Markets and Markups

A New Empirical Framework and Evidence on Exporters from China

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Multi-product multi-destination exporters

Snapshot from Chinese customs data, 2007

	No. of Products	Number of Countries 1	2-5	6-10	10+	Total
by Share of Exporters	1	13.5	6.4	1.6	1.2	22.6
	2-5	9.5	16.5	5.8	5.8	37.6
	6-10	2.2	5.5	3.3	4.4	15.3
	10+	2.1	4.7	4.1	13.6	24.6
	Total	27.2	**33.1**	**14.7**	**25.0**	100.0
by Share of Exports	1	1.2	1.3	0.8	1.3	4.7
	2-5	1.9	4.3	3.3	8.8	18.4
	6-10	0.6	2.2	2.0	8.1	13.0
	10+	1.6	4.0	4.2	54.0	63.9
	Total	5.4	**11.9**	**10.4**	**72.3**	100.0

⇒ **72.8% of exporters sell to multiple destinations**

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

Note: Each cell in the top panel shows the percentage of exporters in the Chinese customs data in 2007 that falls under the relevant description. The bottom panel presents the corresponding value of exports.

The question

To what extent do firms adjust export prices and quantities to market-specific conditions – such as exchange rate swings and tariff changes?

- A large exciting literature exploits the increasing availability of high-dimensional customs databases

  e.g., Berman, Martin and Mayer (2012), Chatterjee, Dix-Carneiro and Vichyanond (2013), Amiti, Itskhoki and Konings (2014), Fitzgerald and Haller (2014), De Loecker et al. (2016), Fitzgerald and Haller (2018) and counting
- What can we learn from multi-destination exporters about multilateral competition in local and global markets?
- How can we produce evidence that is relevant for open economy modeling of firm dynamics and pricing to market?

What does this paper do?

Analysis of firms' price and quantity adjustments to relative changes in economic conditions across markets.

1. Estimators of cross-market elasticities designed for large custom databases
2. Novel classification of products by degree of differentiation

   Applied to multi-destination exporters from China, 2000-2014 (200,000+ firms, 8100 products, 14600 varieties, 154 markets).
3. Multi-country model building on Atkeson and Burstein (AB) and Corsetti and Dedola (CD): the $ABCD^H$ model.

Preview of Empirical Results

Price changes = global markup adjustments + destination-specific markup adjustments + changes in marginal costs

- Destination-Specific Markup Elasticity (DSME):
  - High differentiation goods: 0.20
  - Low differentiation goods: 0.06

  Markup adjustment accounts for one-third to one-half of incomplete exchange rate pass through.

- Cross Market Supply Elasticity (CMSE):
  - High differentiation goods: 0.83
  - Low differentiation goods: 2.47

  Relatively inelastic supply response for products with large destination-specific markup responses.

Literature

- **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)

Goal: estimating elasticities

The price ($\approx$ unit value) p_{ifdt} of product i, sold by firm f in destination market d at time t can be decomposed as:

$$p_{ifdt} = \mu_{ifdt} + mc_{ifdt}$$

where the markup μ_{ifdt} and the marginal cost mc_{ifdt} are all denominated in the exporter's currency. Variables are in logs.

We are interested in

$$\frac{\partial \mu_{ifdt}}{\partial e_{dt}} = \frac{\partial p_{ifdt}}{\partial e_{dt}} - \frac{\partial mc_{ifdt}}{\partial e_{dt}}$$

Issue: **the marginal cost mc_{ifdt} is an endogenous function of bilateral exchange rates e_{dt}.**

One approach: Estimate marginal cost

Estimate productivity at the firm or firm-product 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.

Our approach: Difference out mc in a multi-destination setting

To obtain an unbiased estimator of the markup elasticity requires

1. **addressing the endogenous selection of markets:**
   - Firms frequently switch their exporting markets*
   - The choices of markets respond to changes in relative local market conditions*

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

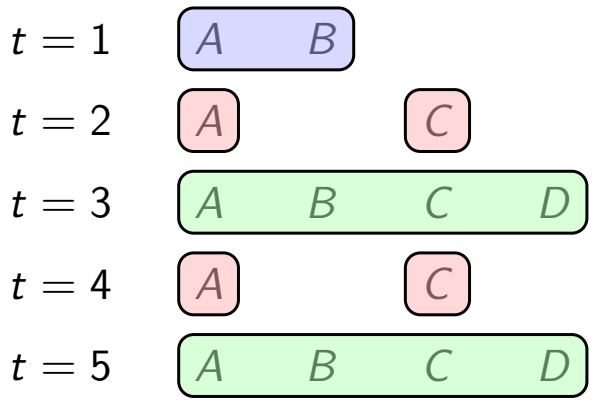
2. **clarifying potential issues from (possible) destination-specific components of marginal cost.**
   $\Rightarrow$ the Identification Condition.

*Han (2018, JMP): Export Market Switching: Theory and Evidence from Chinese and British firms

Multi-country Problem: Trade Pattern Fixed Effects

Consider a firm exporting a product to four countries, A through D, over 5 time periods. Empty elements in the matrix indicate that there was no trade.

Observed Trade Patterns



To estimate the markup elasticity, we compare price residuals at $\mathbf{t = 2}$ with $\mathbf{t = 4}$ and $\mathbf{t = 3}$ with $\mathbf{t = 5}$.

Multi-country Problem: Trade Pattern Fixed Effects

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

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

- For each firm-product pair, calculate the average price in each period; then extract destination-specific price residuals.
- The average price in a period is equal to the common markup and the average marginal cost.
- Estimate the markup elasticity by comparing price residuals over time within the same trade pattern.

