Who Pays for the Tariffs and Why? A Tale of Two Countries

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Trade, value chains and financial linkages in the global economy
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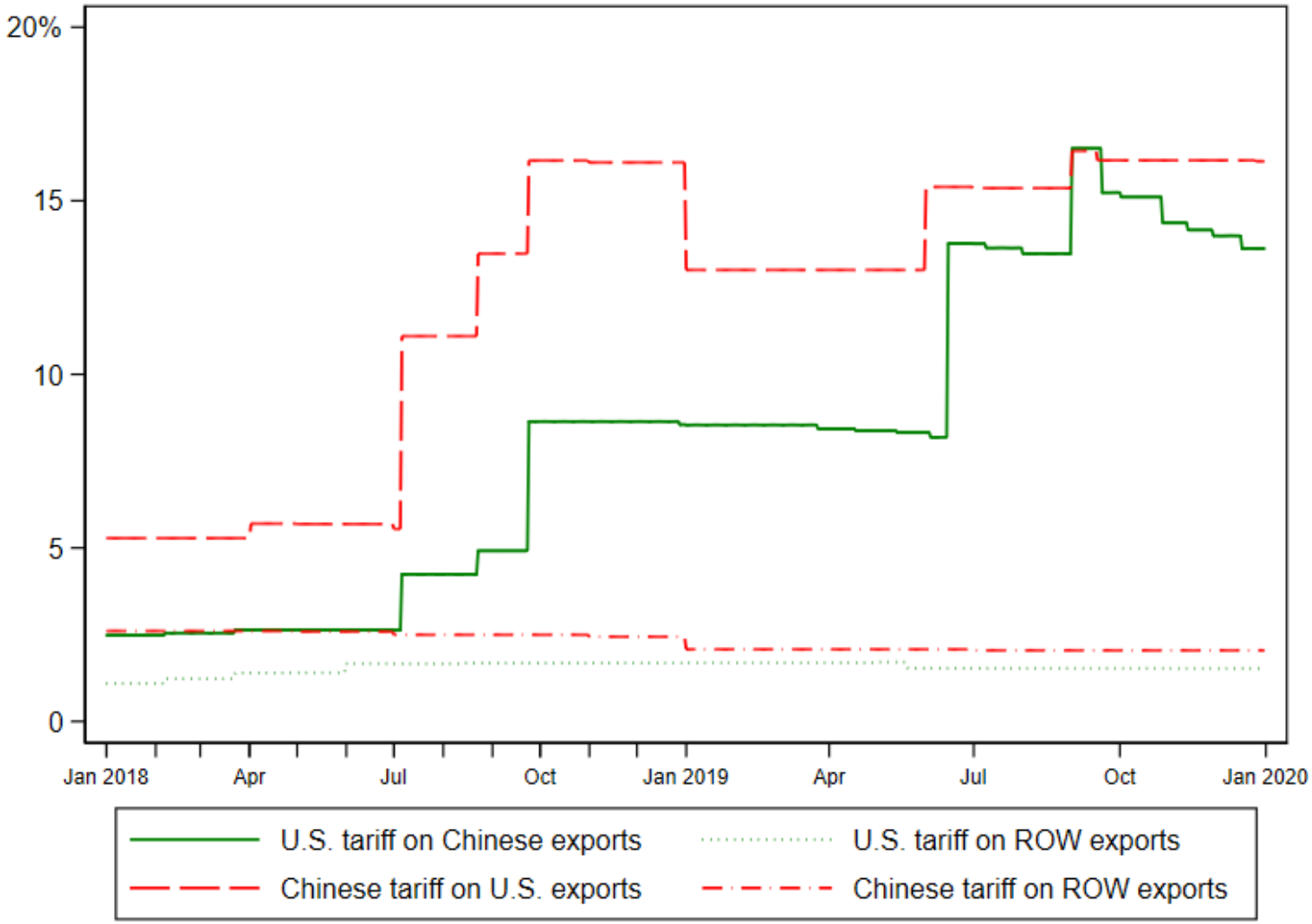
The US-China Trade War



Note: the figure shows the import-weighted tariffs enacted by China and the U.S. on each other, where the weights are the import share in 2017.

Research questions and main findings

Who pays for the tariffs? (importer vs. exporter) ▸ Pass-through %

- U.S. importers: 98%
- Chinese importers: 74%

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- The findings are puzzling
  - Why does the tariff pass-through differ in the two countries?
  - Why is the U.S. tariff complete pass-through complete?

