A new approach to estimating exporters' markups
Lecture 2

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How large are exporters' markup elasticities to the exchange rate?
What can empirical estimates from different estimators tell us about the shocks facing exporting firms?

Evidence in this talk comes from:

- "Markets and Markups," by G. Corsetti, M. Crowley, L. Han and H. Song, CEPR Working Paper 13904, March 2023.

Disclaimer

The views expressed herein are those of the authors and not necessarily those of the Bank of Canada.

The exchange rate disconnect puzzle is one of the six great puzzles of international economics:

- prices of imported goods, measured in the local currency of an importing country, are excessively stable relative to bilateral exchange rates.

Classical economic explanation (Krugman 1986 and Dornbusch 1987):

- firms adjust their export prices (in their own currency) in response to time-varying shifts in local demand or marginal cost to keep import prices in local currency stable – they price-to-market.

Price-setting by firms in the global economy

Empirical studies find that firms with more market power adjust their markups in response to exchange rates or trade policy, confirming a role for pricing-to-market, but the magnitudes of estimates vary.

- Belgium (Amiti, Itskhoki, Konings, 2014),
- Brazil (Chatterjee, Dix-Carneiro, and Vichyanond, 2013),
- India (deLoecker, Goldberg, Khandelwal, and Pavcnik, 2016),
- Ireland (Fitzgerald and Haller, 2014, 2018), and
- France (Berman, Martin, and Mayer, 2012)

A variety of different methodologies employed to address

- the common challenge: obtaining an accurate measure of the marginal cost of production, a time-varying unobservable variable that could vary at the firm, product, and destination level and be correlated with the variable of interest.

One approach: Estimate marginal cost

1. Estimate productivity at the firm or firm-product level
2. Use estimated marginal cost and observed price to back out the markup (level)
   $\Rightarrow$ Berman Martin Mayer (2012) and Amiti Itskhoki Konings (2014)
   $\Rightarrow$ De Loecker et al. (2016).

Main issues: conceptual problems and data limitations

- Input allocations observed at the firm – not product – level
- For multi-product firms, marginal cost estimation at the firm-product-destination level requires assumptions on production functions.
- Data: balance sheet information not (easily) available for many countries

Our approach: Trade Pattern Sequential Fixed Effects

Estimate the markup elasticity to the exchange rate (tariff change) by

1. differencing out product-level marginal cost for multi-destination exporters while
2. addressing the endogenous selection of markets.
   - Firms frequently change their set of export markets

   $\Rightarrow$ the Trade-Pattern Sequential Fixed Effect.

Use simulated data from a well-specified model to show how the TPSFE estimator can reduce omitted variable and selection bias in estimated markup elasticities.

A comparison of different estimators can also shed light on the types of shocks hitting an exporting firm.

A large literature examines prices in international economics

- **Pricing-to-market and exchange rates**

  e.g., Knetter (1989); Knetter (1993); Goldberg and Verboven (2001); Gopinath and Rigobon (2008); Gopinath, Itskhoki and Rigobon (2010); Berman, Mayer and Martin (2012); Amit, Itskhoki and Konings (2014); Fitzgerald and Haller (2014); Auer and Schoenle (2016)

- **Variable markups, trade elasticities, and export dynamics**

  e.g., Dornbush (1987); Atkeson and Burstein (2008); Corsetti and Dedola (2005), De Blas and Russ (2015); Fitzgerald, Haller and Yedid-Levi (2016)

- **Welfare gains and the pro-competitive effect of trade**

  e.g., Feenstra and Weinstein (2017); Arkolakis, et al. (2018)

- **Exchange rates pass through and macro/stabilization policy**

  e.g., Corsetti, Dedola and Leduc (2008, 2010 Handbook, 2018), Engel (2011), Gopinath (2015); Casas et al. (2017)

How responsive are markups to exchange rate movements?

Our answer will exploit information from two empirical discoveries to reduce (possible) bias(es).

- two empirical discoveries – trade patterns and indigenous measurement systems $\Rightarrow$ the empirical motivation
- two biases – omitted variable bias and endogenous selection bias $\Rightarrow$ a new methodology

The punchline: Big administrative datasets contain information on the time-varying sets of foreign destinations for each product a firm exports. Exploiting this information can reduce bias in estimates of markup elasticities; we obtain estimates up to 50% larger than conventional estimators.

More pricing-to-market $\Rightarrow$ better explains exchange rate disconnect.

Multi-destination exporters dominate world trade

The universe of Chinese exporters, 2007

	Number of Foreign Destinations				
	1	2-5	6-10	10+	Total
(a) by Share of Exporters	27.2	**33.1**	**14.7**	**25.0**	100.0
(b) by Share of Export Values	5.4	**11.9**	**10.4**	**72.3**	100.0
(c) by Share of No. of Annual Transactions	3.0	**8.0**	**7.8**	**81.2**	100.0

⇒ **72.8% of exporting firms multi-destination exporters**

⇒ **94.6% of export value originates from multi-destination exporters**

⇒ **97.0% of annual transactions originate from multi-destination exporters**

Starting point: Economists understand that multi-destination exporters are responsible for most trade.

- France (Melitz, Mayer & Ottaviano, 2014)
- The United Kingdom (Corsetti, Crowley, & Han, 2022)

The Time-Varying Trade Patterns of a Firm's Product

What has been less appreciated is how a firm's product-level trade pattern changes over time....