Estimating Equation for DSME

Regress price residuals on destination-demeaned variables and the trade pattern fixed effects.

$$\widetilde{p}_{ifdt,D_{ift}} = \kappa_0 + \kappa_1 \widetilde{e}_{dt,D_{ift}} + \widetilde{X}'_{dt,D_{ift}} \kappa_2 + TP_{d,D_{ift}} + \widetilde{u}_{ifdt,D_{ift}}$$

where

- κ_1 is the DSME
- D_{ift} denotes a set of destinations, e.g. VN-KR-JP.
- The trade pattern dummies, $TP_{d,D_{ift}}$, are strings that append the destination country for each *ifdt* observation to the set of destinations D_{ift}.
  e.g. VN-VN-KR-JP, KR-VN-KR-JP and JP-VN-KR-JP.

Identification Condition

For each firm f and product i, write the marginal cost as the sum of its average across destinations in period t, plus a destination-specific deviation.

$$mc_{ifdt} \equiv \overline{mc}_{ift} + \psi_{ifdt},$$

The identification condition

$$\frac{1}{n^{DT}} \sum_{d} \sum_{t} (\overline{\psi}_{dt} - \overline{\psi}_{d})(e_{dt} - \overline{e}_{d}) = 0$$

is satisfied if

- no destination-specific component in mc, i.e., $\psi_{ifdt} = 0$;
- destination-specific mc component is uncorrelated with exchange rate in diff-in-diff, (e.g., high quality products are constantly sold to some set of countries).

Destination-specific markup elasticity (DSME)

TPSFE results, all exports from China

For a 1% appreciation of the local currency → destination-specific markups adjust .07% (2000-2005) and .11% (2006-2014).

	(1) Markup Elasticity 2000-2005	(2) Markup Elasticity 2006-2014
Bilateral nominal exchange rates	0.07***	0.11***
	(0.01)	(0.01)
Destination CPI	-0.03*	-0.00
	(0.02)	(0.01)
Destination real GDP	-0.02	-0.01
	(0.02)	(0.00)
Import-to-GDP ratio	0.01	0.05***
	(0.01)	(0.01)
Observations	1,072,775	4,824,344
FE	TPSFE	TPSFE
SE	Robust	Robust
Con Price Change	Yes	Yes

- Export prices denominated in RMB. Bilateral exchange rates are defined as RMB per foreign currency, i.e an increase means RMB depreciation.
- Estimates conditional on a price change, as in Gopinath et al. [2010]. US and HK are excluded (results unaffected by inclusion).

Markup Elasticity (DSME) versus ERPT

DSME and Pass-through estimates, all exports from China

	Markup Elasticity 2000-2005	Markup Elasticity 2006-2014	Price (1-ERPT) 2000-2005	Price (1-ERPT) 2006-2014
Elasticity to bilateral exchange rates, conditional on a price change	0.07***	0.11***	0.23***	0.24***

Against a 1% bilateral appreciation of the local currency (depreciation of the renminbi):

- export prices in renminbi rise by 0.24%
  export prices in the destination-market currency fall by 1-0.24%=0.76%:
  ERTP is 0.76
- Between 1/3 to 1/2 of "missing pass-through" is due to destination-specific markup adjustments:
  .07/23 and .11/.24

Price movements (ERPT) result from:

1. markup adjustment common across destinations
2. destination-specific markup adjustment
   (what we measure)
3. changes in marginal costs

Cross-Market Supply Elasticity (CMSE)

Goal: estimate the cross-market quantity response to exchange rates corresponding to estimated changes in relative markups.

- First stage: calculate $\widehat{\widetilde{p}}_{ifdt,D_{ift}}$, the predicted change in the *relative markup* in response to a destination-specific change in the exchange rate

$$\widehat{\widetilde{p}}_{ifdt,D_{ift}} = \widehat{\kappa}_0 + \widehat{\kappa}_1 \widetilde{e}_{dt,D_{ift}} + \widetilde{X}'_{dt,D_{ift}} \widehat{\kappa}_2$$

  Intuitively, a proxy for relative demand conditions.

- Second stage:

$$\widetilde{q}_{ifdt,D_{ift}} = \gamma_0 + \gamma_1 \widehat{\widetilde{p}}_{ifdt,D_{ift}} + \widetilde{X}'_{dt,D_{ift}} \gamma_2 + TP_{d,D_{ift}} + \widetilde{v}_{ifdt,D_{ift}}$$

  γ_1: proposed measure for cross-market supply elasticity (CMSE).

Cross market supply elasticity

Whole sample

Cross-market Supply Elasticity 2000-2005	Cross-market Supply Elasticity 2006-2014	Naïve regression 2000-2005	Naïve regression 2006-2014
4.09***	1.51***	-0.71***	-0.70***

Naïve regression: destination demeaned quantities are regressed on destination demeaned prices with controls (CPI, real GDP and Import-to-GDP ratio) and trade pattern fixed effects.

- Over 2000-2005, DSME is very low (0.07) and CMSE is relatively elastic (4.09).
- Over 2006-2014, DSME is higher (0.11) and CMSE is relatively inelastic (1.51).

Refining estimates by firms' market power

In leading classifications, e.g., by Rauch (1999), tomato paste and tractors are both "differentiated manufactured goods."

But tomato paste seems less differentiated than tractors.

Are firms' pricing strategies similar for these two products?