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  - Why does the tariff pass-through differ in the two countries?
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Decomposition I: econometrics

- Import structure+product heterogeneity in pass-through+trade policy

Decomposition II: import demand and export supply elasticity

Literature review

Trade war

- U.S./Chinese tariff and U.S. data: Amiti, Redding, Weistein (2019); Blanchard, Bown and Chor (2019); Waugh (2019); Amiti, Kong, Weinstein (2020); Fajgelbaum, Goldberg, Kennedy, Khandelwal (2020); Jaccard (2021); Handley, Kamal, Monarch (2020); Huang, Lin, Liu, Tang (2020); Cavallo, Gopinath, Neiman, Tang (2021); Autor, Beck, Dorn, Hanson (2022); Flaaen and Pierce (2024); Fajgelbaum, Goldberg, Kennedy, Khandelwal, Taglioni (2024)
- U.S. tariffs & Chinese data: Chor and Li (2021); Jiao, Liu, Tian, Wang (2023); Du and Li (2023); Jiang, Lu, Song, Zhang (2023); Bao, Chen, Huang, Li, Wang (2024); Li, Lu, and Yin (2024)
- Chinese retaliatory tariffs: Ma and Xu (2021, May 2019); Yu, Tian, and Zheng (2021, export); Chang, Yao, Zheng (2020)
- Non-tariff barrier: Chen, Hsieh, and Song (2022)

Tariff pass-through

- e.g., Feenstra (1989), Irwin (2014), and Boehm, Levchenko, and Pandalai-Nayar (2020)

▸ Market structure

Contributions

Document a puzzling empirical finding

- Estimate tariff pass-through: U.S. (complete) vs. China (3/4)

Explore the determinants of tariff pass-through

- Decomposition I: import structure, trade policy, and product heterogeneity
- Decomposition II: import demand elasticity ane export supply elasticity under perfect competition

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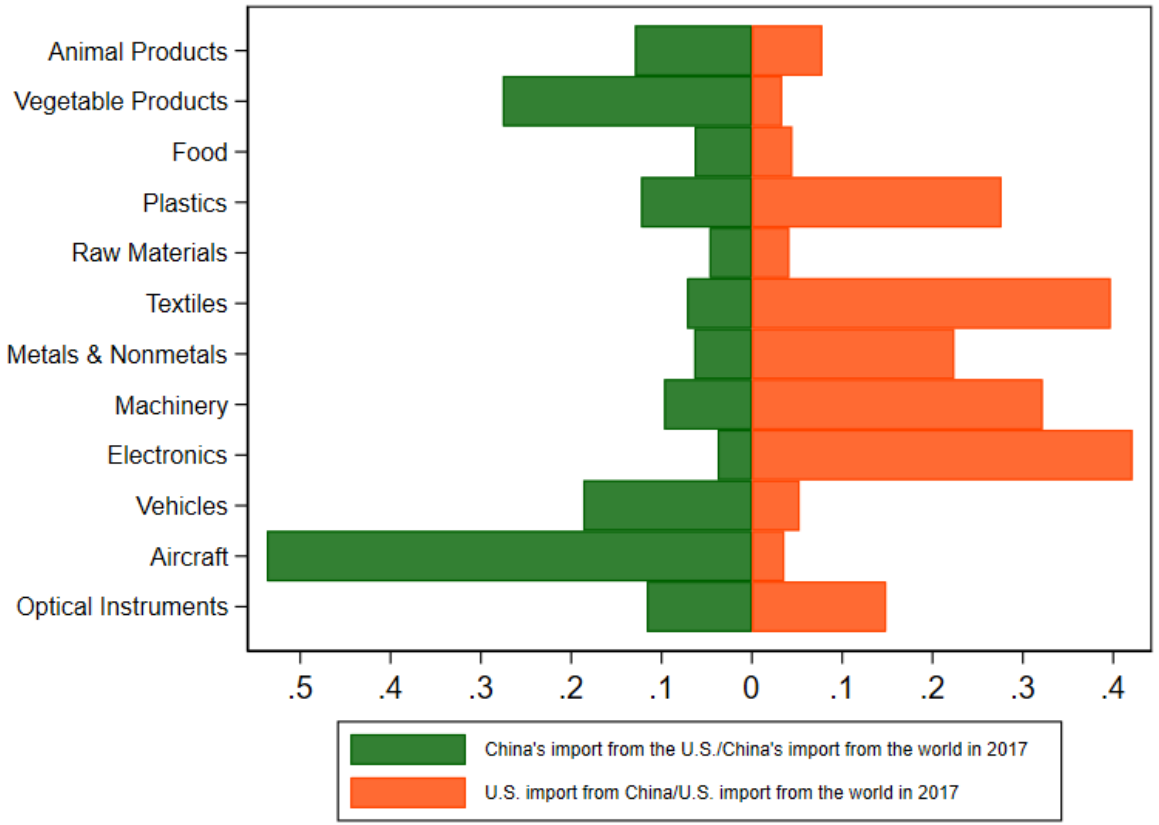
Key fact #1: import structure