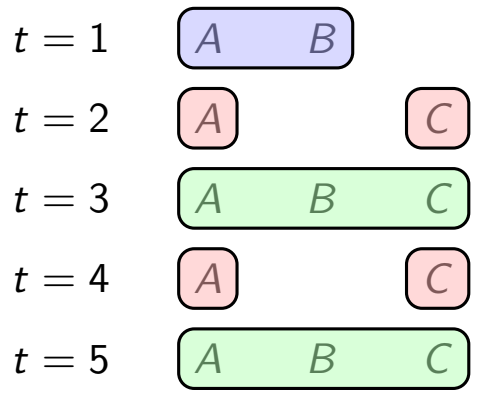

Figure 1: Example of an observed trade pattern

- Firms enter and exit markets with products annually.
- Sets of destinations appear repeatedly ⇒ Empirical Discovery 1

Number of unique trade patterns

given a firm and product's total export life (China 2000-2014)

Number of Unique Trade Patterns (y)	Total Number of Exporting Years (x)														
	2	3	4	**5**	6	7	8	9	10	11	12	13	14	15	Total
1	35.9	26.6	22.4	19.3	16.7	14.0	11.8	10.3	8.8	7.7	6.2	5.5	5.1	4.7	23.4
2	64.1	23.2	16.5	13.0	10.8	9.1	7.7	6.7	6.0	5.4	4.6	4.3	3.8	3.8	28.5
3		50.2	20.3	**14.1**	11.0	8.9	7.1	6.3	5.4	4.7	3.9	3.5	3.0	3.1	15.0
4			40.8	17.6	12.2	9.3	7.3	6.2	5.1	4.3	3.6	2.9	2.6	2.7	8.9
5				35.9	15.8	11.1	8.3	6.6	5.3	4.5	3.7	2.9	2.7	2.3	6.1
6					33.4	14.9	10.1	7.7	6.2	5.0	3.8	3.0	2.4	2.2	4.5
7						32.7	13.8	9.6	7.3	5.5	4.5	3.7	2.9	2.2	3.5
8							33.9	13.7	9.4	7.0	5.2	4.2	3.3	2.3	2.8
9								33.0	13.5	9.1	6.7	5.0	3.7	2.7	2.0
10									33.3	13.2	8.9	6.8	5.1	3.2	1.6
11										33.6	13.1	9.0	6.5	3.5	1.1
12											35.9	13.7	8.4	5.1	0.9
13												35.6	13.6	7.1	0.6
14													36.9	12.1	0.5
15														42.9	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Share	29.3	17.9	12.0	9.1	7.3	5.8	5.0	3.7	2.9	2.2	1.6	1.2	0.9	1.1	100.0

The firm and product in figure 1 falls in the yellow cell:
an export life of 5 years (column) characterized by 3 distinct trade patterns (row): $\{AB, AC, ABC\}$.

Number of unique trade patterns

given a firm and product's total export life (China 2000-2014)

Number of Unique Trade Patterns (y)	Total Number of Exporting Years (x)														
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
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2	64.1	23.2	16.5	13.0	10.8	9.1	7.7	6.7	6.0	5.4	4.6	4.3	3.8	3.8	28.5
3		50.2	20.3	**14.1**	11.0	8.9	7.1	6.3	5.4	4.7	3.9	3.5	3.0	3.1	15.0
4			40.8	17.6	12.2	9.3	7.3	6.2	5.1	4.3	3.6	2.9	2.6	2.7	8.9
5				35.9	15.8	11.1	8.3	6.6	5.3	4.5	3.7	2.9	2.7	2.3	6.1
6					33.4	14.9	10.1	7.7	6.2	5.0	3.8	3.0	2.4	2.2	4.5
7						32.7	13.8	9.6	7.3	5.5	4.5	3.7	2.9	2.2	3.5
8							33.9	13.7	9.4	7.0	5.2	4.2	3.3	2.3	2.8
9								33.0	13.5	9.1	6.7	5.0	3.7	2.7	2.0
10									33.3	13.2	8.9	6.8	5.1	3.2	1.6
11										33.6	13.1	9.0	6.5	3.5	1.1
12											35.9	13.7	8.4	5.1	0.9
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14													36.9	12.1	0.5
15														42.9	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Share	29.3	17.9	12.0	9.1	7.3	5.8	5.0	3.7	2.9	2.2	1.6	1.2	0.9	1.1	100.0

The firm-product dyads in the red cells maintain the same trade pattern in every year of export life: a perfectly repeating trade pattern.

Number of unique trade patterns

given a firm and product's total export life (China 2000-2014)

Number of Unique Trade Patterns (y)	Total Number of Exporting Years (x)														
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	**35.9**	**26.6**	**22.4**	**19.3**	**16.7**	**14.0**	**11.8**	**10.3**	**8.8**	**7.7**	**6.2**	**5.5**	**5.1**	**4.7**	23.4
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3		**50.2**	20.3	**14.1**	11.0	8.9	7.1	6.3	5.4	4.7	3.9	3.5	3.0	3.1	15.0
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9								**33.0**	13.5	9.1	6.7	5.0	3.7	2.7	2.0
10									**33.3**	13.2	8.9	6.8	5.1	3.2	1.6
11										**33.6**	13.1	9.0	6.5	3.5	1.1
12											**35.9**	13.7	8.4	5.1	0.9
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Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Share	29.3	17.9	12.0	9.1	7.3	5.8	5.0	3.7	2.9	2.2	1.6	1.2	0.9	1.1	100.0

The firm-product dyads in the blue cells change their trade pattern in every year of export life: no trade pattern ever repeats.