Identifying high- and low-differentiation products

Exploit information on how products are measured in custom forms:

- Count Classifier → High Differentiation
- Mass Classifier → Low Differentiation

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

Examples of count classifiers

How does CCHS differ from Rauch?

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

	Corsetti-Crowley-Han-Song (CCHS)		
	Low Differentiation/ Mass Noun	High Differentiation/ Count 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

- The large class of Rauch differentiated goods splits into roughly equal-size bins of Low Differentiation (LD) and High Differentiation (HD) goods.
- All Rauch commodities are CCHS Low Differentiation goods.

ERPT and Markup elasticities for HD-LD goods

CCHS classification

	All		High Differentiation		Low Differentiation		
	1-ERPT	Markup	1-ERPT	Markup	1-ERPT	Markup	n. of obs
2000 – 2005	0.23***	0.07***	0.25***	0.14***	0.22***	0.02	1,076,815
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	
2006 – 2014	0.24***	0.11***	0.32***	0.20***	0.19***	0.06***	4,863,196
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	

- ERPT higher (81%), DSME lower (.06%) for LD goods.
- ERPT lower (68%), DSME higher (.20%) for HD goods.
- For HD goods, two-thirds of price adjustment due to markups.

For commodities (not shown): estimated markup elasticity is 0.

Cross-Market Markup and Supply Elasticity

CCHS classification

	All		High Differentiation		Low Differentiation		
	Markup	CMSE	Markup	CMSE	Markup	CMSE	n. of obs
$2000-2005$	0.07***	4.09***	0.14***	2.57***	0.02	†	1,076,815
	(0.01)	(0.82)	(0.02)	(0.49)	(0.01)		
$2006-2014$	0.11***	1.51***	0.20***	0.83***	0.06***	2.47***	4,863,196
	(0.01)	(0.16)	(0.01)	(0.12)	(0.01)	(0.43)	

† First stage is not significantly different from zero.

- HD products: small changes in relative quantities (CMSE) in response to large changes in markups.
- LD products: large changes in relative quantities (CMSE) in response to very small changes in markup.

Conclusions

In this paper, we develop:

- a framework to estimate cross-market markup and quantity adjustments in response to changing market conditions.
- a novel product classification that identifies product-markets where firms have more vs. less market power.

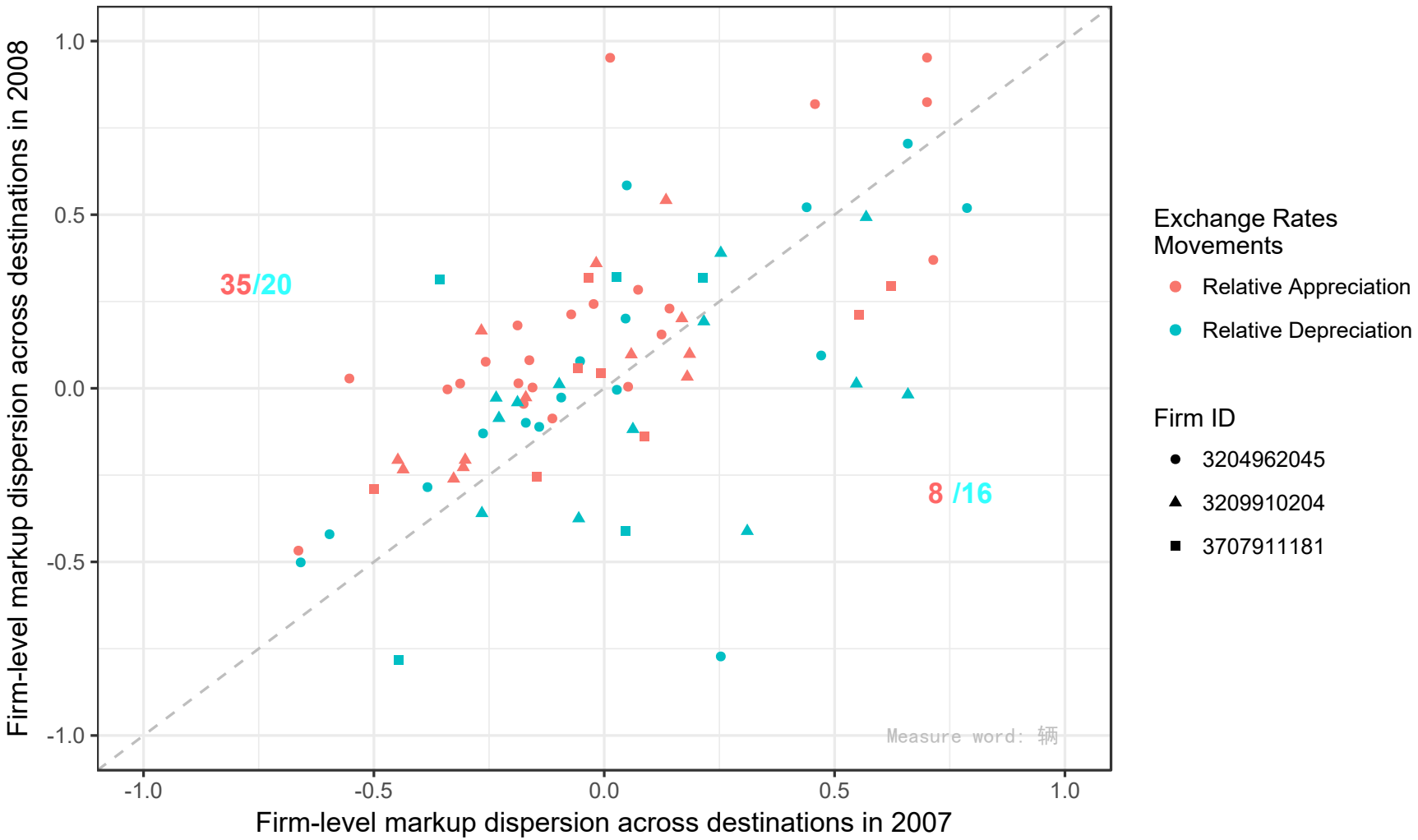
Results unveil novel and valuable evidence for model development.