- Major products China's import from the U.S
  - Agricultural products, optical instrument, aircraft, motor vehicles, nuclear reactors and machinery, electronic integrated circuits
- Major products the U.S. import from China
  - Shoes, clothes, mobile phones, and toys

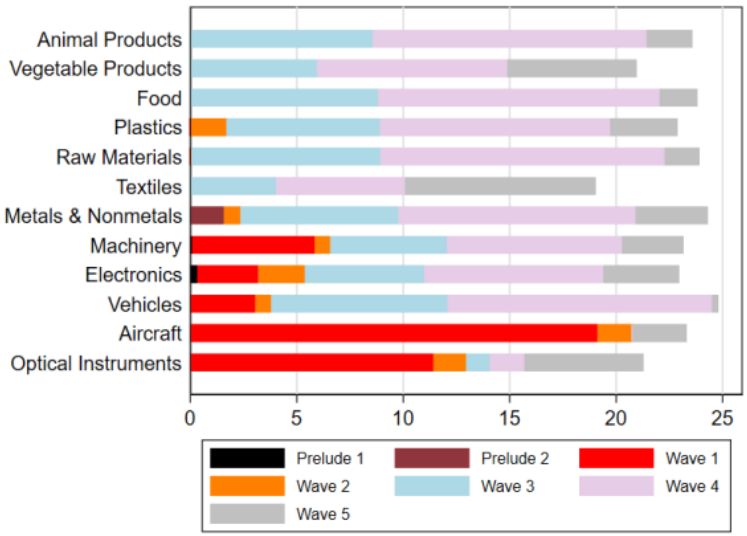


▸ Import share: substitutability ▸ Import value by product ▸ Import share by product

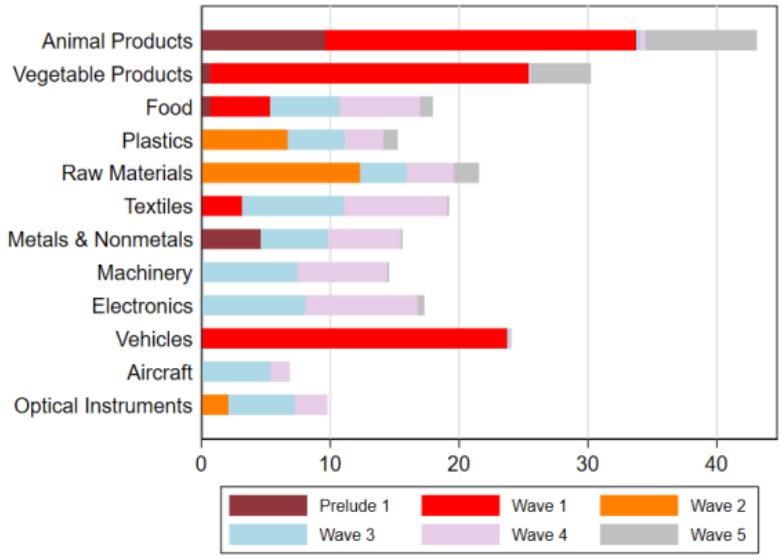
Key fact #2: trade policy (tariff)

- United States: high-end manufactured products (wave 1 & 2) ▸ Details
  - Prelude 1 & prelude 1: solar panel, washing machine, steel, and aluminum
  - Wave 1-5 (China): wave 1-2 (specific sectors) vs. wave 3-5 (general)
- China: agricultural products (prelude 1 & wave 1) ▸ Details
  - Prelude 1 & wave 1-2 (specific sectors) vs. wave 3-5 (general)

The U.S. tariffs vs. China's retaliatory tariffs in 2018



(b) U.S. tariff (%)



(a) Chinese retaliatory tariff(%)

▸ Share of products affected ▸ Econometric decomposition ▸ Exogeneity ▸ Determinants of tariff setting

The two countries' strategies

United States

- Target at high-tech sectors and ease future competition
  - Care less about trade deficit reduction
  - Avoid major imported products in the first few rounds
  - Care the economic interests of US imports (MNCs) and consumers

China

- Set tariffs in sectors with market power on the demand side
  - Hurt the U.S. as much as possible to stop the trade war
  - Target at major products imported from the United States (e.g., agricultural products and cars) with lower tariff pass-through rates.
  - Avoid products with low substitution (e.g., aircraft and chips)

▸ Product-level pass-through ▸ Import and PT

Data

Tariff

- Tariff escalation (2017-2019)
  - China's State Council and the U.S. International Trade Commission
  - HS 8-digit (10-digit product), trade partner, and date
  - Considers tariff exemption
- Baseline tariffs
  - Common practice: HS 6-digit annual MFN tariffs
  - Chinese MFN tariffs vary by HS 10-digit product and month considering monthly adjustments (e.g. July/December 2017, May/July/November 2018, and January/July 2019) ▸ MFN figure ▸ Regression
  - Chinese preferential tariffs (HS 10-digit, trade partner, and month), 42% of imports in 2017 (e.g., ASEAN, Korea, Australia)
  - U.S. MFN/preferential/specific/compound tariffs from USITC (HS 8-digit product, trade partner, and year)

