From Border to Basket: Pass-through of U.S. Trade Policy to Consumers

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Disentangling Incidence of Import Tariffs

- Who pays for import tariffs?
  - Existing evidence from U.S.-China trade war: U.S. importers paid fully for import tariffs applied to Chinese goods
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  - Evidence is scarce, and existing estimates suggest retail price elasticity ~ 0
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- But this is only one of many possible reasons for discrepancy between the retail price elasticity and the border price elasticity of tariffs

This Paper

- Link U.S. scanner data to barcode country of origin and tariff data
  - Estimate pass-through and substitution at U.S. stores in response to the 2018-2019 U.S.-China trade war
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- Within barcodes, we document tariff pass-through into retail prices of $\sim$15%
  - Moderate quantity response (implied price elasticity between 2 and 3)
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  - Anti-competitive effects, increased domestic costs of production and tariff "smoothing" unable to explain discrepancy
- Accounting for product replacement bias and the foreign cost share of retail prices, we cannot reject complete pass-through into retail prices
  - Endogenous product turn-over and "shrinkflation" $\rightarrow$ $\sim$33%-54% retail pass-through
  - Foreign cost share estimate from linking scanner data to customs prices $\sim$30%-50%

Related literature

- Growing literature on the economic effects of tariffs
  - Pass-through into border prices: Amiti et al (2019); Amiti et al (2020); Fagjelbaum et al (2021)
  - Pass-through into retail prices: Flaaen et al (2020); Cavallo et al (2021)
  - Reallocation of trade flows, effects on employment and production, etc. (e.g. Flaaen and Pierce (2025), Fajgelbaum et al (2024)
  - See Fajgelbaum and Khandelwal (2022) for review of literature up to 2022
- Product turnover and inflation measurement (Rotemberg (2005), Nakamura and Steinsson (2011), Nakamura and Steinsson (2012))
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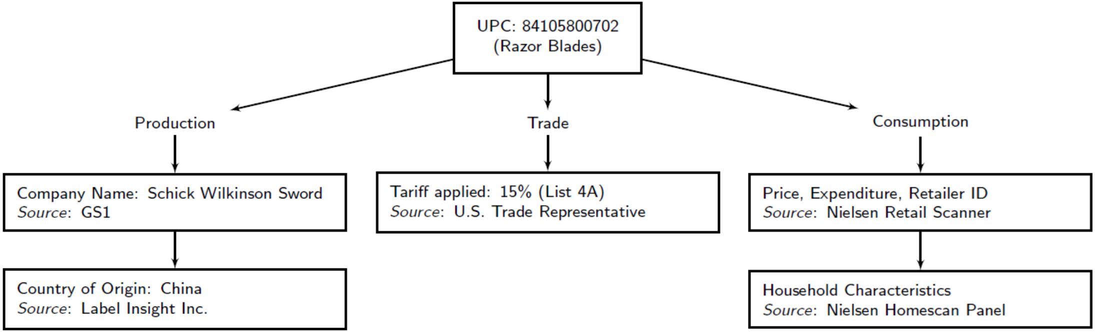
- Not covered today: heterogeneous pass-through by firm and retailer market share
  - Atkeson and Burstein (2008); Alviarez et al (2024)

Datasets

- NielsenIQ Retailer Panel:
  - Weekly price and sales data at store-barcode level
  - Approximately 3M barcodes and 50k stores over 2015-2020
  - 30% of all U.S. mass merchandise sales volume
- Label Insight, origin data for large retailer, and GS1:
  - Barcode-specific production origin country recovered from packaging statement ("Made in China", etc.)
  - Firm name and information from GS1
- NielsenIQ places barcodes into "Product Modules"
  - "Dry Pasta", "Soft Drinks", "Beer", "Deodorant", etc.
  - Bai and Stumpner (2019) manually map product modules to HS6 sector definitions
    - ★ We augment by mapping modules to HS8 classifications

