The Mutable Geography of Firms' International Trade: Evidence and Macroeconomic Implications

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Bank of Canada and CEPR

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- This paper: study market changes of multi-destination exporters

Trade Pattern of a Chinese Exporter Selling T-shirts

2003	Australia	South Korea	Japan		
2004	Australia	South Korea		Germany	
2005	Australia		Japan	Germany	
2006	Australia			Germany	Belgium Canada

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   $\Rightarrow$ Multi-country GE model to quantify welfare implications

New Empirical Facts and Analytical Framework

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Develop a simple analytical framework to interpret these facts

- Within-firm market changes are mainly driven by residual demand shocks, with a quarter being correlated across firm's markets

Aggregate Implications of Market Changes

- Incorporate calibrated granular shocks into a multi-county GE model

  $\Rightarrow$ Calibrate granular (firm- and firm-destination-specific) shocks to match empirical facts on market changes

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- Granular hypothesis: Idiosyncratic shocks may not sum to zero and thus can cause agg. fluctuations Gabaix (11), Giovanni, Levchenko, Mejean (14, 18, 24)

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- With the calibrated granular shocks and endogenous market changes, welfare (consumption) is 3.5% higher due to enlarged gains from trade

Roadmap

- Empirical Results
  - ⋆ New measures of within-firm market changes
  - ⋆ Market changes and intensive margin adjustments in continuing markets
- Analytical Framework
  - ⋆ Mapping empirical measures to model parameters
  - ⋆ Quantify the importance of various shocks
- Aggregate Implications
  - ⋆ Importance of granular shocks and market changes

New Measures of Market Changes

Consider a firm selling a product to countries A, B, C, D over 4 time periods:

					Trade Pattern	Activity
$t = 1$	A	B			A-B	–
$t = 2$	A		C		A-C	Churn
$t = 3$	A		C	D	A-C-D	Add
$t = 4$	A		C		A-C	Drop

New Measures of Market Changes

Consider a firm selling a product to countries A, B, C, D over 4 time periods:

					Trade Pattern	Activity	**(a) M. Changes/ Markets**	**(b) Drops/ Changes**
$t = 1$	A	B			A-B	–	–	–
$t = 2$	A		C		A-C	Churn	2/2	1/2
$t = 3$	A		C	D	A-C-D	Add	1/3	0/1
$t = 4$	A		C		A-C	Drop	1/2	1/1

(a) captures the **magnitude** of market changes
(b) captures the **direction** of market changes

e.g. drops/changes $= 0 \Leftrightarrow$ Add; $0 <$ drops/changes $< 1 \Leftrightarrow$ Churn; drops/changes $= 1 \Leftrightarrow$ Drop

Within-Firm Market Changes

A typical exporter changes more than half of its markets on a year-to-year basis

Market Changes/ Markets (Median)

	All Firms	Large Firms
Chinese Exporters, 2000-2006		
Firm-product (8-digit) level	0.67	0.64
Firm-industry (2-digit) level	0.60	0.52
Firm level	0.57	0.50

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Firm level	0.57	0.50
British Exporters, 2010-2016		
Extra-EU Destinations		
Firm-product (8-digit) level	0.86	0.71
Firm-industry (2-digit) level	0.67	0.50
Firm level	0.67	0.50
All Destinations		
Firm-product (8-digit) level	0.50	0.50
Firm-industry (2-digit) level	0.50	0.40
Firm level	0.60	0.37

Data Breakdown by Firm and Product Types

Drop-to-Change Ratio and Market Switching

Equal probability of drops and adds and 1/3 of these changes involve market switching

Statistics from Firm-product Level Trade Patterns (Median)

	All Firms	Large Firms
Chinese Exporters, 2000-2006		
Market Drops/ Market Changes	0.50	0.50
British Exporters, All Dest., 2010-2016		
Market Drops/ Market Changes	0.50	0.50

Drop-to-Change Ratio and Market Switching

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Statistics from Firm-product Level Trade Patterns (Median)

	All Firms	Large Firms
Chinese Exporters, 2000-2006		
Market Drops/ Market Changes	0.50	0.50
Probability of Churn	**0.26**	**0.33**
British Exporters, All Dest., 2010-2016		
Market Drops/ Market Changes	0.50	0.50
Probability of Churn	**0.32**	**0.45**

Next, link drop-to-change ratio to price and quantity adjustments in continuing markets

Market Changes and Intensive Margin Adjustments

How can price and quantity changes in the firm's continuing markets inform us the reasons behind the market changes?

- If observe big intensive margin changes in continuing markets $\Rightarrow$ factors correlated across markets
- If observe big price changes in continuing markets $\Rightarrow$ supply factors affecting firm's marginal cost

					Changes in the Quantity of Continuing Markets	**Drops/Changes**
$t=1$	A	B			.	.
	$\downarrow$					
$t=2$	A		C		$q_{A,2} - q_{A,1}$	$1/2$
	$\downarrow$		$\downarrow$			
$t=3$	A		C	D	$q_{AC,3} - q_{AC,2}$	$0/1$
	$\downarrow$		$\downarrow$			
$t=4$	A		C		$q_{AC,4} - q_{AC,3}$	$1/1$

Regress Quantity Changes in Continuing Markets on Drop-to-Change Ratio

Linking Extensive and Intensive Margins

Firms dropping more markets reduce sales in continuing markets (with little change in price)

Elasticities of Quantity and Price to Drop-to-Change Ratio

	Mean Quantity	Unit Value	Observations
Chinese Exporters, 2000-2006			
Firm-product level	-0.65***	$0.01^{\dagger}$	1,244,580
Firm-industry level	-0.73***	$0.03^{\dagger}$	731,199
Firm level	-0.73***	$0.05^{\dagger}$	281,564
British Exporters, 2010-2016			
Firm-product level	-0.51***	$0.00^{\dagger}$	1,149,821
Firm-industry level	-0.39***	$0.01^{\dagger}$	488,877
Firm level	-0.25***	$0.02^{\dagger}$	230,634

Big quantity drop but small price change $\Rightarrow$ demand factors more important

Note: Each cell represents an estimate from a separate estimation equation.

