.016 | 0.001 | 0.012 |
| Obs. | | 99,687 | 99,687 | 68,080 | 68,080 |

Regression Analysis Conditional on Price Changes

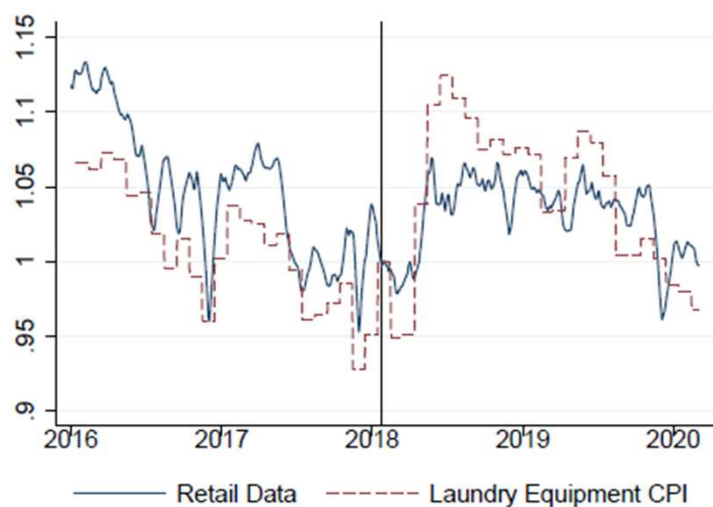
- Conclusions are robust to estimation using only price changes.

Retail Micro Data by Tariff Wave

| COICOP | Description | By Chinese Tariff | | | | | Total |
|--------|--|-------------------|--------|--------|--------|--------|-------|
| | | Not Affected | Jul-18 | Aug-18 | Sep-18 | Sep-19 | |
| 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

At the Store: A Closer Look at Washing Machines



(a) Price Indices

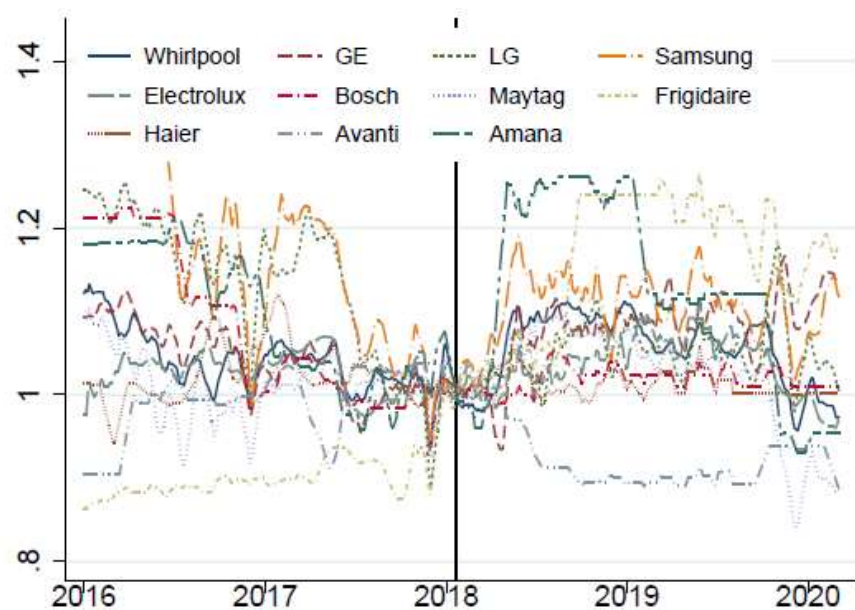


(b) Annual Inflation

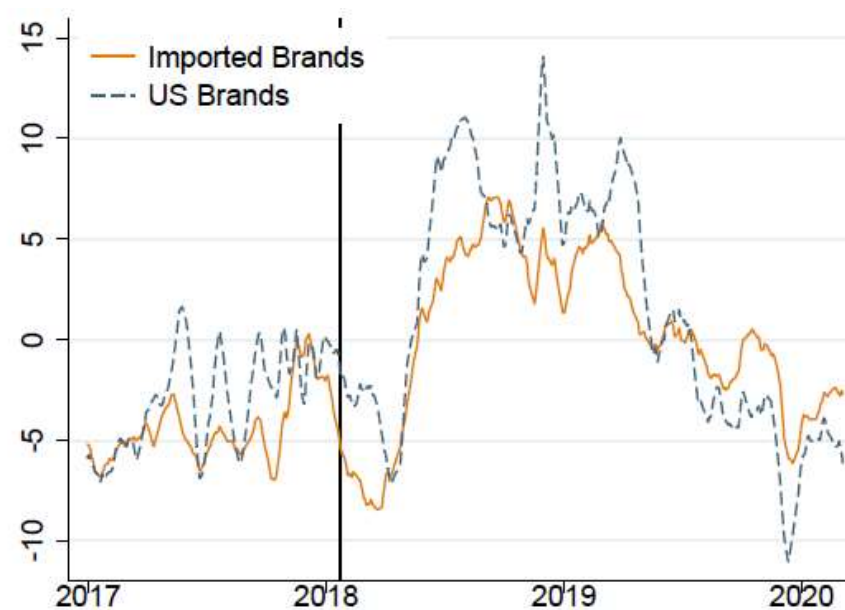
Figure A4: Retail Washing Machine Prices from the BPP and the CPI

- Our washing machine price index approximates the CPI for “Laundry Equipment”