- Using our estimates as a diagnostic for theory yields a sharp message – certain realistic model features are essential:
  a. multilateral, horizontal competition by local and third country producers
  b. vertical interactions between (upstream) exporters and (downstream) local distributors (and manufacturers).

Wheeled Tractors as High Differentiation good

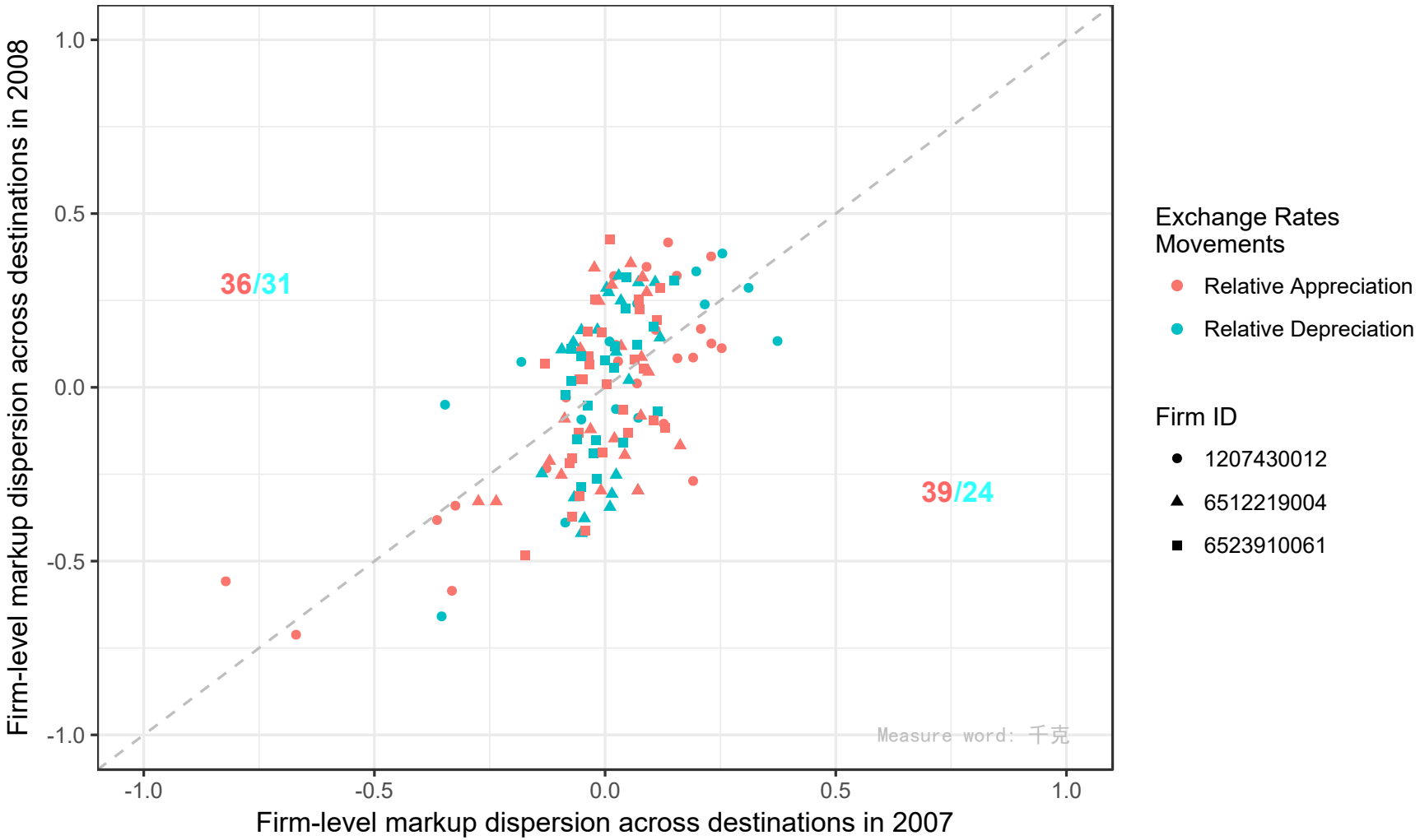
High markup dispersion and response vis-à-vis bilateral exchange rates changes

markups tend to rise when foreign currency appreciates



Tomato Paste as Low-Differentiation good

Low markup dispersion unrelated to bilateral exchange rates



Simulated Example for Endogenous Selection Bias

The data generating process is given as follows:

$$p_{fdt} = \beta_1 e_{dt} + \beta_2 mc_{ft} + u_{fdt}$$
$$e_{dt} = \mathcal{F}_d + \mathcal{F}_t + \mathcal{F}_d * \mathcal{F}_t$$
$$mc_{ft} = \mathcal{C}_f + \mathcal{C}_t + \mathcal{C}_f * \mathcal{C}_t$$