$***$ indicates significance at 0.1%; † indicates the significance of the estimate is sensitive to alternative samples.
Firm(-product/industry) and year fixed effects are included.

Summary and Roadmap

✓ Empirical Results:

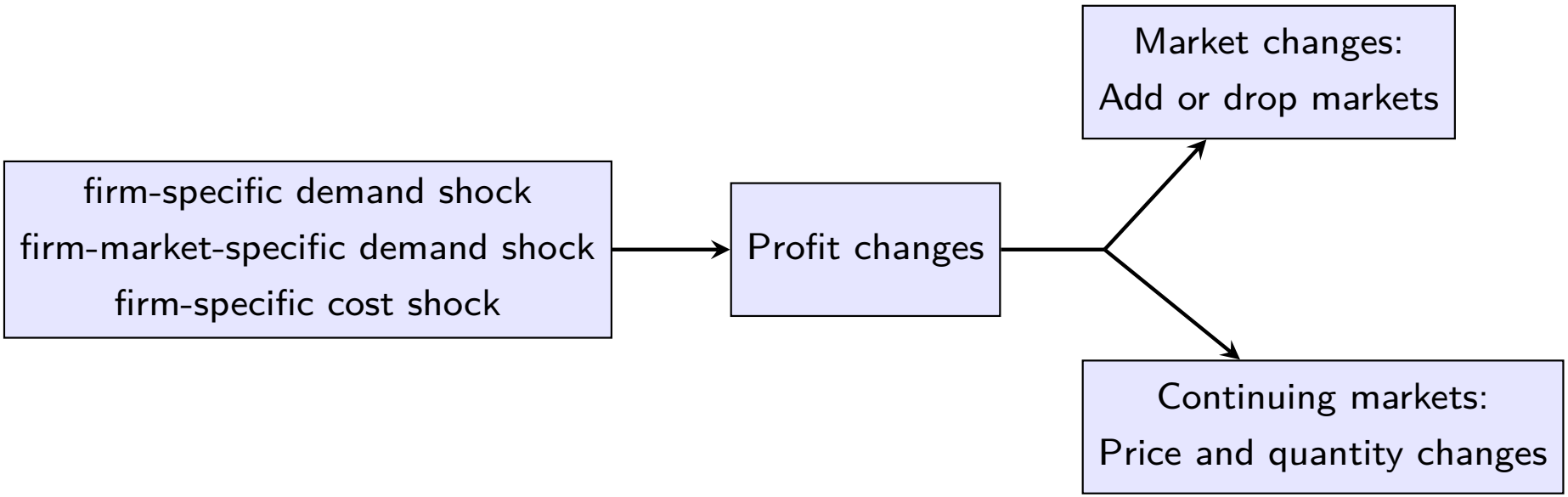
- ⋆ Typical exporter changes more than half of its markets on a yearly basis
- ⋆ 3 key empirical statistics:
  1. market change to markets ratio
  2. price elasticity to drop-to-change (DC) ratio
  3. quantity elasticity to DC ratio

⇒ Analytical Framework

- ⋆ Tractable partial equilibrium model to show the 3 key statistics can help gauge relative contributions of different shocks driving the market changes

- Aggregate Implications of Market Changes

Analytical Framework



In the next few slides,

- characterize market and profit changes
- closed-form solutions using two-firm two-market example
- numerical solutions for many firm and markets

Characterizing Market Changes

Firm f faces a fixed cost ζ_{fd} of exporting to each market d. Export decision is based on potential operating profit π_{fdt} in market d:

$$\begin{array}{lll} \text{If} & \pi_{fdt} > \zeta_{fd} & \rightarrow \quad \text{export to market } d \\ \text{If} & \pi_{fdt} \leq \zeta_{fd} & \rightarrow \quad \text{do not export to market } d \end{array}$$

Probability of market d being *added* from $t-1$ to t is:

$$Pr(\pi_{fdt-1} \leq \zeta_{fd} \bigcap \pi_{fdt} > \zeta_{fd})$$

Similarly, probability of market d being *dropped* is:

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Probability of market d being *added* from $t-1$ to t is:

$$Pr(\tilde{\zeta}_{fdt-1} \geq 0 \bigcap \widehat{\pi}_{fdt} > \tilde{\zeta}_{fdt-1})$$

Similarly, probability of market d being *dropped* is:

$$Pr(\tilde{\zeta}_{fdt-1} < 0 \bigcap \widehat{\pi}_{fdt} \leq \tilde{\zeta}_{fdt-1})$$

$\Rightarrow$ Market changes are characterized by the distribution of

1. change in operating profit: $\widehat{\pi}_{fdt} \equiv \pi_{fdt} / \pi_{fdt-1} - 1$
2. 'distance' of the firm's profit from export cost: $\tilde{\zeta}_{fdt-1} \equiv \zeta_{fd} / \pi_{fdt-1} - 1$