At the Store: A Closer Look at Washing Machines



(a) Price Indices

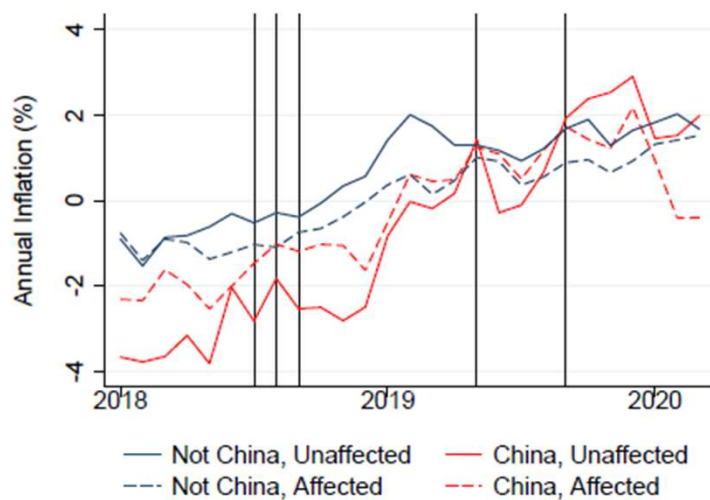


(b) Annual Inflation

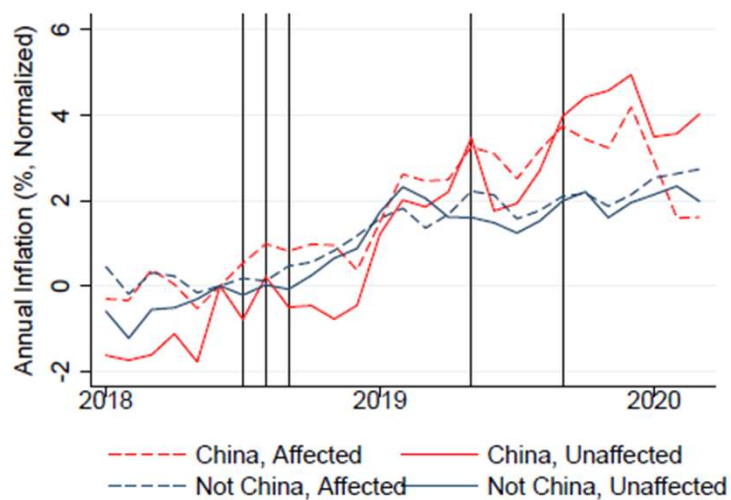
Figure A5: Retail Washing Machine Prices from the BPP, Variation Across Brands

- Aggregate index hides significant heterogeneity across brands
- Importantly, domestic brands saw the same price increases as imported foreign brands, consistent with Flaaen, Hortacsu, and Tintelnot (2019).

Annual Inflation Rates - 2 Large Retailers



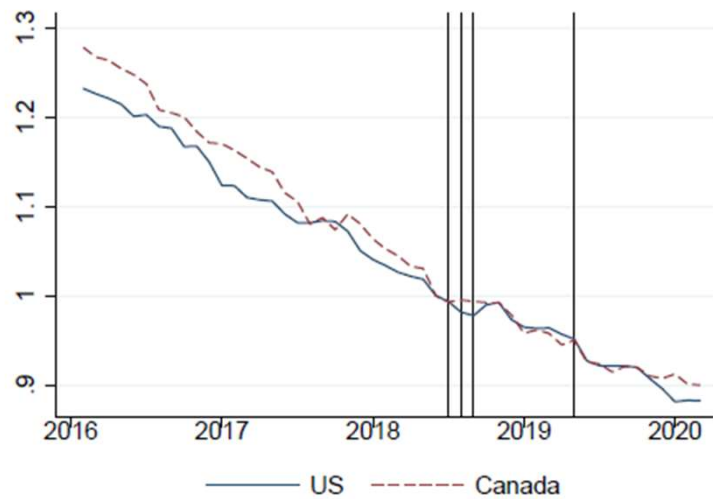
(a) Annual Inflation



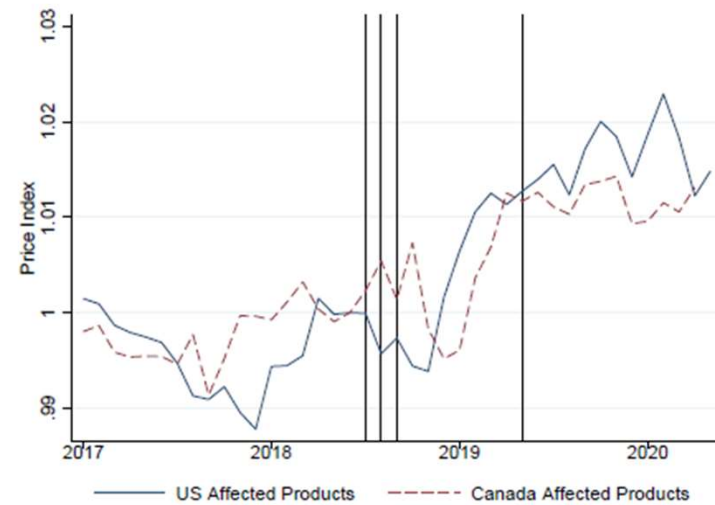
(b) Annual Inflation - Normalized

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

Additional US - Canada Price Index Comparisons



Multiple Retailers



Data from CPI