Example of Dataset Taxonomy for Razor Blade UPC

Figure: Taxonomy of Datasets

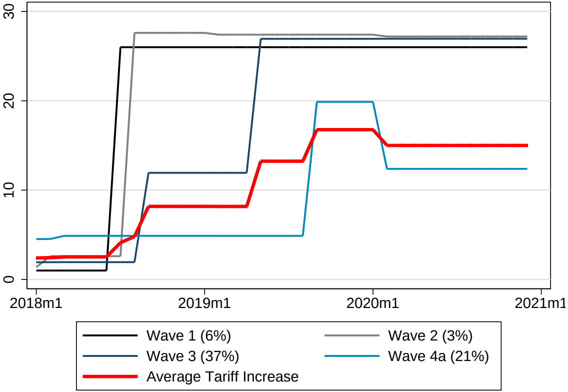


Sample (I)

- Focus on balanced panel of stores w/ non-zero sales in all months of 2015-2020
  - $\sim$30k stores; 68 individual retail chains
- Aggregate scanner data to barcode-by-retailer-by-month level
  - Barcode i at chain r in month t
  - Barcode i belongs to product category $c(i)$ and is produced in country $j(i)$, such that tariff rate $\tau_{j(i)c(i)t}$ is at the category-country-month level
- Per-year sample averages (unbalanced panel):
  - 220k barcodes produced by 13k firms representing 2/3 of all recorded sales in NielsenIQ retailer panel
- Tariff waves 1 and 2 were mostly intermediate/capital goods with poor representation in scanner data
  - We focus on products targeted in waves 3 and 4a

Distribution by Department

2018/19 U.S. Tariff Waves against China



- Rroughly 1/3 of US imports from China were never taxed (list 4b) and serve as the control group

Empirical Framework: Barcode-Level Pass-through and Substitution

- Triple-difference identification strategy at the barcode-retailer level
  - Similar to research design in Flaaen et al (2020) and Cavallo et al (2021)
- Consider outcome y_{irt} for barcode i sold at retail chain r in month t
  - i is from origin country $j(i)$ and belongs to product category $c(i)$
- Apply OLS to following empirical model:

$$\ln(y_{irt}) = \beta \ln(1 + \tau_{j(i)c(i)t}) + \alpha_{irt} + \gamma_{i,q(t)} + \epsilon_{irt}$$

- Where α_{irt} denotes fixed effects:

$$\alpha_{irt} = \alpha_{ir} + \alpha_{rt} + \alpha_{c(i),t} + \alpha_{j(i),t}$$

Comparison to Cavallo et al (2021)

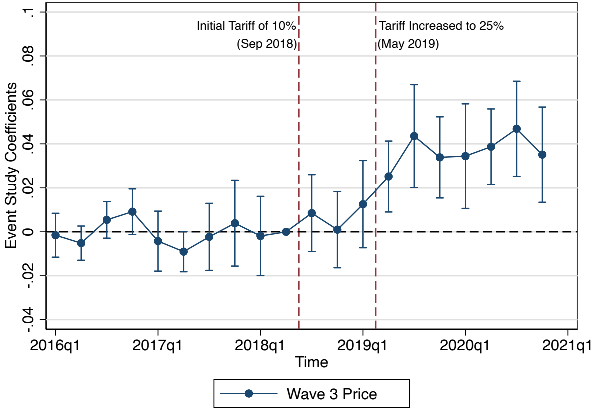
Fixed Effects, Controls, and Interpretation

- Notice that this identification strategy is akin to a triple-difference:
  - We include barcode-retailer, retailer-month, category-month, and country-month fixed effects
  - Compare outcome of China barcode in category $c(i)$ to non-China barcodes within same tariff-affected category
  - Compare to same difference in non-tariff categories sold within same retail chain before and after tariff change
- $\gamma_{i,q(t)}$ denote seasonality controls
  - We interact each quarter of the year $q(t)$ with dummy for whether barcode is from China and specific tariff wave
  - In practice, only Chinese goods are targeted in Waves 3 and 4a