Characterizing Profit Changes

Profit changes are driven by demand shifters and cost changes

Assume that firms face residual demand function:

$$q_{fdt} = a_{fdt} b_{ft} (p_{ft})^{-\eta}$$

- a_{fdt} is firm-destination specific demand shifter
- b_{ft} is firm-specific demand shifter
- η is elasticity of substitution across products

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Operating profit at optimal price is:

$$\pi_{fdt} = q_{fdt}(p_{ft} - mc_{ft}) = \frac{1}{\eta} a_{fdt} b_{ft} \left(\frac{\eta}{\eta - 1} mc_{ft} \right)^{1-\eta}$$

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$\Rightarrow$ Percentage change in profit from $t-1$ to t is:

$$\widehat{\pi}_{fdt} = \widehat{a}_{fdt} + \widehat{b}_{ft} + (1-\eta)\widehat{mc}_{ft}$$

Contribution to Profit Changes

Specify underlying shock processes driving market changes

Rewrite profit change in terms of variance contribution:

$$\widehat{\pi}_{fdt} = \widehat{a}_{fdt} + \underbrace{\widehat{b}_{ft} + \overbrace{(1-\eta)\widehat{mc}_{ft}}^{\text{supply contribution}}}_{\text{firm-specific contribution}}$$

$$\Rightarrow \qquad \widehat{\pi}_{fdt} = \underbrace{(1-\rho)A_{fdt}}_{\widehat{a}_{fdt}} + \underbrace{\rho\gamma B_{ft}}_{\widehat{b}_{ft}} + \underbrace{\rho(1-\gamma)C_{ft}}_{(1-\eta)\widehat{mc}_{ft}}$$

- $\rho \in [0,1]$: relative contribution of firm-specific/common changes
- $\gamma \in [0,1]$: relative contribution of firm's demand-side changes
- A_{fdt}, B_{ft} and C_{ft} drawn from normal distributions with zero mean and $\sigma_A^2 = \frac{\sigma^2}{(1-\rho)^2+\rho^2}$ and $\sigma_B^2 = \sigma_C^2 = \frac{\sigma_A^2}{(1-\gamma)^2+\gamma^2}$, so that $\widehat{\pi}_{fdt} \sim \mathcal{N}(0, \sigma^2)$.

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Next: How empirical statistics can inform the underlying shocks (σ, ρ, γ) driving firms' market change decisions

A First Look with Two Firm Types and Two Markets

Closed-form solutions for how the 3 key empirical measures depend on parameters $\{\sigma, \rho, \gamma\}$

Two simplification assumptions:

- Fixed cost ζ_{fd} of exporting in market 1 is sufficiently low
  $\rightarrow$ firms always export to market 1
- Two types of firms in market 2, with $\xi_{fdt-1} \equiv \frac{\zeta_{fd}}{\pi_{fdt-1}} - 1$ drawn from $\{-\overline{\xi}, \overline{\xi}\}$ with equal probability.

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Closed-form solutions of 3 key empirical measures:

1. Markets change to markets (MCM) ratio $\uparrow \sigma$
2. Quantity elasticity to drop-to-change (DC) ratio $\uparrow \sigma$, $\uparrow \rho$, $\downarrow \gamma$
3. Price elasticity to drop-to-change ratio, $\uparrow \sigma$, $\uparrow \rho$, $\uparrow \gamma$

σ: profit volatility; ρ: contribution of common changes; γ: contribution of demand changes

Quantity Elasticity to Drop-to-Change Ratio (QDC)

Elasticity of quantity q in continuing market (market 1) to DC ratio:

$$\mathbb{E}(\widehat{q}_{f1t}|\underbrace{\widehat{\pi}_{f2t} \leq -\overline{\xi} \bigcap \xi_{f2t-1} = -\overline{\xi}}_{\text{DC}=1}) - \mathbb{E}(\widehat{q}_{f1t}|\underbrace{\widehat{\pi}_{f2t} > \overline{\xi} \bigcap \xi_{f2t-1} = \overline{\xi}}_{\text{DC}=0})$$

- $\widehat{q}_{f1t} = (1-\rho)A_{f1t} + \rho[\gamma B_{ft} + \frac{\eta}{\eta-1}(1-\gamma)C_{ft}]$
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In closed-form:

$$\text{QDC} = -2\rho^2\sigma \frac{\phi(\overline{\xi}/\sigma)}{\Phi(-\overline{\xi}/\sigma)} \frac{\gamma^2 + (1-\gamma)^2\frac{\eta}{\eta-1}}{\gamma^2 + (1-\gamma)^2} \leq 0$$

$\Rightarrow$ Magnitude of QDC increases in ρ and σ, and weakly decreases in γ

Next: MCM pins down σ, QDC and PDC pin down $\{\rho,\gamma\}$

Price Elasticity to DC Ratio

Many Firm Types and Many Markets

Relaxing the two assumptions:

- Extend to many markets: no longer assume a fixed continuing market
- Many firm types: assume $\tilde{\zeta}_{fdt-1}$ is lognormally distributed