Time-varying trade patterns: summary

Number of Unique Trade Patterns (y)	Total Number of Exporting Years (x)														
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	**35.9**	**26.6**	**22.4**	**19.3**	**16.7**	**14.0**	**11.8**	**10.3**	**8.8**	**7.7**	**6.2**	**5.5**	**5.1**	**4.7**	23.4
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4			**40.8**	17.6	12.2	9.3	7.3	6.2	5.1	4.3	3.6	2.9	2.6	2.7	8.9
5				**35.9**	15.8	11.1	8.3	6.6	5.3	4.5	3.7	2.9	2.7	2.3	6.1
6					**33.4**	14.9	10.1	7.7	6.2	5.0	3.8	3.0	2.4	2.2	4.5
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8							**33.9**	13.7	9.4	7.0	5.2	4.2	3.3	2.3	2.8
9								**33.0**	13.5	9.1	6.7	5.0	3.7	2.7	2.0
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15														**42.9**	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Share	29.3	17.9	12.0	9.1	7.3	5.8	5.0	3.7	2.9	2.2	1.6	1.2	0.9	1.1	100.0

The firm-product dyads in the unhighlighted cells have time-varying trade patterns that repeat; we argue that repeating trade patterns contain information about unobservable time-varying cost or demand shocks that move the firm's extensive margin and impact its optimal price and markup.

Time-varying trade patterns: key insight

Number of Unique Trade Patterns (y)	Total Number of Exporting Years (x)														
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
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15														**42.9**	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Share	29.3	17.9	12.0	9.1	7.3	5.8	5.0	3.7	2.9	2.2	1.6	1.2	0.9	1.1	100.0

Key insight from empirical discovery 1: A fixed effect that controls for a firm, product, and destination market *when it appears as part of a larger trade pattern*, can restrict the comparison of price observations to cases where the underlying time-varying unobservables take similar values. This reduces the bias in markup elasticities coming from unobserved omitted variables.

Pricing strategy depends on competition in product markets & firms' market power

Tomato paste and tractors are "differentiated manufactured goods."

But tomato paste seems less differentiated than tractors.

Are firms' pricing strategies similar for these two products?

Market power for products from linguistics

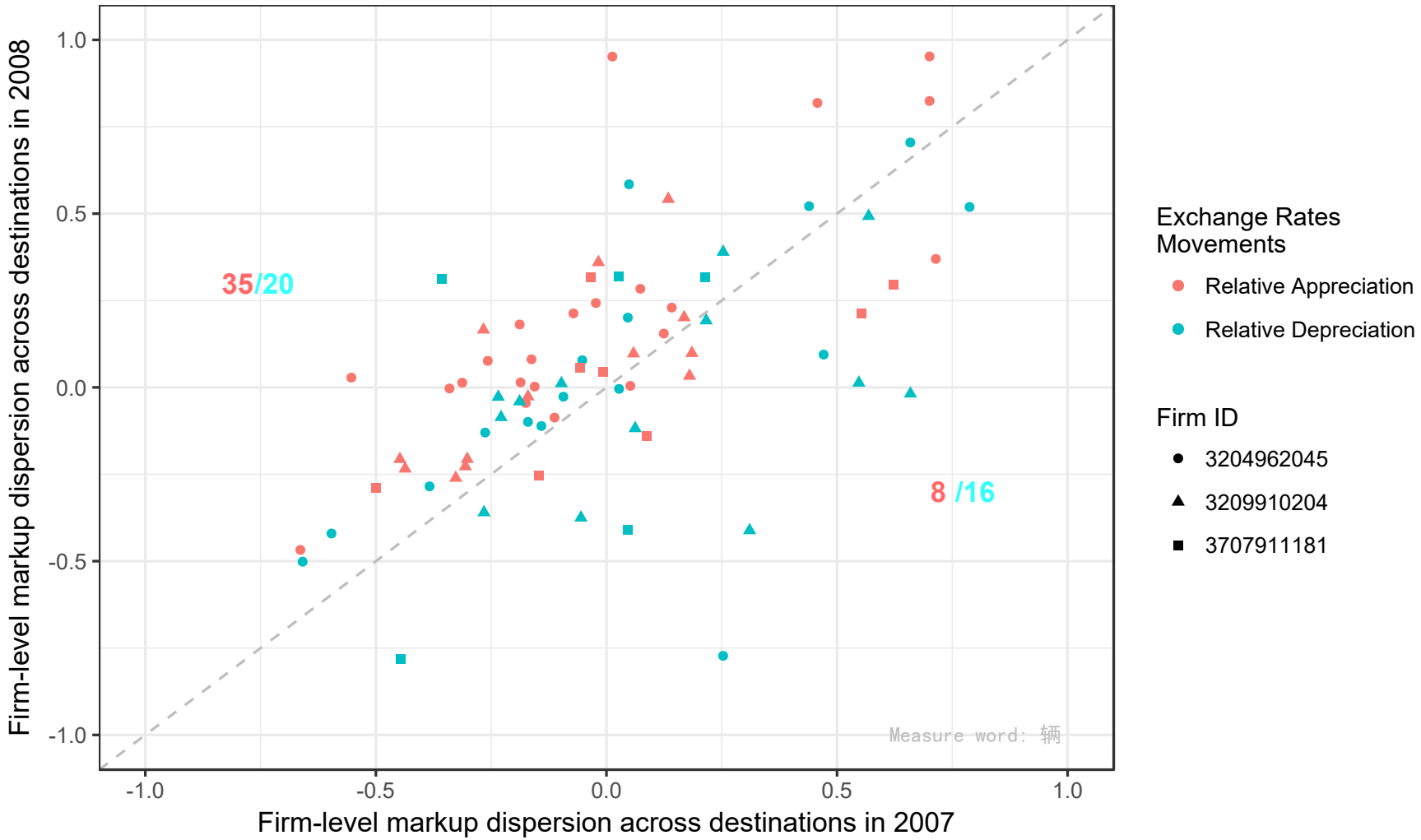
A linguistics-based indigenous measurement system is used in Chinese customs data ⇒ Empirical Discovery 2