Additional Seasonality Details

Event Study Estimates: Barcode-Level Pass-through and Substitution

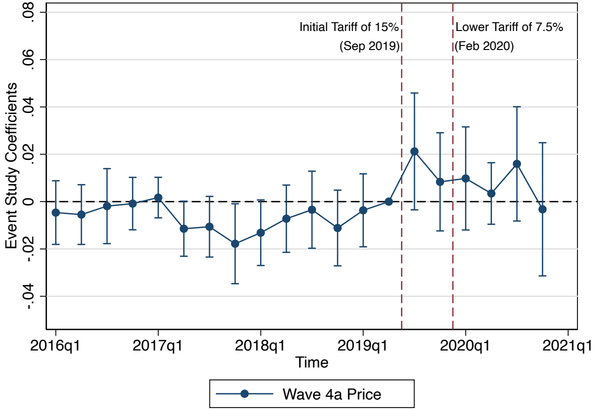
Figure: Barcode-Level Price: Wave 3



Quantity graphs

Event Study Estimates: Barcode-Level Pass-through and Substitution

Figure: Barcode-Level Price: Wave 4a



Quantity graphs

Triple-Difference Estimates: Barcode Pass-through and Substitution

Table: Estimates of Tariff Pass-through and Substitution for Continuing Barcodes

	(1) log Price	(2) log Price	(3) log Price	(4) log Quantity	(5) log Quantity	(6) log Quantity
$\log(1+\tau)$	0.154***			-0.265*		
	(0.036)			(0.154)		
$\log(1+\tau) \times$ Wave 3		0.153***	0.155***		-0.266*	-0.438**
		(0.036)	(0.038)		(0.154)	(0.181)
$\log(1+\tau) \times$ Wave 4		0.096			-0.323	
		(0.064)			(0.269)	
Wave 3 only			✓			✓
Sample			≤2019			≤2019
Fixed Effects (α_{irt})	✓	✓	✓	✓	✓	✓
R^2	1.00	1.00	1.00	0.97	0.97	0.98
Observations	34911382	34911382	16622973	34911382	34911382	16622973

*Notes: Columns (1)-(3) define y_{irt} as the average price at barcode-retailer-month irt. Columns (4)-(6) define y_{irt} as quantity of units sold. The interactions depict an interaction between tariff changes and an indicator for that tariff change being associated with wave 3 or wave 4a. Standard errors clustered at the barcode-retailer-pair level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.*

Within-Barcode Tariff Elasticity of Retail Prices

- Average pass-through 15%, demand elasticity between 2 and 3
  - First evidence of positive pass-through into retail prices, but small compared to 100% at the border
- We consider three potential sources of downward bias in these estimates due to contamination of control group:
  1. Anti-competitive effects Anti-Competitive
  2. Retailers spreading tariff shocks across many goods Smoothing Tariffs
  3. Imported intermediate goods Comparison to other Imported Products

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  3. Imported intermediate goods Comparison to other Imported Products
- No evidence for any appreciable effect of these three sources of bias
- Instead, focus on two relatively understudied sources of discrepancy between store and border prices:
  - Product replacement bias
  - The foreign cost share of retail prices

Product Turnover, Replacement Bias, and "Shrinkflation"

- Main estimation focuses on pass-through of tariffs within the same barcode
  - Not exactly comparable to the unit values recorded in customs data
  - Potentially a problem if product turn-over is dominant mechanism for achieving pass-through (Nakamura and Steinsson (2012))

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  - We also consider an exact decomposition of unit value pass-through into the numerator and denominator tariff elasticity ("sticker price" versus average package size)

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  - We also consider an exact decomposition of unit value pass-through into the numerator and denominator tariff elasticity ("sticker price" versus average package size)
- For outcome y_{jcrt}, estimate triple-difference model:

$$\ln y_{jcrt} = \beta \ln(1 + \tau_{jct}) + \alpha_{jcrt} + \gamma_{jc,q(t)} + \epsilon_{jcrt}$$