Data

Import

- China Customs: 2017-2019
  - Value and quantity
  - by HS 8-digit, country, trading regime, and month
  - Firm, HS-8-digit product, and trade partner (2016)
- USITC: 2017-2019
  - Value and quantity
  - by HS 10-digit, by country, and month

▸ Data clean details

Sample period: 2017.01-2019.12

- Avoid the interference of the Covid-19
- In January 2020 the two country signed an agreement to halt further tariff escalations and the existing tariffs remained in place as of 2021.

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Econometric specification: tariff pass-through

$$\Delta_{12} \ln y_{igt} = \beta \Delta_{12} \ln \tau_{igt} + \eta_{gt} + \eta_{it} + \varepsilon_{igt}$$

- Δ_{12}: the difference operator between period t and $t-12$
- $\ln y_{igt}$ is China or the U.S.'s import value, or import quantity, or (tariff-exclusive and tariff-inclusive) import price of product g from exporting country i
- η_{gt}: product-time fixed effects ▸ Exogeneity discussion: tariff setting
- η_{it}: country-time fixed effects (e.g. exchange rate fluctuations) ▸ USD-CNY
- Weight: product-country-date level import in 2017

China's import market: tariff pass-through

Tariffs: 26% paid by exporters (Column 3) vs. 74% paid by importers (Column 4)

	(1)	(2)	(3)	(4)	(5)	(6)
(1) = (2) + (3)	$\Delta_{12}\ln(p^*_{igt}q_{igt})$	$\Delta_{12}\ln(q_{igt})$	$\Delta_{12}\ln(p^*_{igt})$	$\Delta_{12}\ln(p_{igt})$	$\Delta_{12}\ln(p^*_{igt})$	$\Delta_{12}\ln(q_{igt})$
$\Delta_{12}\ln(1+\tau_{igt})$	-2.49***	-2.23***	-0.26**	0.74***		
	(0.57)	(0.54)	(0.11)	(0.11)		
$\Delta_{12}\ln(q_{igt})$					0.12***	
					(0.05)	
$\Delta_{12}\ln(p_{igt})$						-3.03***
						(0.92)
Observations	1,093,446	1,093,446	1,093,446	1,093,446	1,093,446	1,093,446
R-squared	0.45	0.43	0.44	0.44	-0.27	-0.60
F stat for H_0: pass-through =1				6.20**		
HS-8 Product FE	YES	YES	YES	YES	YES	YES
HS-6 Product × Year-month FE	YES	YES	YES	YES	YES	YES
Country × Year-month FE	YES	YES	YES	YES	YES	YES

Notes: Regressions are weighted by product-level annual import data. The sample covers China's monthly variety-level import data from all countries from 2017:1 to 2019:12. Any observations with a ratio of unit values in t relative to $t-12$ greater than 3 or less than 1/3 are dropped.

▸ Summary of findings ▸ Econometric specification ▸ Estimate elasticities ▸ Compositional effect: no weights ▸ Graphic illustration: elasticity

Perfect competition:

Foreign export supply elasticity: 8.33=1/0.12 (Column 5); first stage (Column 2)

Import demand elasticity: 3.03 (Column 6); first stage (Column 4)

Tariff pass-through: $\beta = 0.73 = 1/\left[1+\left(\epsilon^D/\epsilon^S\right)\right] = 1/(1+3.03/8.33)$

The U.S import market: tariff pass-through

The U.S. importers bear most of the tariff burden

$(1) = (2) + (3)$	(1) $\Delta_{12} \ln\left(p^*_{igt} q_{igt}\right)$	(2) $\Delta_{12} \ln\left(q_{igt}\right)$	(3) $\Delta_{12} \ln\left(p^*_{igt}\right)$	(4) $\Delta_{12} \ln\left(p_{igt}\right)$	(5) $\Delta_{12} \ln\left(p^*_{igt}\right)$	(6) $\Delta_{12} \ln\left(q_{igt}\right)$
$\Delta_{12} \ln(1+\tau_{igt})$	-2.01***	-1.99***	-0.02	0.98***		
	(0.25)	(0.28)	(0.07)	(0.07)		
$\Delta_{12} \ln\left(q_{igt}\right)$					0.01	
					(0.03)	
$\Delta_{12} \ln\left(p_{igt}\right)$						-2.02***
						(0.24)
Observations	1,723,720	1,723,720	1,723,720	1,723,720	1,723,720	1,723,720
R-squared	0.32	0.3	0.3	0.31	-0.01	-0.20
F stat for H_0: pass-through $=1$				0.07		
HS-10 Product FE	YES	YES	YES	YES	YES	YES
HS-6 Product $\times$ Year-month FE	YES	YES	YES	YES	YES	YES
Country $\times$ Year-month FE	YES	YES	YES	YES	YES	YES

Notes: Regressions are weighted by product-level annual import data. The sample covers the U.S.'s monthly variety-level import data from all countries from 2017:1 to 2019:12. Any observations with a ratio of unit values in t relative to $t-12$ greater than 3 or less than 1/3 are dropped.