Quantity Measure	Classifier	Meaning	Types of goods	Percent of export value
qiān kè, 千克	mass	kilogram	grains, chemicals	40.5
tái, 台	count	machines	engines, pumps, fans	24.7
gè, 个	count	small items	golf balls, batteries, spark plugs	12.8
jiàn, 件	count	clothing	shirts, jackets	6.6
shuāng, 双	count	paired sets	shoes, gloves, snow-skis	2.6
tiáo, 条	count	tube-like items	rubber tyres, trousers	2.5
mǐ, 米	mass	meters	camera film, fabric	2.1
tào, 套	count	sets	suits of clothes, sets of knives	1.8
liàng, 辆	count	wheeled vehicles	cars, tractors, bicycles	1.4
sōu, 艘	count	boats	tankers, cruise ships, sail-boats	1.3

- Count/Discrete Classifier → Highly Differentiated Product
- Mass/Continuous Classifier → Less Differentiated Product

Wheeled tractor prices in foreign markets of 3 Chinese exporters

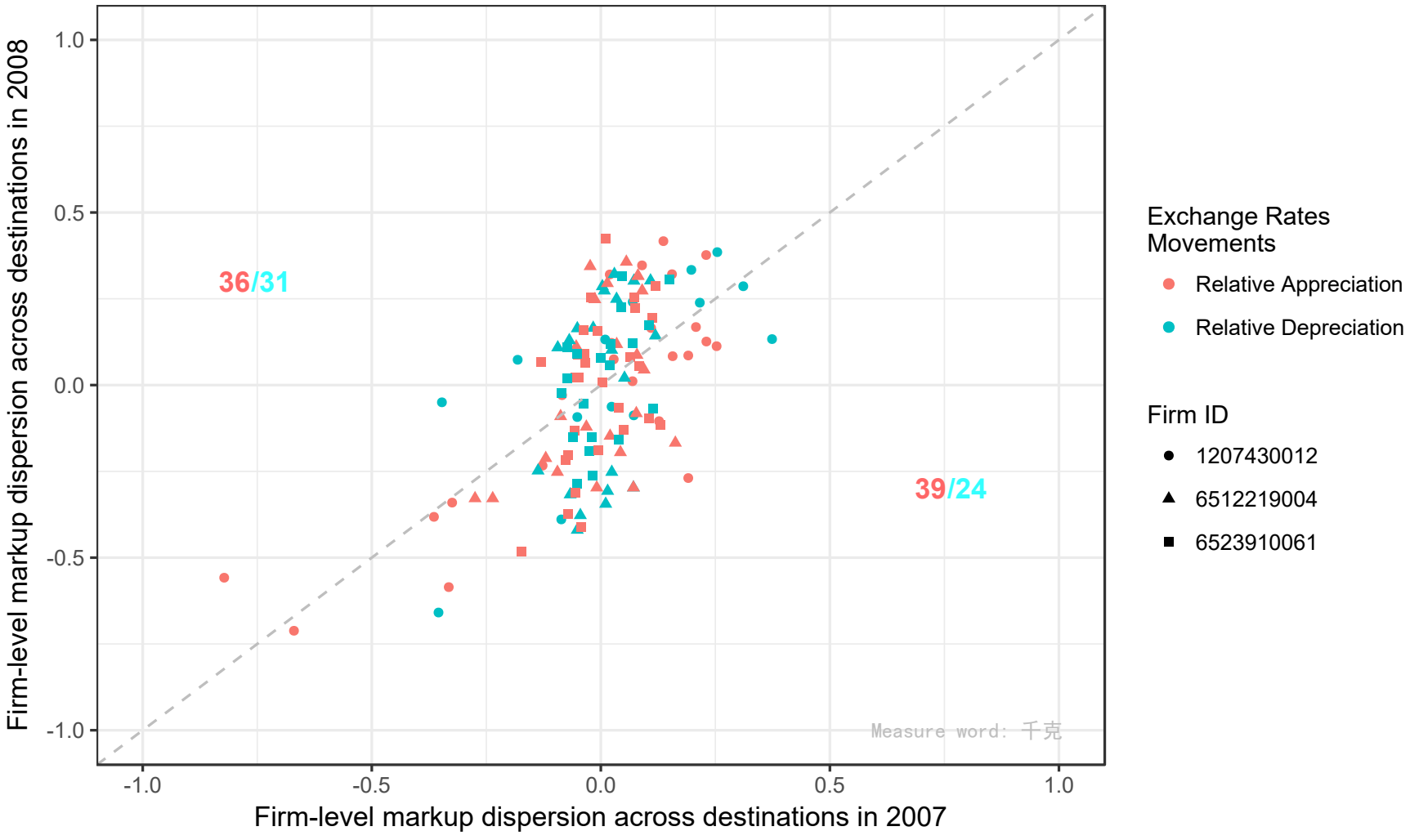
Local price - relative to the firm's average - changes with local economic conditions