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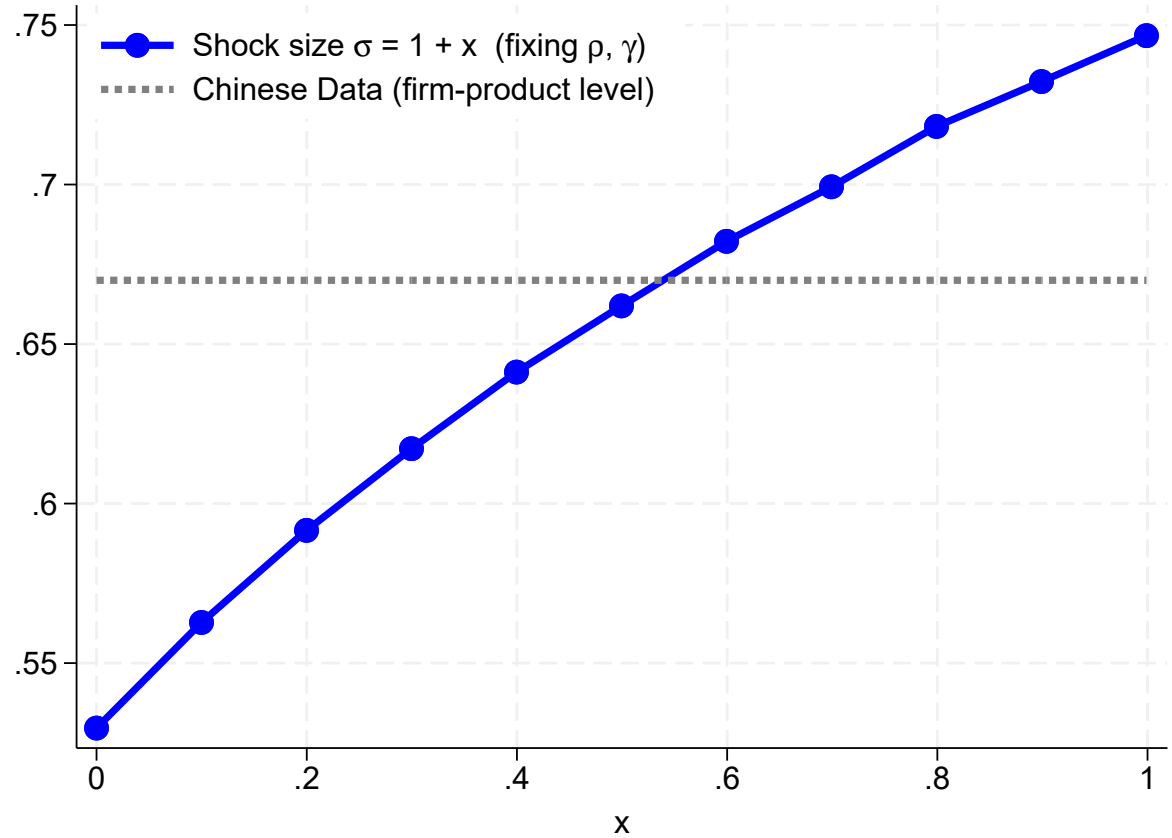
Solved numerically: simulate 10,000 potential firms and 20 markets

Investigate how measured statistics vary with model parameters $\{\sigma, \rho, \gamma\}$

- Start with calibration $\sigma = 1.54, \rho = 0.25, \gamma = 0.90$
- Vary one parameter at a time to see how empirical statistics change
- Takeaways from the two-market model carry through

Mapping Empirical Measures to Model Parameters

(a) Market Changes to Markets (MCM)