The formulation of factors and the residual term is given by:

$$u_{fdt} = \mathcal{I}_1 \mathcal{C}_f + \mathcal{I}_2 \mathcal{F}_d + \mathcal{I}_3 \mathcal{F}_t + \epsilon_{fdt}$$
$$\mathcal{F}_d \sim N(0,1) \quad \mathcal{C}_f \sim N(0,1) \quad \mathcal{F}_t = \mathcal{C}_t \sim N(0,1) \quad \epsilon_{fdt} \sim N(0,1)$$

where $\mathcal{I}$ is an indicator variable that takes values of 0 or 1. For instance, $\mathcal{I}_2$ reflects the cross-destination compatibility problem, i.e., cross-destination comparisons of macro variables such as nominal exchange rates and CPI are meaningless. In each simulation, a balanced panel with 200 firms, 10 destinations and 10 time periods is generated, i.e., $n^F = 200, n^D = 10, n^T = 10$.

Endogenous Selection

$$p_{fdt} = \begin{cases} \text{missing} & \textit{if} \quad \begin{array}{c} \text{top 20 percentile of exchange rate shocks at time } t \\ \& \text{ top 20 percentile of marginal cost shocks at time } t \end{array} \\ \text{observed} & \textit{otherwise} \end{cases}$$

			Balanced Panel			Unbalanced Panel			Theoretical
$\mathcal{I}_1$	$\mathcal{I}_2$	$\mathcal{I}_3$	Time Diff	fd, t	TPSFE	Time Diff	fd, t	TPSFE	
0	0	0	1.00***	1.00***	1.00***	1.17***	0.85***	1.00***	1.00
			(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	
1	1	1	1.00***	1.00***	1.00***	1.48***	0.84***	1.00***	1.00
			(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	

Estimates and standard errors are calculated from the average of 100 simulations. Each simulation contains a randomly generated sample of 200 firms, 10 destinations and 10 time periods based on the data generating process specified in the paper. The 'Time Diff' column presents estimates using S-period time differenced variables at the firm-destination level adding time fixed effects. The 'fd, t' column presents estimates applying firm-product and time fixed effects in the reghdfe estimator. The 'TPSFE' column presents estimates applying our trade pattern sequential fixed effects estimator.

Analytical decomposition:

$$\Delta_{s|fd} p_{fdt} = \beta_1 \Delta_{s|fd} e_{dt} + \beta_2 \Delta_{s|fd} mc_{ft} + \Delta_{s|fd} u_{fdt}$$

where

$$\Delta_{s|fd} e_{dt} = \mathcal{F}_t - \mathcal{F}_{t-s|fd} + \mathcal{F}_d(\mathcal{F}_t - \mathcal{F}_{t-s|fd})$$
$$\Delta_{s|fd} mc_{ft} = \mathcal{C}_t - \mathcal{C}_{t-s|fd} + \mathcal{C}_f(\mathcal{C}_t - \mathcal{C}_{t-s|fd})$$

Generally, we have

$$\begin{aligned}
\Delta_{s|ifd} p_{ifdt} \;=\; & \Delta_{s|ifd} \mathcal{F}_t + \Delta_{s|ifd} \mathcal{C}_t \\
& + \Delta_{s|ifd} \mathcal{F}_{it} + \Delta_{s|ifd} \mathcal{F}_{ft} + \Delta_{s|ifd} \mathcal{F}_{dt} + \Delta_{s|ifd} \mathcal{C}_{it} + \Delta_{s|ifd} \mathcal{C}_{ft} \\
& + \Delta_{s|ifd} \mathcal{F}_{fdt} + \Delta_{s|ifd} \mathcal{F}_{idt} + \Delta_{s|ifd} \mathcal{F}_{ift} + \Delta_{s|ifd} \mathcal{C}_{ift} \\
& + \Delta_{s|ifd} \mathcal{F}_{ifdt}
\end{aligned}$$

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Economics meets linguistics: A general classification of high- and low-differentiation products

Wide variety of count classifiers in Chinese customs data:

Quantity Measure	HS08 Code	English Description	Chinese Description
tào, 套	82111000	Sets of assorted knives	成套的刀
bǎ, 把	82119100	Table knives having fixed blades	刃面固定的餐刀
bǎ, 把	82119200	Other knives having fixed blades	其他刃面固定的刀
bǎ, 把	82119300	Pocket & pen knives & other knives with folding blades	可换刃面的刀
bǎ, 把	82121000	Razors	剃刀
piàn, 片	82122000	Safety razor blades, incl razor blade blanks in strips	安全刀片, 包括未分开的刀片条

$\rightarrow$ Unit values closer to transaction prices

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Broad Economic Categories

More on production costs vs. markup adjustment

	All		High Differentiation		Low Differentiation		
Category	Price	Markup	Price	Markup	Price	Markup	n. of obs
2000 – 2005							
Consumption	0.25***	0.10***	0.29***	0.17***	0.19***	0.02	426,462
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	
Intermediate	0.23***	0.03	0.22***	0.14***	0.24***	0.01	294,929
	(0.02)	(0.02)	(0.06)	(0.05)	(0.02)	(0.02)	
2006 – 2014							
Consumption	0.33***	0.20***	0.44***	0.32***	0.16***	0.08***	1,756,214
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	
Intermediate	0.21***	0.05***	0.34***	0.12***	0.19***	0.05***	1,593,591
	(0.01)	(0.01)	(0.06)	(0.04)	(0.01)	(0.01)	

Markup adjustment to exchange rate:

- largest for HD consumption goods (32%)
- smallest for LD intermediates (5%)

Cross-Market Supply Elasticity by BEC Classifications (2006 – 2014)

	All		High Differentiation		Low Differentiation		
Category	Naïve Reg.	CMSE	Naïve Reg.	CMSE	Naïve Reg.	CMSE	n. of obs
Consumption	-0.71***	0.54***	-0.77***	0.23**	-0.63***	1.92***	1,756,214
	(0.00)	(0.11)	(0.00)	(0.09)	(0.00)	(0.59)	
Intermediate	-0.71***	2.92***	-0.74***	1.33	-0.70***	3.27***	1,593,591
	(0.00)	(0.73)	(0.01)	(0.86)	(0.00)	(0.90)	

Cross country supply adjustment:

- smallest for HD consumption goods (.23)
- largest for LD intermediates (3.27)

CCHS vs Rauch classifications

	All		High Differentiation		Low Differentiation		
Category	Price	Markup	Price	Markup	Price	Markup	n. of obs
2000 – 2005							
Differentiated Products	0.22***	0.09***	0.25***	0.14***	0.20***	0.04**	815,223
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	
Organized Exchange	0.60***	0.02	-	-	0.62***	0.02	11,925
	(0.06)	(0.05)			(0.06)	(0.05)	
Reference Priced	0.23***	0.09**	0.05	0.26**	0.24***	0.08*	88,959
	(0.03)	(0.04)	(0.16)	(0.12)	(0.04)	(0.04)	
2006 – 2014							
Differentiated Products	0.22***	0.12***	0.32***	0.20***	0.14***	0.07***	3,944,681
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	
Organized Exchange	1.02***	-0.05	-	-	1.03***	-0.05	27,235
	(0.07)	(0.05)			(0.07)	(0.05)	
Reference Priced	0.43***	0.11***	0.14	0.16*	0.45***	0.10***	366,974
	(0.02)	(0.02)	(0.10)	(0.09)	(0.02)	(0.02)	

$ABCD^H$ setup

Multi-country Atkeson and Burstein (2008) with vertical interaction, as in Corsetti and Dedola (2005)

As in CD, we model vertical interactions as "distribution:" bringing a product to the consumers requires the use of χ_i units of local nontradables.

Firms compete by choosing the price $p_{f,i,o,d,t}$ internalizing (i) impact on the industry level price index $P_{i,d,t}$ and (ii) the wedge $(\chi_i P_{N,d,t})$ that distribution creates between producer and consumer prices. Abstracting from double marginalization for simplicity:

$$\max_{p_{f,i,o,d,t}} q_{f,i,o,d,t} \left[(p_{f,i,o,d,t} - \chi_i P_{N,d,t}) e_{o,d,t} - mc_{f,i,o,t} \right]$$

subject to

$$q_{f,i,o,d,t} = \left(\frac{p_{f,i,o,d,t}}{P_{i,d,t}} \right)^{-\rho_i} \left(\frac{P_{i,d,t}}{P_{T,d,t}} \right)^{-\eta} C_{T,d,t}$$

- f firm, i industry, o origin, d destination, t time;
- All prices denominated in the destination currency;
- $mc_{f,i,o,t}$: marginal cost of firm f from sector s and origin o at time t;
- $e_{o,d,t}$: bilateral exchange rate; defined as units of currency o per unit of currency d at time t;
- $P_{T,d,t}$, $C_{T,d,t}$: price and consumption of tradable goods.
- ρ_i within-industry elasticity of substitution—different from trade elasticity!; η cross-industry elasticity of substitution.

A three-way decomposition of markups

Markup changes *expressed in the exporter's currency* can be decomposed as follows:

$$\widehat{\mu}_{k,i,o,d,t} = \left[1-(1-\lambda_{k,i,o,d,t})(1-\omega_{k,i,o,d,t})\right](\widehat{e}_{o,d,t}-\widehat{mc}_{k,i,o,t}) + (1-\lambda_{k,i,o,d,t})\left[\omega_{k,i,o,d,t}\widehat{P}_{N,d,t}-\kappa_{k,i,o,d,t}\widehat{CE}_{k,i,o,d,t}\right]$$

where $\lambda_{k,i,o,d,t}$ accounts for the degree of horizontal competition (AB^{-}, since this abstracts from competitors' reaction):

$$\lambda_{k,i,o,d,t} \equiv 1-\frac{1}{1-(1-ms_{k,i,o,d,t})(1-\rho_i)\kappa_{k,i,o,d,t}};$$

$\omega_{k,i,o,d,t}$ accounts for vertical interactions (CD):

$$\omega_{k,i,o,d,t} \equiv \frac{\chi_i P_{N,d,t} e_{o,d,t}}{mc_{k,i,o,t}+\chi_i P_{N,d,t} e_{o,d,t}};$$

and $\widehat{CE}_{k,i,o,d,t}$ is the total effect of competitors' reactions (completing AB):

$$\widehat{CE}_{k,i,o,d,t} = \sum_{o'}\sum_{f\neq k} ms_{f,i,o',d,t}(1-\rho_i)\left[\begin{array}{c}(1-\omega_{f,i,o',d,t})(\widehat{mc}_{f,i,o',t}-\widehat{e}_{o',d,t})+\\ \omega_{f,i,o',d,t}\widehat{P}_{N,d,t}+\kappa_{f,i,o',d,t}\widehat{ms}_{f,i,o',d,t}\end{array}\right].$$

- ms: market share
- κ: price elasticity with respect to market share

An analytically tractable case

For tractability, assume that firms in each country have similar productivity and thus market share distributions. This ensures that $\varepsilon_{k,i,1,2,t} = \varepsilon_{k,i,1,3,t}$, $\lambda_{k,i,1,2,t} = \lambda_{k,i,1,3,t}$, $\omega_{k,i,1,2,t} = \omega_{k,i,1,3,t}$.