Perfect competition: ▸ Discussion: elasticity

Foreign export supply elasticity: 100=1/0.01 (Column 5); first stage (Column 2)

Import demand elasticity: 2.02 (Column 6); first stage (Column 4)

$\beta = 0.98 = 1/\left[1 + \left(\epsilon^D/\epsilon^S\right)\right] = 1/(1 + 2.02/100)$

Summary of the key findings

- Tariff pass-through ▸ Baseline: China vs. United States ▸ Summary statistics
- Exogeneity ▸ Discussion
  - Anticipation effect: event study ▸ Go
  - Pre-trends: placebo test ▸ Go
  - Lobby: additional product fixed effects ▸ Go
  - Exchange rate ▸ Go
  - Tariff: endogeneity ▸ Pass-through: China vs. US (no correlation)
- Robustness checks
  - Different horizons: month-to-month change ▸ Go
  - Outliers: winsor ▸ Go
  - Alternative sample: continuous products ▸ Go
  - Zero import value: log change vs. inverse hypobolic sign ▸ Go
  - Alternative specification: level of aggregation ▸ Go
  - Compositional effect ▸ Go
  - Alternative weights and fixed effects ▸ Go
- Welfare analysis ▸ Welfare ▸ Welfare: parameters ▸ Welfare: parameters

Summary of the key findings

- More robustness checks
  - Alternative method of calculating tariffs ▸ No weight: exclude minor products
  - Sub-sample
    - G7 ▸ Go
    - KL ratio ▸ Go
  - Elasticities and welfare estimation
    - Export supply elasticity ▸ Go
    - Import demand elasticity ▸ Go
    - Product elasticity ▸ Go
    - Import elasticity ▸ Go

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Why are Pass-through Rates Different in China and the U.S.

U.S. vs China: ▸ Baseline results: China vs. U.S. ▸ Import structure and PT

- Import structure s_g: ▸ skewed import distribution ▸ weights
- Product heterogeneity in tariff pass-through β_g ▸ PT by product
- Trade policy $\frac{\text{Var}_g(X)}{\text{Var}(X)}$: China vs. the U.S. ▸ background

Single continuous regressor ▸ Generalization
Let $Y = X\beta_g + \varepsilon$ for $g = 1, 2$, and $X \in \mathbb{R}^1$,

$$\begin{aligned}\text{plim}_{n\to\infty} \hat{\beta} &= \mathbb{E}\left(XX'\right)^{-1}\left(s_1\mathbb{E}_1\left(XX'\right)\beta_1 + s_2\mathbb{E}_2\left(XX'\right)\beta_2\right) \\ &= s_1\beta_1\frac{\text{Var}_1(X)}{\text{Var}(X)} + s_2\beta_2\frac{\text{Var}_2(X)}{\text{Var}(X)}.\end{aligned}$$