- MCM increases in volatility of profit σ

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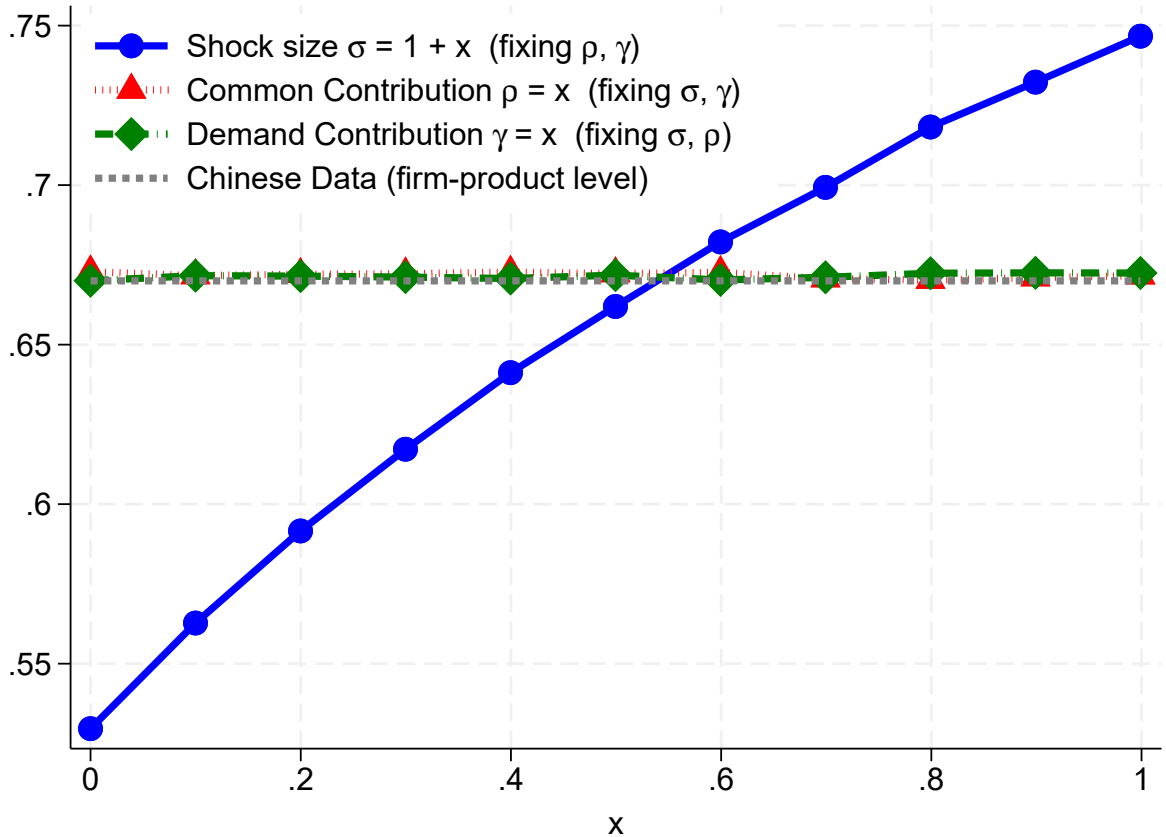
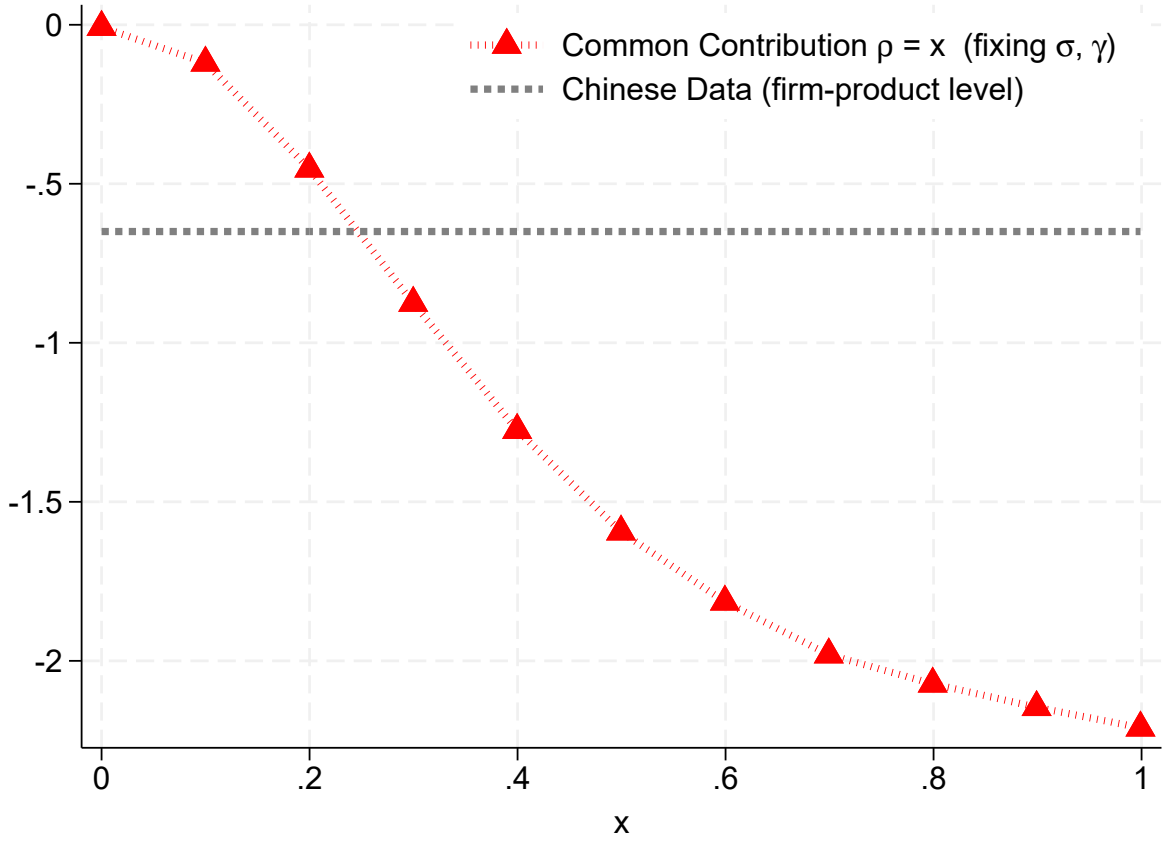


- Fixing σ, changing ρ or γ has no impact on MCM

Mapping Empirical Measures to Model Parameters

(b) Elasticity of Quantity w.r.t. Drop-to-Change (QDC)