$$\alpha_{jcrt} = \alpha_{jcr} + \alpha_{rt} + \alpha_{ct} + \alpha_{jt}$$

Decomposition Details

Pass-through into Unit Values and Decomposition

Table: Category-Level Pass-through and Compositional Effects

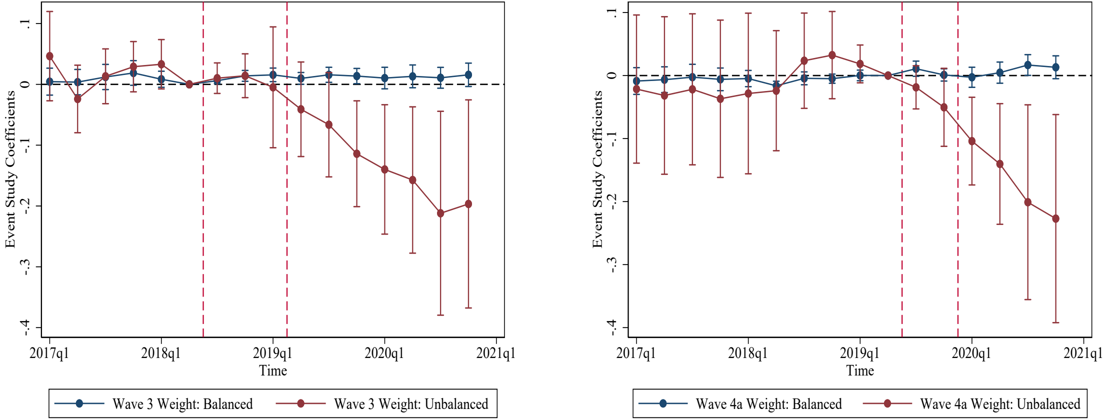
	(1) Log Price	(2) Log Price	(3) Log Quantity	(4) Log Quantity	(5) Log Price	(6) Log Price	(7) Log Weight	(8) Log Weight
$\log(1+\tau)$	0.086*	0.327*	-0.151	-0.259	0.060	-0.108	-0.026	-0.435**
	(0.045)	(0.180)	(0.174)	(0.395)	(0.038)	(0.096)	(0.039)	(0.185)
Balanced	✓		✓		✓		✓	
Unbalanced		✓		✓		✓		✓
Price per weight	✓	✓						
Raw sticker price					✓	✓		
R^2	1	1	1	1	1	1	1	1
Observations	2,705,306	2,705,306	2,705,306	2,705,306	2,705,306	2,705,306	2,705,306	2,705,306

*Notes: All models include fixed effects by country-category-retailer, retailer-month, category-month, and country-month. From left to right, dependent variables are: average price per unit weight, total quantity sold (in units of weight), average sticker price (not per unit weight), and the average weight of barcodes sold. The unit value in columns (1) and (2) is a weighted average of per-unit-weight prices, with weights being weight-adjusted quantities. Columns (3) and (4) is a simple sum of weight-adjusted quantities. Columns (5)-(8) are calculated according to the exact decomposition described earlier. Columns (1), (3), (5), and (7) construct variables using the balanced panel of continuing barcodes, while Columns (2), (4), (6), and (8) use the raw unbalanced panel to construct averages. Standard errors are clustered two-way at the category-country and month level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.*

Estimates for Clean Subsample

Tariff Elasticity of Average Package Weight

Figure: Event Study Estimates for Average Category Weight Effects



Unit Value Event Study

The Foreign Cost Share (FCS) of Import Retail Prices

- Product replacement bias and "shrinkflation" account for $\sim$33% pass-through
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  - Substantial share of retailing costs occur after tariffs are applied, such as domestic distribution costs, retailing costs, etc.
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- Available estimates: FCS $\in [30\%, 50\%]$ (Berger et al. (2012)
  - Work-in-progress: We estimate the foreign cost share from data on retail prices and customs unit values for our set of scanner products
  - Preliminary result: average FCS across all categories and origin countries: 28%
    - ★ For China exports to U.S.: $\sim$32%

Conclusion

- We match barcode scanner data with country of origin information and tariff data to estimate the effect of 2018/19 Trump tariffs on prices and product substitution
    - Product-specific pass-through: 15%
    - Pass-through into average unit values: 33%-54%
    - Mechanism for discrepancy: "shrinkflation" via a negative and significant tariff elasticity of average package size
- Foreign cost share places upper bound on tariff pass-through into retail prices
    - FCS is likely between 30%-50%, such that we cannot reject full pass-through of U.S. import tariffs into consumer prices

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- Preliminary implications: incidence of U.S. import tariffs in 2018-2019 borne entirely by U.S. consumers
- We also study heterogeneous tariff effects by products, retailers, and consumers
  - Not mentioned here due to time constraints, but happy to discuss

Tariff Elasticity Heterogeneity

Thank You!