Source: Corsetti, Crowley, Han and Song (2018)

Tomato paste prices in foreign markets of 3 Chinese firms

Far less "pricing to market" for less-differentiated goods ⇒ global pricing



Source: Corsetti, Crowley, Han and Song (2018)

CCHS product classification: key insight

Share of goods by classification: obs. weighted (2000-14)

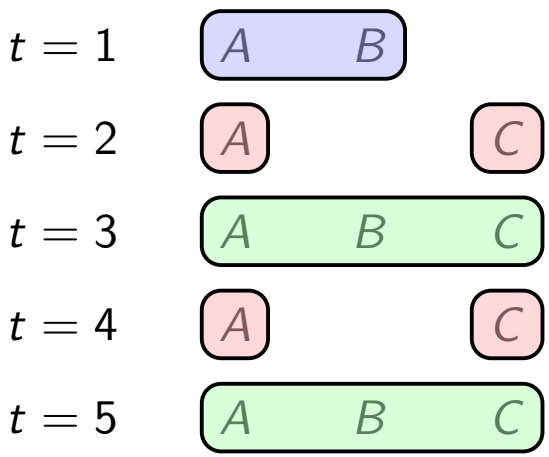
	Corsetti-Crowley-Han-Song (CCHS)		
	Low Differentiation/ Mass/Cont. Noun	High Differentiation/ Count/Discrete Noun	
Rauch (Liberal Version)			
Differentiated Products	41.1	38.8	79.8
Reference Priced	6.9	0.7	7.6
Organized Exchange	0.6	0.0	0.6
Unclassified†	10.5	1.5	12.0
	59.1	40.9	100.0

Key insight from empirical discovery 2: By refining the definition of highly differentiated goods, using information on a product's physical attributes that are embedded in a Chinese linguistic particle reported in customs data, we can narrow the search for pricing-to-market to goods in which there is less direct competition due to the nature of the product.

Estimation Strategy: Trade Pattern Sequential Fixed Effects

Implement the TPSFE estimator in two steps by taking differences:

1. Remove the mean value of all variables within a time period to obtain *destination residuals*
2. Remove the mean value of all destination residuals within a firm-product-destination & trade pattern to obtain *time residuals*



To estimate the markup elasticity, we compare twice-differenced price residuals for firm f selling product i in country A

- at $\mathbf{t = 2}$ with $\mathbf{t = 4}$ and
- at $\mathbf{t = 3}$ with $\mathbf{t = 5}$.

Step 1: Demean variables across destinations within a time period

$$\dot{x}_{fidt} \equiv x - \frac{1}{n^D_{fit}} \sum_{d \in D_{fit}} x \quad \forall x \in \{p_{fidt}, e_{dt}\} \tag{1}$$

where

- n^D_{fit} is the number of active foreign destinations of firm f selling product i in year t;
- D_{fit} denotes the set of destinations of this firm-product pair in year t;
- p is the export price denominated in the producer's currency (i.e., in RMB);
- e_{dt} is the bilateral exchange rate defined as the units of RMB per units of destination market currency.
- All variables are in logs.

Trade Pattern Fixed Effects: Step 1 Example

$$\begin{bmatrix} p_{A,1} & p_{B,1} & . \\ p_{A,2} & . & p_{C,2} \\ p_{A,3} & p_{B,3} & p_{C,3} \\ p_{A,4} & . & p_{C,4} \\ p_{A,5} & p_{B,5} & p_{C,5} \end{bmatrix} = \begin{bmatrix} \widetilde{p}_{A,1} + \overline{p}_1 & \widetilde{p}_{B,1} + \overline{p}_1 & . \\ \widetilde{p}_{A,2} + \overline{p}_2 & . & \widetilde{p}_{C,2} + \overline{p}_2 \\ \widetilde{p}_{A,3} + \overline{p}_3 & \widetilde{p}_{B,3} + \overline{p}_3 & \widetilde{p}_{C,3} + \overline{p}_3 \\ \widetilde{p}_{A,4} + \overline{p}_4 & . & \widetilde{p}_{C,4} + \overline{p}_4 \\ \widetilde{p}_{A,5} + \overline{p}_5 & \widetilde{p}_{B,5} + \overline{p}_5 & \widetilde{p}_{C,5} + \overline{p}_5 \end{bmatrix}$$

$$= \begin{bmatrix} \mu_{A,1} + (\mu + mc)_{AB,1} & \mu_{B,1} + (\mu + mc)_{AB,1} & . \\ \mu_{A,2} + (\mu + mc)_{AC,2} & . & \mu_{C,2} + (\mu + mc)_{AC,2} \\ \mu_{A,3} + (\mu + mc)_{ABC,3} & \mu_{B,3} + (\mu + mc)_{ABC,3} & \mu_{C,3} + (\mu + mc)_{ABC,3} \\ \mu_{A,4} + (\mu + mc)_{AC,4} & . & \mu_{C,4} + (\mu + mc)_{AC,4} \\ \mu_{A,5} + (\mu + mc)_{ABC,5} & \mu_{B,5} + (\mu + mc)_{ABC,5} & \mu_{C,5} + (\mu + mc)_{ABC,5} \end{bmatrix}$$