- Contribution of firm-specific shocks ρ has significant impact on QDC

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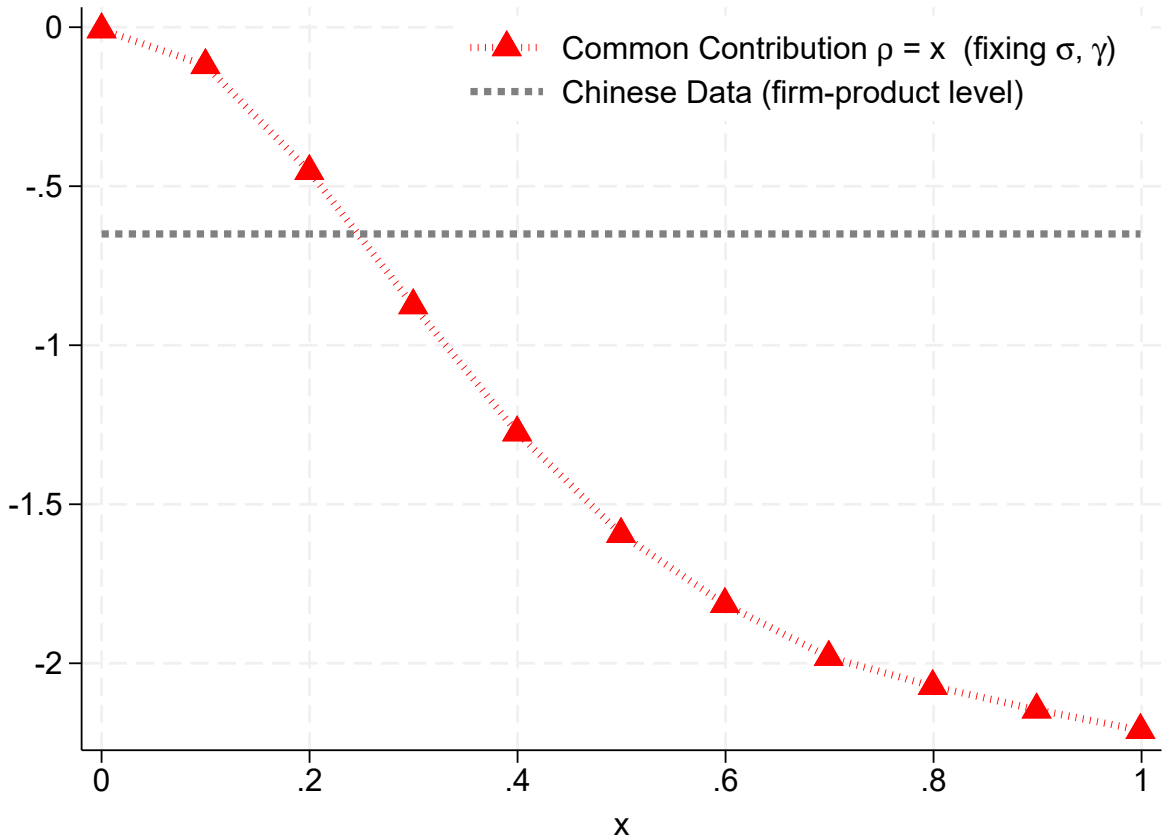
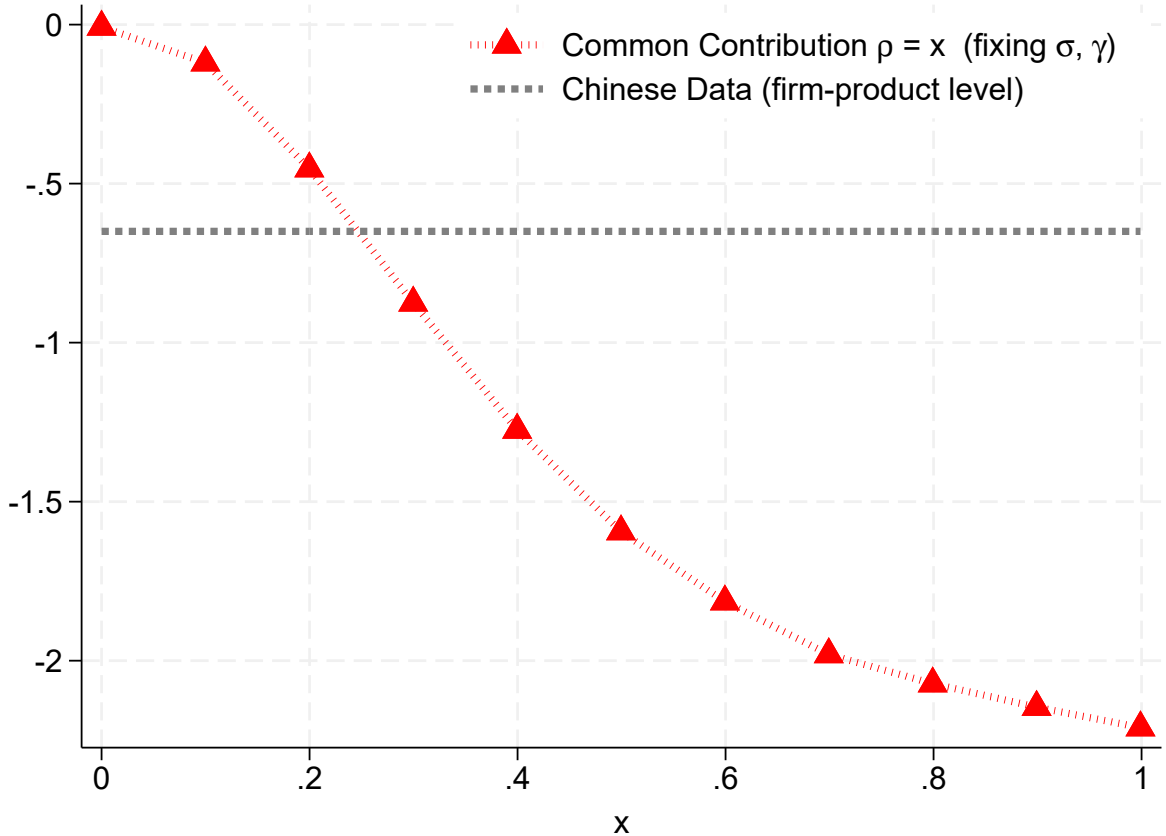