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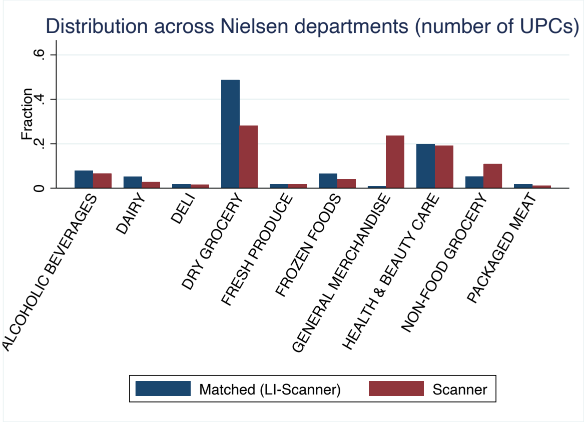
Appendix

Details on Sample

- Raw data: 235m barcode-by-retailer-by-month observations, 2015-2020, 1.38m barcodes in total (by 33k firms), 786k in 2017 (by 25k firms), total expenditure in 2017 = $220bn
- Unbalanced Panel: Restrict to barcodes with country of origin information: 144m barcode by retailer by month observations, 332k barcodes (16k firms), 216k barcodes in 2017 (13k firms), total expenditure in 2017 = $140bn (64% of total)
- Balanced Panel: 35m barcode-by-retailer-by-month observations, 2015-2020, 50k barcodes in 2017 (1350 from CN), 4.3k firms, $63bn expenditure in 2017 (29% of total)

Merged Sample versus Raw NielsenIQ Data

Figure: Distribution of Barcodes by Department



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Comparison with Estimating Equation in Cavallo et al (2021)

- Using our notation, Cavallo et al (2021) estimate the following equation:

$$\Delta \ln p_{it} = \alpha_k + \alpha_{\Gamma(i)=1} + \alpha_{j(i)=China} + \beta^\tau \Delta \ln \tau_{j(i)c(i)t} + \beta^S \Delta \ln S_{j(i)t} + \beta^X \Delta \ln X_{j(i)t} + \epsilon_{irt}$$

- Where $\alpha_{\Gamma(i)=1}$ denotes a constant trend associated with prices of Chinese barcodes eventually treated by a tariff
  - $\alpha_{j(i)=China}$ captures trend common to all Chinese exports, regardless of tariff
- S and X denote the exchange rate and the producer price index of origin country j
  - We use a country-period fixed effect instead, which captures three of the terms in Cavallo et al (2021) estimating equation
- We also include category-period fixed effects, controlling for α_k
  - We control for differential trends of tariff-affected Chinese goods via seasonality controls

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Details Regarding Seasonality Controls

- We construct seasonality controls according to both whether barcode i is from China and the specific tariff wave applied to that good
  - In practice, this is either Wave or Wave 4a
- If $q(t)$ is the quarter of period t, define Γ_i^{w4} as a dummy equal to one if i is in Wave 4a, and Γ_i^{w3} is a dummy for i being in Wave 3
- We therefore construct seasonality controls as the following:

$$\gamma_{i,q(t)} = \sum_{q'=1}^{4} \gamma_{q'} \times \Gamma_i^{w3} \times \mathbf{1}[q(t) = q'] + \sum_{q'=1}^{4} \gamma_{q'} \times \Gamma_i^{w4} \times \mathbf{1}[q(t) = q']$$

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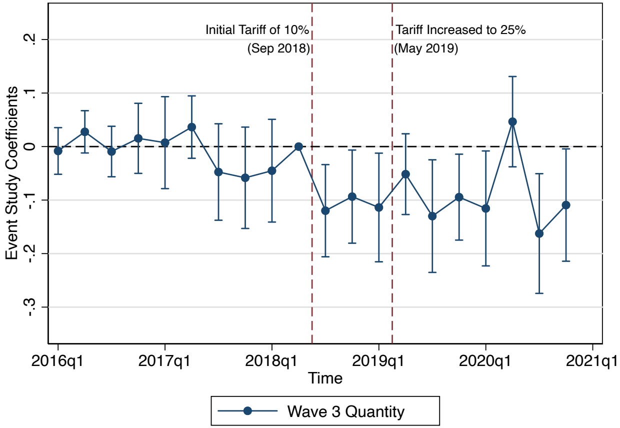
Event Study Estimates: Barcode-Level Pass-through and Substitution