For firm k, industry i, origin country 1 at time t (dropping all unnecessary subscripts):

$$\widehat{p}_2 + \widehat{e}_2 - (\widehat{p}_3 + \widehat{e}_3) = \Gamma(\widehat{e}_2 - \widehat{e}_3) + (1-\lambda)\omega(\widehat{P}_{N,2} - \widehat{P}_{N,3}) - (1-\lambda)\kappa(\widehat{CE}_2 - \widehat{CE}_3)$$

$$\widehat{p}^b_2 + \widehat{e}_2 - (\widehat{p}^b_3 + \widehat{e}_3) = \frac{\Gamma - dm}{1-dm}(\widehat{e}_2 - \widehat{e}_3) + \frac{(1-\lambda)\omega - dm}{1-dm}(\widehat{P}_{N,2} - \widehat{P}_{N,3}) - \frac{(1-\lambda)\kappa}{1-dm}(\widehat{CE}_2 - \widehat{CE}_3)$$

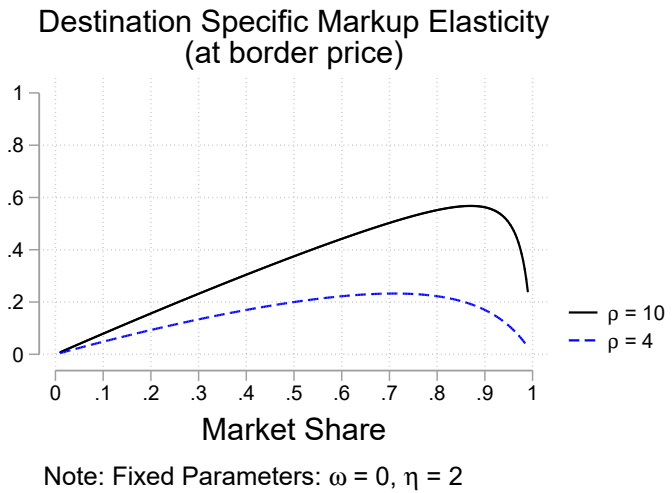
$$\widehat{q}_2 - \widehat{q}_3 = -\varepsilon(\Gamma - 1)(\widehat{e}_2 - \widehat{e}_3) - \varepsilon(1-\lambda)\omega(\widehat{P}_{N,2} - \widehat{P}_{N,3}) + \left[\frac{\rho - \eta}{1-\rho} + \varepsilon(1-\lambda)\kappa\right](\widehat{CE}_2 - \widehat{CE}_3) + \eta(\widehat{P}_{T,2} - \widehat{P}_{T,3}) + \widehat{C}_{T,2} - \widehat{C}_{T,3}$$

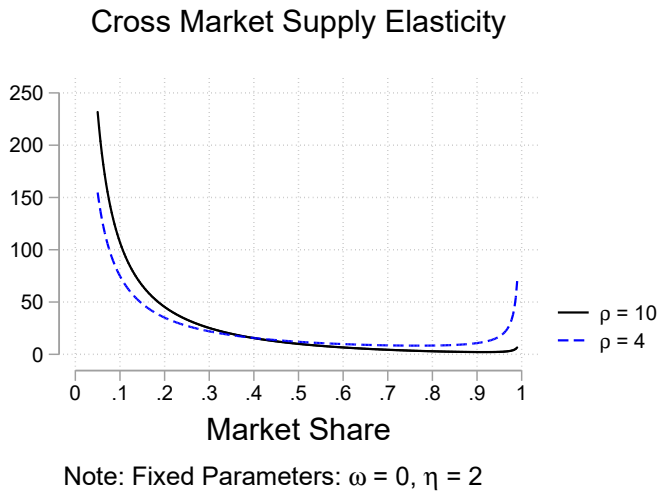
- $\Gamma \equiv 1 - (1-\lambda)(1-\omega)$: 1 - (1-horizontal competition)*(1-vertical integration)
- $dm \equiv \chi P_N / p$: distribution margin
- p^b_d: border price at destination d
- ε: demand elasticity with respect to consumer price

We can use this framework to switch examine each mechanism on its own, and interactions. Back

Only Horizontal Competition

(Atkeson Burstein 2008)





Share of distribution $\omega = 0$.
Relative to evidence:

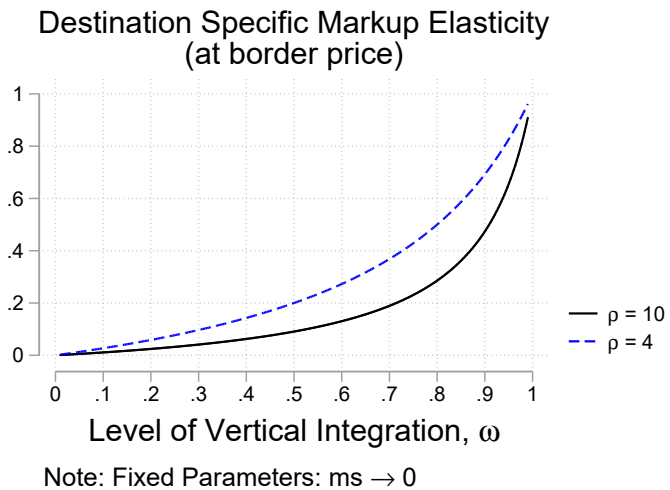
- opposite ranking: markup elasticity is higher for less differentiated products (high ρ)
- wrong magnitude: Q/M is too high when M is low