- When $\rho = 0$, the proportion of markets being dropped is not correlated with quantity adjustments in continuing markets and QDC $= 0$

Mapping Empirical Measures to Model Parameters

(b) Elasticity of Quantity w.r.t. Drop-to-Change (QDC)



- As ρ increases, shocks become more correlated, and firms dropping more markets also see quantity drops in continuing markets

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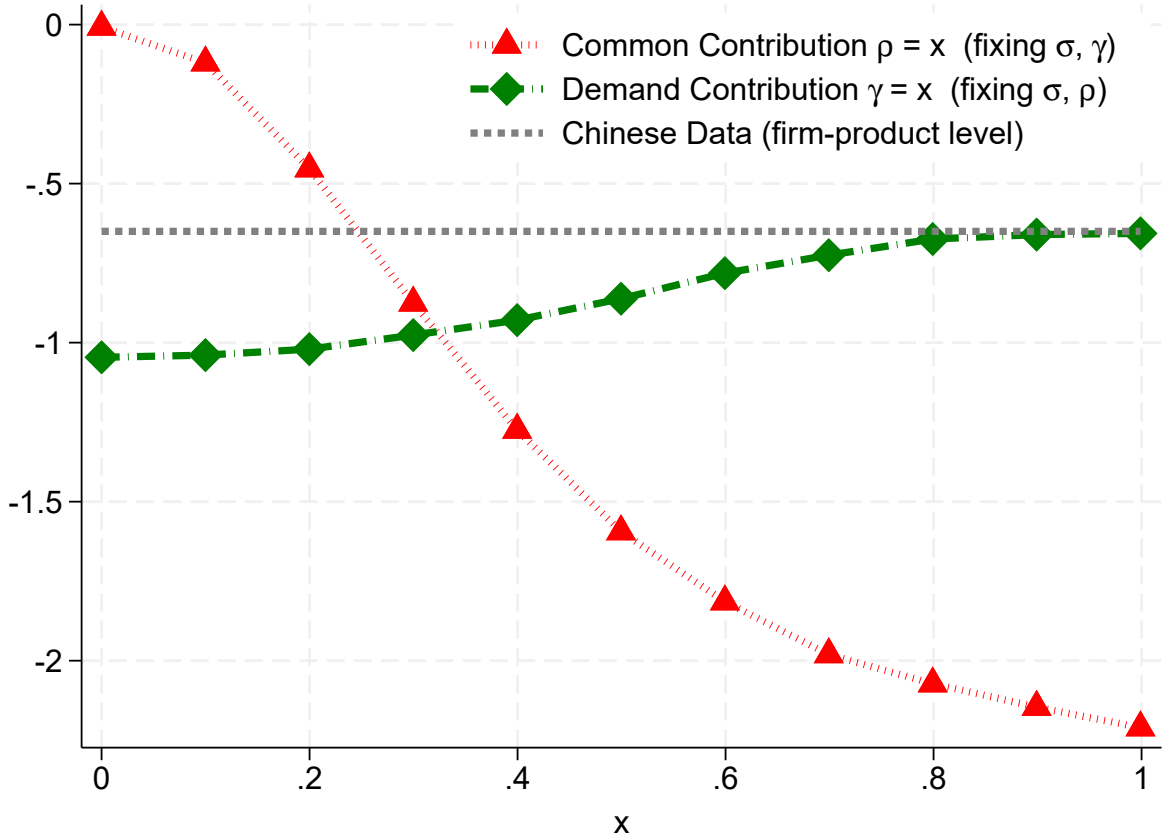
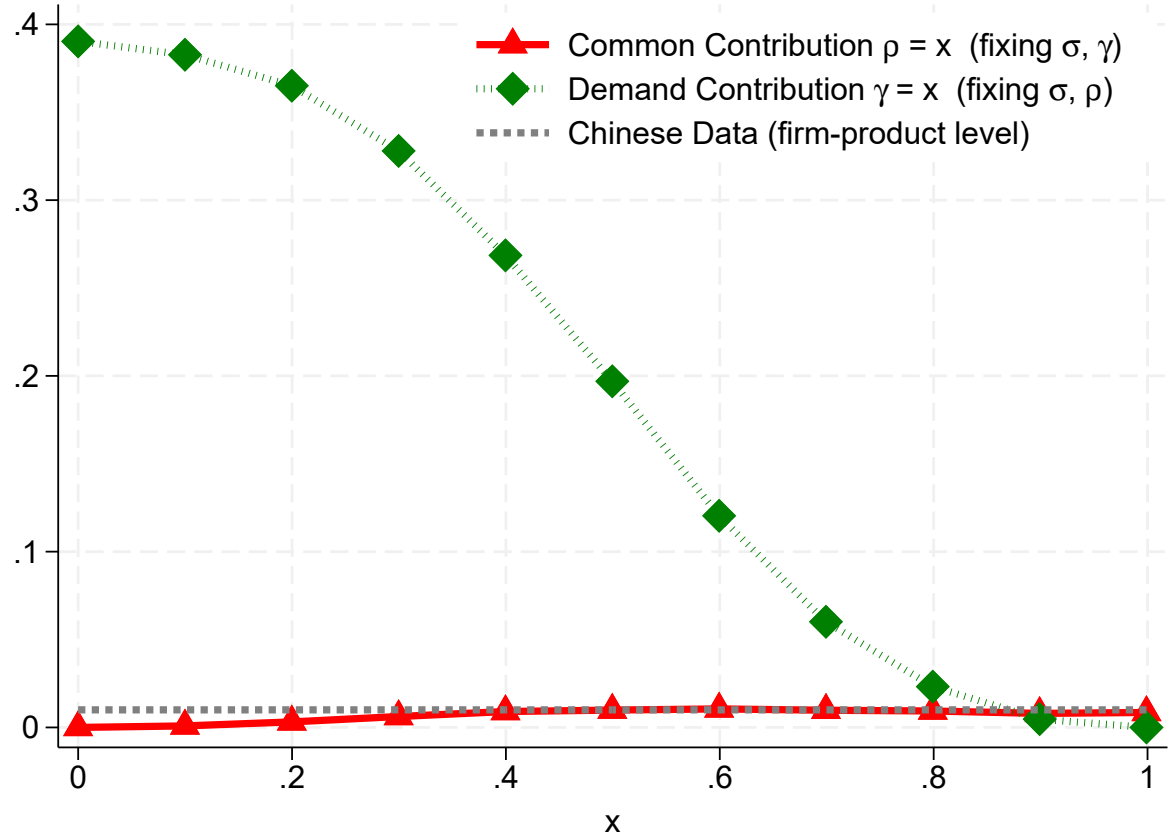