Figure: Barcode-Level Quantity: Wave 3



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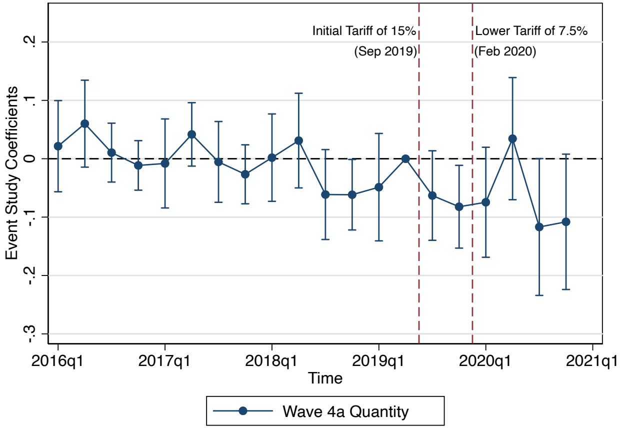
Event Study Estimates: Barcode-Level Pass-through and Substitution

Figure: Barcode-Level Quantity: Wave 4a



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Anti-competitive effects

Estimate the following equation among non-CN barcodes:

$$\ln(p_{irt}) = \beta \ln(1 + \tau^{cn}_{c(i)t}) + \alpha_{ir} + \alpha_{rt} + \alpha_{j(i)t} + \alpha_{g(i)t} + \gamma_{w(i)q(t)} + \epsilon_{irt} \quad (1)$$

Table: Anti-competitive effects

	(1) log Price	(2) log Price	(3) log Price	(4) log Price
$\log(1+\tau\_CN)$	0.010	-0.023	0.027	-0.008
	(0.016)	(0.022)	(0.020)	(0.026)
$\log(1+\tau\_CN) \times (CNshare > 0)$			-0.031	-0.027
			(0.021)	(0.021)
Wave 3 only		✓		✓
Sample		¡=2019		¡=2019
Fixed Effects	ir+gt+rt+jt	ir+gt+rt+jt	ir+gt+rt+jt	ir+gt+rt+jt
R^2	0.997	0.998	0.997	0.998
Observations	34595190	16356210	34595190	16356210

Notes: This table provides estimates of β from applying OLS to Equation 1. In columns (1) and (3) we estimate our specification on the whole sample, while in columns (2) and (4) we restrict attention to the comparison between wave 3 and the never treated, and stop the sample pre-Covid. Standard errors are clustered two-way at the category-country and month level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

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Retailer Tariff Smoothing

$$\ln(p_{irt}) = \beta \text{Treated Retailer}_r \times \text{Post}_t + \alpha_{irt} + \epsilon_{irt} \quad (2)$$

Table: Smoothing of Price Increases

	(1) log Price	(2) log Price	(3) log Price	(4) log Price	(5) log Price
Treated Retailer × Post	0.008***		0.008***		0.009***
	(0.002)		(0.002)		(0.002)
Treated Firm × Post		0.004	0.003	0.003	
		(0.004)	(0.004)	(0.004)	
Wave 3 only	✓	✓	✓	✓	✓
Sample	¡=2019	¡=2019	¡=2019	¡=2019	¡=2019
Fixed Effects	ir+mt+jt	ir+mt+jt	ir+mt+jt	ir+mt+rt+jt	ir+it
R^2	0.998	0.998	0.998	0.998	0.998
Observations	16355970	16355970	16355970	16355970	15942364

*Notes: In column (1) we estimate equation 2 using barcode-by-retailer, country-by-time, and module-by-time effects, and we do the same in column (2) when we look at the firm effect. Column (3) adds both effects in the same specification. In column (4) we estimate a more demanding specificaiton with retailer-by-time FEs. Column (5) uses only variation for the same barcode sold at the same point in time, using barcode-by-time FEs. Standard errors are clustered two-way at the category-country and month level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.*

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Comparison to other Imported Products

Table: Comparison to other Imported Products

	(1) log Price	(2) log Price
$\log(1+\tau)$	0.136***	0.125***
	(0.039)	(0.038)
Wave 3 only		✓
Sample		¡=2019
Fixed Effects	ir+mt+rt+jt	ir+mt+rt+jt
R^2	0.998	0.998
Observations	5,005,727	2,946,217