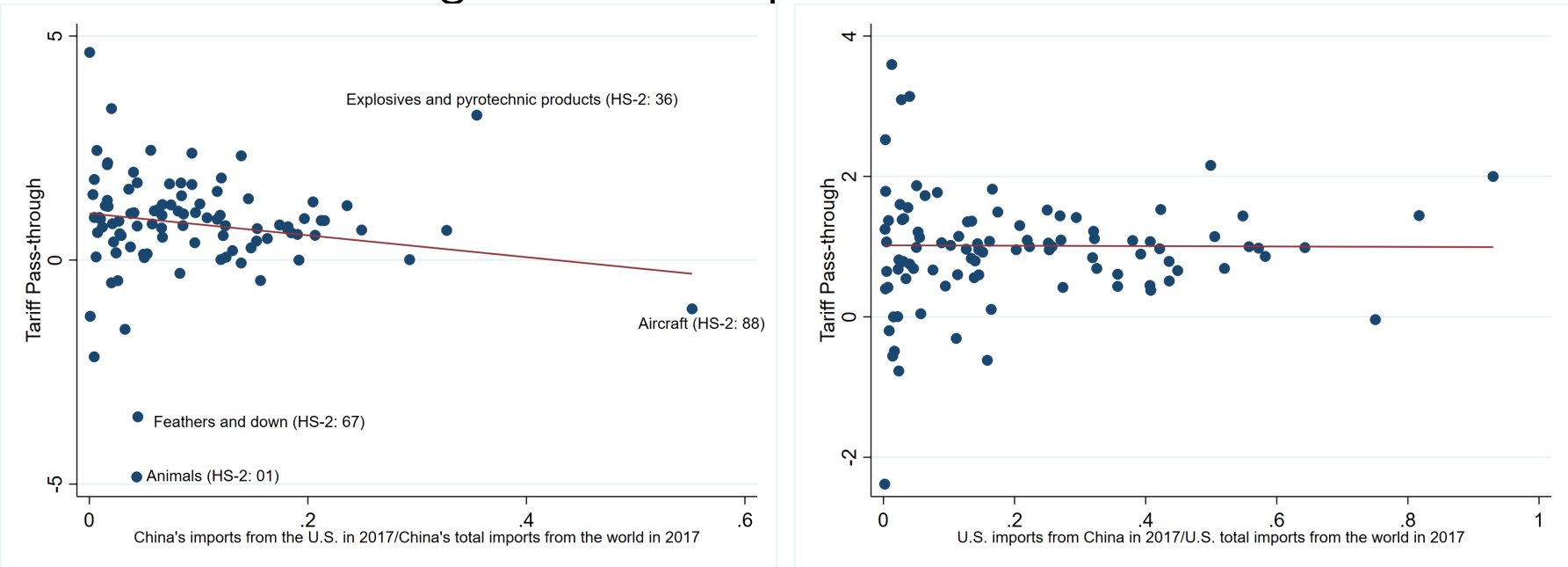
Import structure

Composition effect (between-product) ▸ Econometric decomposition

- China imported more products with low tariff pass-through.

▸ Background ▸ Import distribution ▸ Aircraft

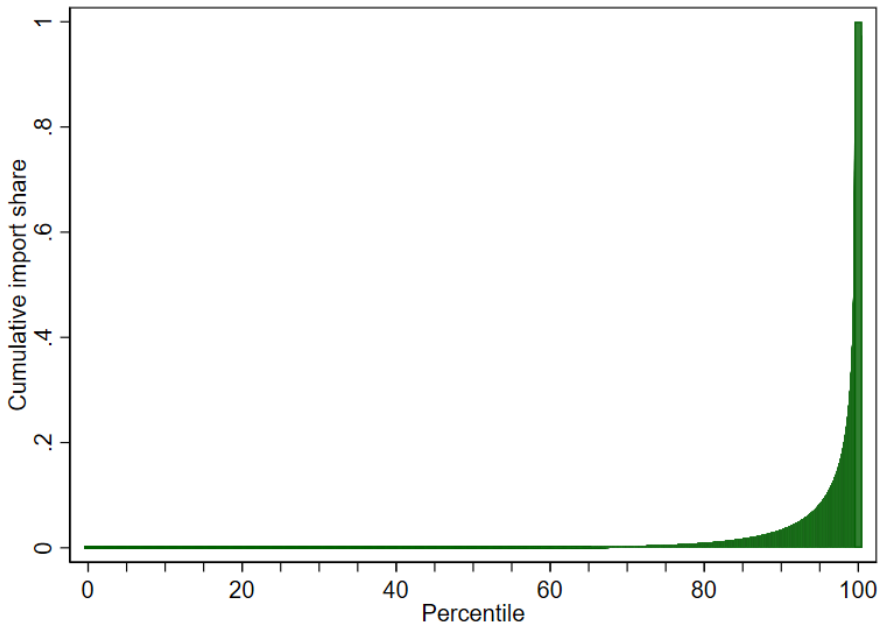
Pass-through rate and import share: China vs. U.S.