- For each firm-product pair, calculate the average price in each period; then extract destination-specific price residuals, e.g., $\widetilde{p}_{A,1}$.
- The average price in a period is equal to the common (global) markup and the average marginal cost.
- In step 2, a destination and trade pattern fixed effect will be applied to the price residuals above. E.g. Two "destination and trade pattern" FEs will be A-AC and B-ABC

Step 2: Demean (across country) residuals across time periods

Apply firm-product-destination-trade pattern ($fidD$) fixed effects to the residuals of prices and exchange rates obtained in step 1.

Implement this by subtracting mean of $\dot{x}_{fidt}$ variables for all time periods associated with the firm-product-destination-trade pattern $fidD$, i.e., $t \in T_{fidD}$:

$$\ddot{x}_{fidt} \equiv \dot{x}_{fidt} - \frac{1}{n^{T}_{fidD}} \sum_{t \in T_{fidD}} \dot{x}_{fidt} \quad \forall x \in \{p_{fidt}, e_{dt}\} \tag{2}$$

where $\ddot{x}_{fidt}$ are the twice-differenced variables.

Note: Aggregate variables (which normally vary along only two dimensions d and t) may "become" firm and product specific, i.e., $\ddot{e}_{fidt}$, due to the unbalancedness of the panel.

Step 3: Estimate markup elasticity using OLS

Final step: run an OLS regression on twice-differenced variables to identify and estimate how markups respond to bilateral exchange rates.

$$\ddot{p}_{fidt} = \beta_0 + \beta_1 \ddot{e}_{fidt} + \ddot{u}_{fidt}. \tag{3}$$

This approach exploits cross-destination variation in prices within a firm-product's trade pattern as well as intertemporal variation in prices within the same firm-product-destination-trade pattern ($fidD$) over time.

Cross-Market Demand Elasticity (CMDE)

Goal: estimate the cross-market quantity response driven by markup adjustments to exchange rate movements.

- First stage: calculate $\widehat{\ddot{p}}_{fidt}$, the predicted relative price change in response to a change in the exchange rate:

$$\widehat{\ddot{p}}_{fidt} = \widehat{\beta}_0 + \widehat{\beta}_1 \ddot{e}_{fidt} + \ddot{\boldsymbol{x}}'_{fidt} \widehat{\boldsymbol{\beta}}_2. \tag{4}$$

- Second stage: regress twice-demeaned quantities on predicted relative markup changes:

$$\ddot{q}_{fidt} = \gamma_0 + \gamma_1 \widehat{\ddot{p}}_{fidt} + \ddot{\boldsymbol{x}}'_{fidt} \boldsymbol{\gamma}_2 + \ddot{v}_{fidt}. \tag{5}$$

γ_1: captures the extent to which a firm expects the quantities of its product sold in different markets to change when it adjusts its markup to exchange rate shocks.

Pricing by global Chinese firms in local foreign markets

Using Chinese exports from 2000-2014, we find that the markup elasticity to the exchange rate varies systematically across:

- Product types
  – less vs. more differentiated and intermediate vs. final goods
- Firm features
  – Big vs. smaller firms and foreign-invested vs. locally-owned

$\Rightarrow$ Refining our estimation sample to firms and products according to the likely degree of market power yields higher estimates of markup elasticities implying more pricing to the local market.

Markup elasticities to the exchange rate

	All	HD Goods	LD Goods	n. of obs
2000 – 2005	0.05**	0.10***	0.02	4,279,808
	(0.02)	(0.03)	(0.02)	[1,073,300]
2006 – 2014	0.07***	0.14***	0.04***	19,272,657
	(0.01)	(0.01)	(0.01)	[4,839,333]

- Export prices denominated in US dollars. Bilateral exchange rates are defined as USD per foreign currency, i.e an increase means an appreciation of the destination country's currency.
- Estimates conditional on a price change, as in Gopinath et al. [2010]. US excluded (results unaffected by inclusion).

Against a 10% bilateral appreciation of the local currency:

- markups of HD goods rise 1.4% (measured in dollars)
- markups of LD goods rise 0.4% (measured in dollars)

$\Rightarrow$ More PTM and more stable import prices *in local currency* for HD goods.

Cross-Market Demand Elasticities

	All	HD Goods	LD Goods	n. of obs
$2000-2005$	$6.18^{*\dagger}$	4.07^{**}	$19.72^{\dagger}$	4,279,808
	(3.18)	(1.72)	(55.14)	[1,073,300]
$2006-2014$	1.53^{***}	0.72^{***}	2.72^{***}	19,272,657
	(0.28)	(0.20)	(0.80)	[4,839,333]

A 1% increase in the markup charged in a market is associated with:

- a 0.72% increase in export quantities supplied to that market
- a 2.72% increase in export quantities supplied to that market

$\Rightarrow$ Firms with market power that adjust markups to exchange rates keep quantities sold relatively stable.