Only Vertical Interaction

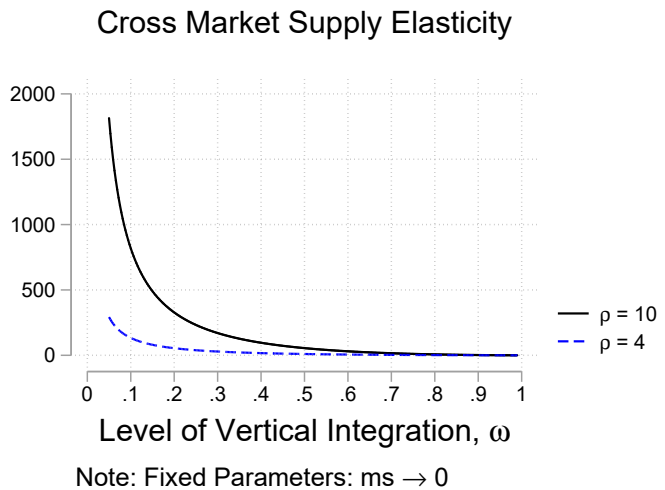
(Corsetti Dedola 2005)

In CD, demand elasticity to the border price is a decreasing function of distribution margin

- high elasticity of substitution $\rho \rightarrow$ lower markup $\rightarrow$
  higher distribution margin $\rightarrow$ lower demand elasticity $\rightarrow$ lower markup adjustments



Note: Fixed Parameters: ms $\rightarrow$ 0



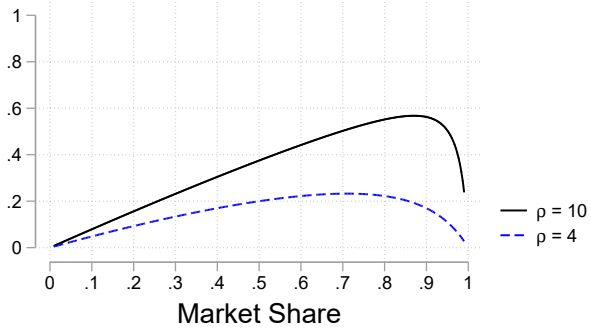
Note: Fixed Parameters: ms $\rightarrow$ 0

Market share $ms \rightarrow 0$
Relative to evidence:

- right ranking: markup elasticity is lower and Q/M is higher for less differentiated products (high ρ)
- wrong magnitude: Q/M is too high when M is low

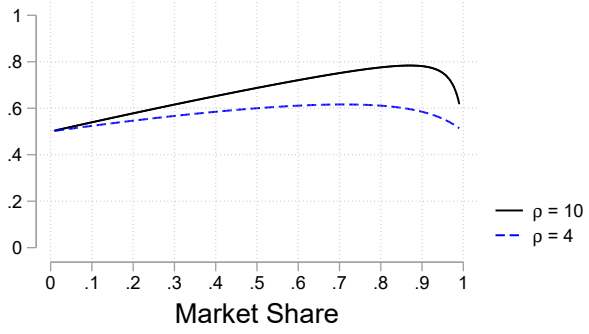
Horizontal Competition with Vertical Integration (ABCD)

Degree of Horizontal Competition, λ



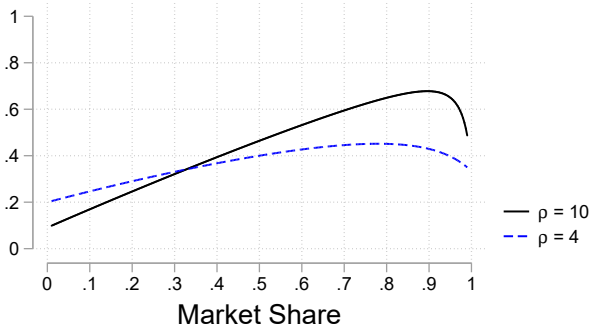
Note: Fixed Parameters: $\omega = .5$, $\eta = 2$

$\Gamma = 1 - (1 - \lambda)(1 - \omega)$



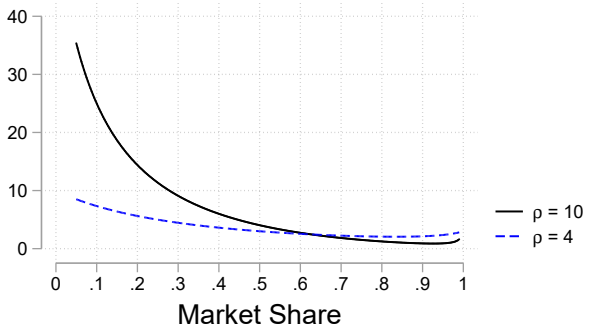
Note: Fixed Parameters: $\omega = .5$, $\eta = 2$

Destination Specific Markup Elasticity (at border price)



Note: Fixed Parameters: $\omega = .5$, $\eta = 2$

Cross Market Supply Elasticity



Note: Fixed Parameters: $\omega = .5$, $\eta = 2$

- Improvement on the ranking
- Q/M magnitude gets closer to empirical estimates (but yet too high)

Back