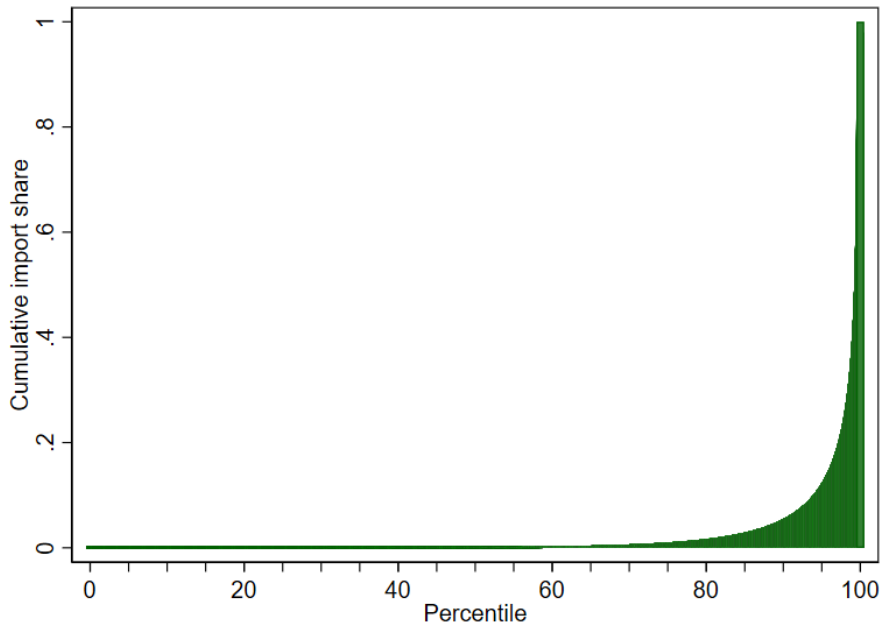


This figure shows the scatter plot between the pass-through rates and import share at the HS-2 level. We calculate the tariff pass-through for each HS-2 product category by regressing the one-month log change of tariff-inclusive unit value on the one-month log change of import tariff.

Import structure

Accumulated import shares: China vs. United States



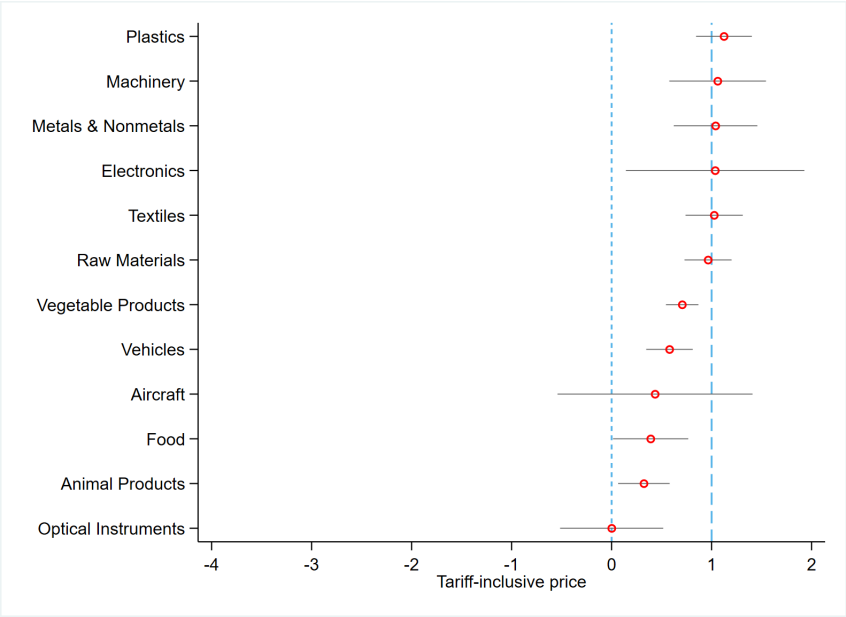


▸ Econometric decomposition ▸ Import share and pass-through

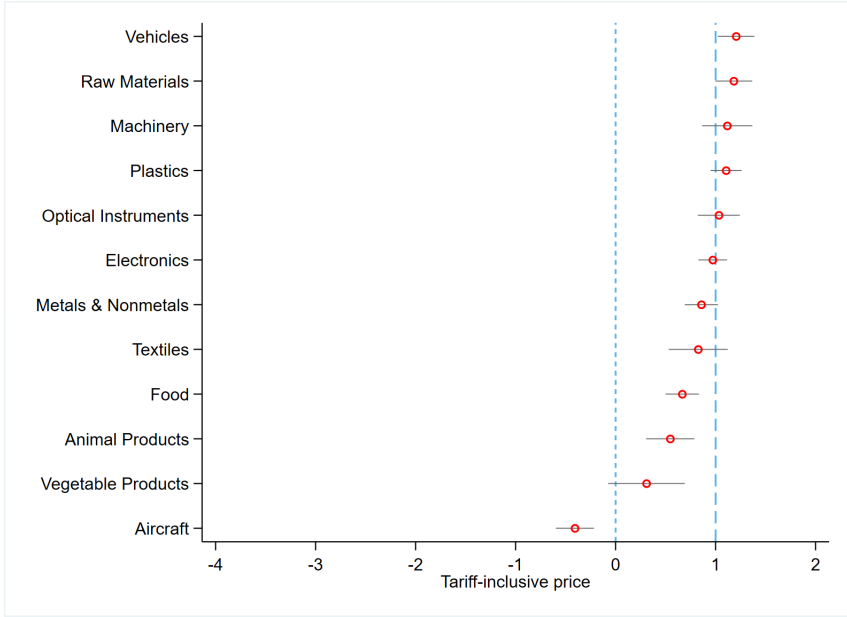
Product-level tariff pass-through rates

- Large product heterogeneity in tariff pass-through ▸ Econometric decomposition

Tariff pass-through by industry: China vs the U.S.