*Notes: This table provides estimates of β when applying OLS to equation 8, excluding US-made goods from the estimation. Standard errors are clustered two-way at the category-country and month level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.*

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Decomposition of Unit Value Pass-through

- Let p_{irt} denote the "sticker" price of barcode i at retailer r in month t
- Let q_{irt} be the raw quantity (number of units, e.g. number of chocolate bars bought)
- Let w_{ir} be package size (e.g. weight per unit)
    - Then $\tilde{q}_{irt} = w_{ir} q_{irt}$ is adjusted quantity (e.g. weight of chocolate bought)
- We decompose aggregate unit value into a "sticker" price component and an average package size component
    - Weighted average with weights equal to the share of raw package sales: $s_{irt} = q_{irt} / q_{cjrt}$

$$uv_{cjrt} \equiv \frac{x_{cjrt}}{\tilde{q}_{cjrt}} = \underbrace{\sum_i s_{irt} p_{irt}}_{\text{Wgt Average sticker price}} \times \left(\underbrace{\sum_i s_{irt} w_{ir}}_{\text{Wgt Average package size}} \right)^{-1}$$

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Pass-through into Unit Values and Decomposition

Table: Category-Level Pass-through and Compositional Effects (consistent unit measure within retailer-category)

	(1) Log Price	(2) Log Price	(3) Log Quantity	(4) Log Quantity	(5) Log Price	(6) Log Price	(7) Log Weight	(8) Log Weight
$\log(1+\tau)$	0.093*	0.539***	-0.138	-0.450	0.051	-0.016	-0.042	-0.555***
	(0.053)	(0.156)	(0.190)	(0.408)	(0.038)	(0.093)	(0.044)	(0.187)
Balanced	✓		✓		✓		✓	
Unbalanced		✓		✓		✓		✓
Price per weight	✓	✓						
Raw sticker price					✓	✓		
R^2	1	1	1	1	1	1	1	1
Observations	2,544,861	2,544,861	2,544,861	2,544,861	2,544,861	2,544,861	2,544,861	2,544,861

Notes: This table provides estimates of β from applying OLS to Equation **??**. *All models include fixed effects by country-category-retailer, retailer-month, category-month, and country-month. From left to right, dependent variables are: average price per unit weight, total quantity sold (in units of weight), average sticker price (not per unit weight), and the average weight of barcodes sold. The unit value in columns (1) and (2) is a weighted average of per-unit-weight prices, with weights being weight-adjusted quantities. Columns (3) and (4) is a simple sum of weight-adjusted quantities. Columns (5)-(8) are computed as described in equation* **??**. *Columns (1), (3), (5), and (7) construct variables using the balanced panel of continuing barcodes, while Columns (2), (4), (6), and (8) use the raw unbalanced panel to construct averages. Standard errors are clustered two-way at the category-country and month level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.*

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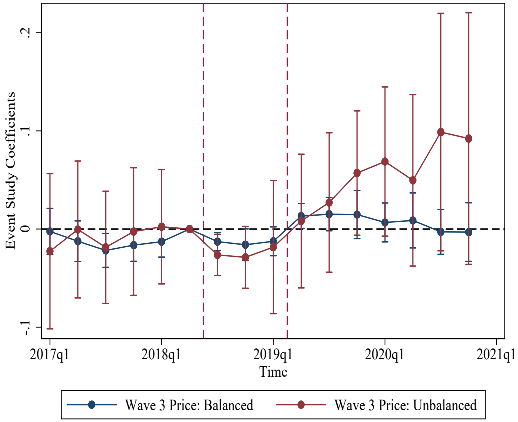
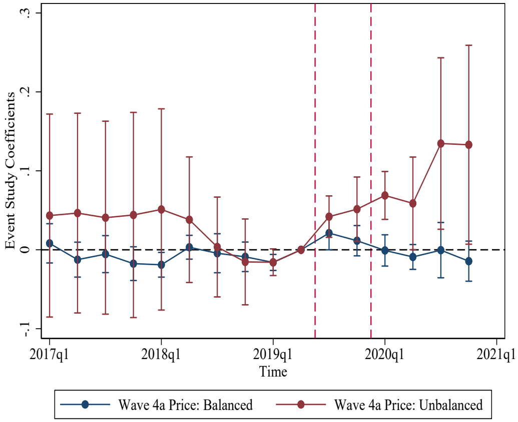
Tariff Elasticity of Unit Values