Markups elasticities by firm-product size (2006 – 2014)

where size is defined by exporters' product-level global revenues

Category	All	HD Goods	LD Goods	n. of obs
Small Exporters	0.02**	0.06***	0.01	6,639,830
	(0.01)	(0.02)	(0.01)	[2,646,437]
Medium Exporters	0.07***	0.18***	0.04**	6,519,743
	(0.01)	(0.03)	(0.02)	[1,448,368]
Large Exporters	0.19***	0.32***	0.14***	6,113,084
	(0.02)	(0.04)	(0.03)	[744,528]
All Exporters (size weighted)	0.31***	0.56**	0.21***	19,272,657
	(0.08)	(0.24)	(0.05)	[4,839,333]

Note: The first three rows show results separately estimated in each of the firm size bins. The last column shows weighted regression estimates of the full sample using the total trade value of a firm-product pair in all years and destinations as the weight.

Two aspects of market power:

- Size: markup elasticities ↑ with firm's product-level export revenue
- Product type: Within each size category, markups of HD goods adjust more

Markups elasticities and Global Value Chains (1):

foreign-invested, state-owned, and private Chinese firms (2006 – 2014)

Category	All	HD Goods	LD Goods	n. of obs
State-owned Enterprises	0.09***	0.26***	0.03	3,526,943
	(0.02)	(0.04)	(0.02)	[646,352]
Foreign Invested Enterprises	0.13***	0.27***	0.09***	4,990,504
	(0.01)	(0.03)	(0.01)	[1,042,481]
Private Enterprises	0.03***	0.06***	0.02	9,897,091
	(0.01)	(0.01)	(0.01)	[2,996,133]

Gobal market power of foreign-invested and multinational enterprises:

- Firm registration type: Markup elasticities of foreign-invested enterprises (e.g. MNEs located in China) are higher for both highly differentiated and less differentiated goods.

Markups elasticities and Global Value Chains (2):

UN Broad Economic Categories of End-Use (2006 – 2014)

Category	All	HD Goods	LD Goods	n. of obs
Consumption	0.18***	0.29***	0.08***	6,133,394
	(0.01)	(0.02)	(0.02)	[1,759,243]
Intermediate	0.02**	0.03	0.02**	6,288,252
	(0.01)	(0.05)	(0.01)	[1,579,220]

Market power appears higher for consumer goods which are advertised to consumers:

- BEC End Use: Markup elasticities of consumer goods are higher for both highly differentiated and less differentiated goods.

Model-based analysis of pricing (1)

Firm's problem:

$$\max_{P_{fidt},\phi_{fidt}\in\{0,1\}} \quad \phi_{fidt}\left[\left(P_{fidt}-\mathcal{MC}_{fit}\right)\psi_i(\alpha_{fid},P_{fidt},D_{fidt},\mathcal{E}_{dt})-\zeta_i\right]$$

- P_{fidt} is the border price denominated in the exporter's currency;
- $\mathcal{MC}_{fit}$ is the marginal cost;
- ζ_i is the exporting cost that the firm needs to pay for each product i sold in a destination market; and
- $\psi_i(.)$ is a Kimball demand function.
- where participation/selection of firm f selling product i in destination d in periods t depends on operating profits at the optimal price exceeding fixed costs.

$$\phi^*_{fidt}=\begin{cases} 1 \ \text{(observed)} & \text{if} \quad \pi_{fidt}\geq\zeta_i \\ 0 \ \text{(missing)} & \text{if} \quad \pi_{fidt}<\zeta_i \end{cases} \tag{6}$$

Model-based analysis of pricing (2)

Operating profits given optimal pricing, $P^*_{fidt}(D_{fidt}, \mathcal{E}_{dt}, \mathcal{MC}_{fit})$:

$$\pi_{fidt} \equiv (P^*_{fidt} - \mathcal{MC}_{fit})\, \psi_i(\alpha_{fid}, P^*_{fidt}, D_{fidt}, \mathcal{E}_{dt}), \tag{7}$$

with Kimball demand function as in Gopinath and Itskhoki (2010) and Amiti, Itskhoki, and Konings (2019):

$$\psi_i(\alpha_{fid}, P^*_{fidt}, D_{fidt}, \mathcal{E}_{dt}) \equiv \alpha_{fid} \left[1 - \xi \ln\left(\frac{P_{fidt}}{\mathcal{E}_{dt} D_{fidt}}\right)\right]^{\frac{\rho_i}{\xi}} \tag{8}$$

where

- ρ_i is the elasticity of substitution across varieties of product i sold by firms;
- ξ is the super elasticity that governs the extent to which the firm adjusts its markups to competition-relevant demand shocks (i.e., $\mathcal{E}_{dt}$, D_{fidt}).

When $\xi \to 0$, the model converges to the conventional CES case, where firms charge constant markups $\rho_i/(1-\rho_i)$ and do not respond to destination-specific demand shocks.