(a) Chinese retaliatory tariffs



(b) U.S. import tariffs

▸ Regression ▸ Import share and PT ▸ Elasticities: by product (figure) ▸ Aircraft

- Different tariff regimes ▸ Background: two countries' strategies

Weights

Compare results with and without weights (Solon, Haider, and Wooldridge, 2015) ▸ Back to econometric decomposition ▸ Back to baseline: China

- China: higher vs. lower tariff pass-through rates
- U.S.: complete pass-through rates

	(1)	(2)	(3)	(4)
			$\Delta_{12} \ln(p_{igt})$	
Sample	Full Sample	Full Sample	Full Sample	Samples excluding aircraft
Weight	Import in 2017	No weight	Import in the last year	Import in 2017
Panel A. China				
$\Delta_{12} \ln(1+\tau_{igt})$	0.74***	1.17***	0.78***	0.73***
	(0.11)	(0.04)	(0.11)	(0.11)
Observations	1,093,446	1,093,446	1,028,588	1,090,725
R-squared	0.44	0.1	0.47	0.44
F stat for H_0: pass-through =1	6.20**	19.28***	3.58*	5.66**
HS-8 Product FE	YES	YES	YES	YES
HS-6 Product × Year-month FE	YES	YES	YES	YES
Country × Year-month FE	YES	YES	YES	YES
Panel B. United States				
$\Delta_{12} \ln(1+\tau_{igt})$	0.98***	0.96***	0.97***	1.00***
	(0.07)	(0.02)	(0.06)	(0.06)
Observations	1,723,720	1,723,720	1,641,824	1,715,012
R-squared	0.31	0.08	0.34	0.32
F stat for H_0: pass-through =1	0.07	5.80**	0.26	0.003
HS-10 Product FE	YES	YES	YES	YES
HS-6 Product × Year-month FE	YES	YES	YES	YES
Country × Year-month FE	YES	YES	YES	YES

Why are pass-through rates different across products?

Mechanism ▸ Back to elasticity

- Inelastic demand and elastic supply? ▸ Go
- Sticky prices?
  - Jiao et al. (2020): 21% of 600 surveyed Chinese firms had inflexibility to adjust prices
  - Imports quantity fell sharply with the tariffs (Amiti et al., 2019; Fajgelbaum et al., 2020)
    ▸ Product-time fixed effects ▸ Event study
- Market structure (Li, Lu, Yin, 2024): U-shaped
- Composition effect? ▸ Go
- Level of aggregation? ▸ Go
- Global value chain? ▸ Go

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Decompose pass-through rate

Tariff pass-through under perfect competition (Weyl and Fabinger, 2013)

▸ Baseline ▸ Discussion on product heterogeneity ▸ Elasticities: by product (figure) ▸ Graphic illustration: elasticity

$$\beta = 1/\left[1 + \left(\epsilon^D/\epsilon^S\right)\right]$$

We identify the structural supply & demand elasticities using tariffs as IVs (Zoutman, Gavrilova, and Hopland, 2018) ▸ Identify two elasticities using one IV

$$\Delta_{12} \ln q_{igt} = \eta^D_{gt} + \eta^D_{it} + \eta^D_{ig} - \epsilon^D \Delta_{12} \ln p_{igt} + \varepsilon^D_{igt}$$

$$\Delta_{12} \ln p^*_{igt} = \eta^S_{gt} + \eta^S_{it} + \eta^S_{ig} + 1/\epsilon^S \Delta_{12} \ln q_{igt} + \varepsilon^S_{igt}$$

- Import demand elasticity ϵ^D is identified by instrumenting the duty-inclusive price $\Delta_{12} p_{igt}$ (price faced paid by importers) with tariff $\Delta_{12}\tau_{igt}$
- Export supply elasticity ϵ^S is identified by instrumenting the import quantity $\Delta_{12} q_{igt}$ with tariff $\Delta_{12}\tau_{igt}$. p^*_{igt} is the duty-exclusive import price of product g from exporting country i.
- $\eta^y_{gt}/\eta^y_{it}/\eta^y_{ig}$: product-time/country-time/country-product fixed effects

Elasticity: China vs. the U.S.

The more inelastic side bears more tariff burden. ▸ Elasticities: China vs. U.S.

$$\beta = 1/\left[1 + \left(\epsilon^D/\epsilon^S\right)\right]$$

Import demand elasticity

- China: 3.03
- U.S.: 2.02

Foreign export supply elasticity

- China: 8.33
- U.S.: 100

Product heterogeneity ▸ Elasticities: by product (regression) ▸ Substitutability: import share

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Conclusion

Who pays the tariffs?

- United States importers: complete tariff pass-through (98%)
- Chinese importers: 74%

Why are tariff pass-through rates different in China and the U.S.?

- Different import structure
- Product heterogeneity
- Different trade policy

Why are tariff pass-through rates different across countries/products?

- Import demand elasticity and export supply elasticity