Figure: Event Study Estimates for Category-Retailer Unit Value Effects





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Tariff Elasticity Heterogeneity

- We use our detailed data to consider tariff pass-through heterogeneity via firm and retailer market share
- Initial findings:
  1. Tariff pass-through increasing in barcode-specific market share, from 7% to as high as 28%
  2. Quantity elasticity strongest for low-market share barcodes: opposite pattern from tariff pass-through
  3. We consider two-sided market power, and estimate pass-through according to firm market share at a given retail chain, and retailer market share within a given firm
     - No relationship between firm importance at a given retailer and tariff pass-through
     - Strong negative relationshp between retailer market share within a given firm and tariff pass-through
     - Suggests monopsonistic behaviour

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Heterogeneity in Pass-Through: Products

- Market share distribution very skewed: Only 5% of products have market share $> 1\%$ (but 40% of sales)

Table: Pass-through and Substitution by Market Share Bins

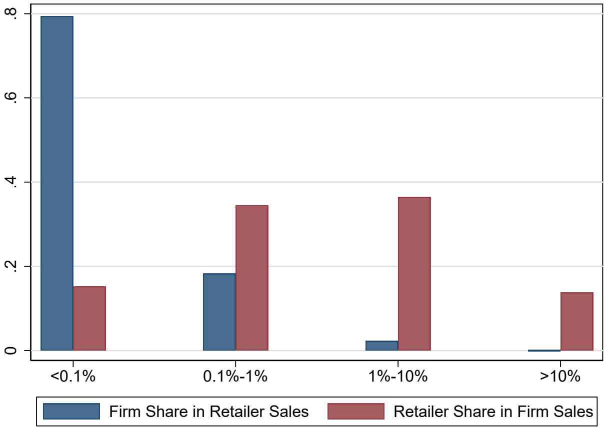
	(1) log Price	(2) log Quantity
$\log(1+\tau) \times s_1$	0.071**	-0.843***
	(0.035)	(0.240)
$\log(1+\tau) \times s_2$	0.111	-0.214
	(0.109)	(0.315)
$\log(1+\tau) \times s_3$	0.107*	-0.265
	(0.060)	(0.308)
$\log(1+\tau) \times s_4$	0.247***	-0.472
	(0.082)	(0.335)
$\log(1+\tau) \times s_5$	0.276***	0.029
	(0.073)	(0.383)
FEs	ir+rt+jt+mt	ir+rt+jt+mt
R^2	0.997	0.968
Observations	35043587	35043587

Notes: Tariff pass-through by barcode market share, from low market share (s_1) to high market share (s_5). Market shares are computed within product modules based on 2017 sales volume. See Table **??** *for summary statistics regarding bins. Standard errors are clustered at the barcode-retailer-pair level.* *, **, *and* *** *denote statistical significance at the 10%, 5%, and 1% levels, respectively.*

Heterogeneity in Pass-Through: Firms and Retailers

- Very little variation in firm shares in retailer sales

Figure: Firm and Retailer Bilateral Dependence



Bilateral Sales Shares and Tariff Pass-Through

Table: Bilateral Sales Shares and Tariff Pass-Through

	(1) log Price	(2) log Price
$\log(1+\tau)$	0.190***	0.206***
	(0.044)	(0.052)
$\log(1+\tau)\times$ Firm Share in Retailer	1.015	
	(1.748)	
$\log(1+\tau)\times$ Retailer Share in Firm	-0.303**	
	(0.120)	
$\log(1+\tau)\times$ High firm share in retailer sales		0.013
		(0.039)
$\log(1+\tau)\times$ High retailer share in firm sales		-0.094***
		(0.034)
Fixed Effects	ir+mt+rt+jt	ir+mt+rt+jt
R^2	0.997	0.997
Observations	34305115	34305115

Notes: Tariff pass-through by bilateral firm-retailer relationship. Standard errors are clustered at the barcode-retailer-pair level. *, **, *and* *** *denote statistical significance at the 10%, 5%, and 1% levels, respectively.*