Model-based analysis of pricing (3)

For the Kimball demand function:

$$\psi_i(\alpha_{fid}, P^*_{fidt}, D_{fidt}, \mathcal{E}_{dt}) \equiv \alpha_{fid}\left[1 - \xi \ln\left(\frac{P_{fidt}}{\mathcal{E}_{dt} D_{fidt}}\right)\right]^{\frac{\rho_i}{\xi}} \tag{9}$$

there are four arguments that can potentially contribute to selection or omitted variable bias when estimating markup elasticities:

- D_{fidt} is a markup-relevant demand shifter
- α_{fid} is a markup-irrelevant preference shifter
- $P_{fidt}$is the border price and
- $\mathcal{E}_{dt}$ is the bilateral exchange rate between the exporting country and the destination country, where an increase in $\mathcal{E}_{dt}$ is a depreciation of the exporting country's currency.

Signing bias caused by unobserved demand or marginal cost shocks

	Selection Bias			Selection & OV Bias	
Unobservable variable x:	1 D_{fidt}	2 α_{fidt}	3 $\mathcal{MC}_{fit}$	4 $\mathcal{MC}_{fit}$	5 $\mathcal{MC}_{fit}$
How does x co-move with:					
– exchange rate, $corr(\Delta \ln x, \Delta \ln \mathcal{E})$	.	.	.	+	−
– optimal price, $\frac{\partial P^*}{\partial x}$	+	.	+	+	+
– operational profit, $\frac{\partial \pi}{\partial x}$	+	+	−	−	−
Direction of bias					
– omitted variable	.	.	.	+	−
– selection	−	.	+	+	+
Overall bias	−	.	+	+	+/−

Note: "." means no correlation or bias. "+/−" means the direction of the bias is indeterminant.

An idiosyncratic positive D shock raises prices and op. profits. However, b/c for an importer with a weak currency, we only observe sales when idiosyncratic demand is strong, there will be a negative correlation between $\mathcal{E}_{dt}$ and D_{fidt} in *observed transactions*, resulting in a downward selection bias in the estimated markup elasticity.

Comparison across Estimators: Simulated Data

from model with firm-product-time cost shocks
+ firm-product-destination-time demand shocks

Sample	(5) $fid + t$ FE	(6) $fit + d$ FE	(7) TPSFE	(8) Best Linear
All	0.17	0.09	0.13	0.18
	(0.01)	(0.00)	(0.01)	(0.00)
HD ($\rho = 4$)	0.22	0.13	0.28	0.27
	(0.01)	(0.00)	(0.02)	(0.00)
LD ($\rho = 12$)	0.12	0.05	0.08	0.09
	(0.01)	(0.00)	(0.00)	(0.00)

Note: Estimates and standard errors are calculated based on the average of 10 simulations of each setting.

- Best linear estimates using OLS with all unobservable variables included.
- TPSFE estimator reduces bias in the presence of two types of time-varying unobservables.
- When destination-specific demand for a firm's product is time-varying, $fit + d$ FE estimates suffer from downward *selection bias*.

Comparison across Estimators

Highly Differentiated Products by Firm Registration Type, 2006-2014

Sample	(1) TPSFE	(2) $(fid + t)$ FE	(3) $(fit + d)$ FE	n. of obs
2006-2014, High Differentiation				
State-owned Enterprises	0.26***	0.25***	0.08***	1,617,483
	(0.04)	(0.01)	(0.01)	
Foreign Invested Enterprises	0.27***	0.18***	0.07***	2,267,880
	(0.03)	(0.01)	(0.00)	
Private Enterprises	0.06***	0.11***	0.04***	3,988,833
	(0.01)	(0.00)	(0.00)	
Intermediate Goods	0.03	0.22***	0.03***	580,037
	(0.05)	(0.02)	(0.01)	
Consumption Goods	0.29***	0.23***	0.12***	3,581,291
	(0.02)	(0.01)	(0.00)	

For highlighted goods: markup elasticities obtained from TPSFE estimator are 2-3 times larger than those from $fit + d$ FE estimator.
Insight from model-simulated data: when destination-specific demand for a firm's product is time-varying, $fit + d$ FE estimates suffer from downward *selection bias*.

Comparison across Estimators

Less Differentiated Products by Firm Registration Type, 2006-2014

Sample	(1) TPSFE	(2) $(fid + t)$ FE	(3) $(fit + d)$ FE	n. of obs
2006-2014, Low Differentiation				
State-owned Enterprises	0.03	0.01	0.01***	1,909,460
	(0.02)	(0.01)	(0.00)	
Foreign Invested Enterprises	0.09***	0.08***	0.05***	2,722,624
	(0.01)	(0.00)	(0.00)	
Private Enterprises	0.02	0.02***	0.03***	5,908,258
	(0.01)	(0.00)	(0.00)	
Intermediate Goods	0.02**	0.02***	0.02***	5,712,115
	(0.01)	(0.00)	(0.00)	
Consumption Goods	0.08***	0.08***	0.05***	2,553,583
	(0.02)	(0.01)	(0.00)	

Markup elasticities obtained from different estimators are similar in value (and very small) $\Rightarrow$ very little (if any) bias from time-varying unobservables or selection.

Conclusions

Pricing-to-market plays a large role in stabilizing import prices in local currency for some products and some firms (those with market power).

Our new framework to estimate markup elasticities

- builds on and exploits an important and robust empirical feature of international trade data: trade patterns;
- develops a novel product classification that identifies product-markets where firms have more vs. less market power; and
- shows how comparing estimates from different estimators can reveal the nature of time-varying unobservable shocks.

Results unveil new estimates of markup elasticities that help us to explain a quantitative puzzle – exchange rate disconnect – that a large and sophisticated literature has been unable to fully resolve.