- For a given common contribution ρ, both demand and supply changes can cause quantity changes in continuing markets

$\rightarrow$ quantity does not change much with relative demand contribution

Mapping Empirical Measures to Model Parameters

(c) Elasticity of Price w.r.t. Drop-to-Change (PDC)



- PDC increases in cost/supply contribution $(1 - \gamma)$

Variable Markups

Mapping Empirical Measures to Model Parameters

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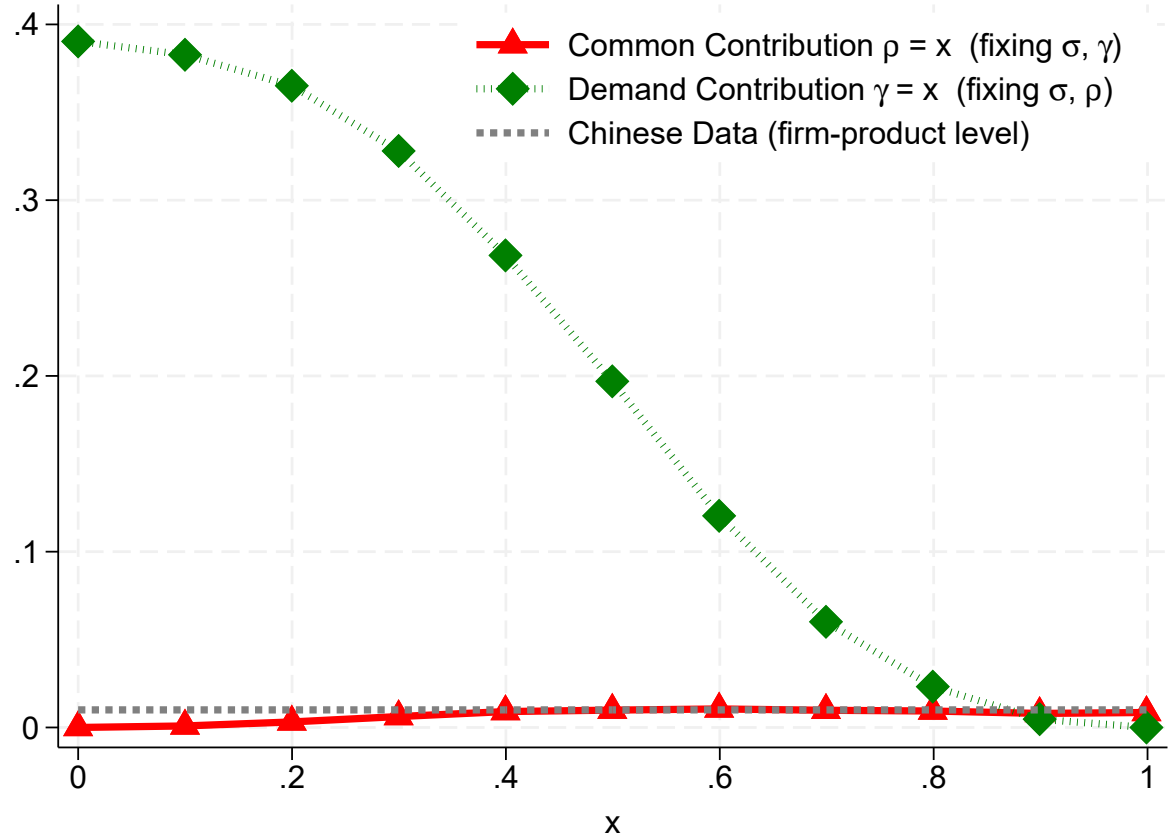

- PDC increases in cost/supply contribution $(1-\gamma)$
- When $\gamma \approx 1$, changing ρ has little impact on PDC

Variable Markups

Takeaways

- In this simple model, the three statistics provide a joint system to pin down the three key model parameters: $\{\sigma, \rho, \gamma\}$
  1. Market change to markets ratio pins down volatility of firms' profits σ
  2. Price elasticity to DC ratio pins down cost contribution $(1 - \gamma)$
  3. Quantity elasticity to DC ratio pins down common contribution ρ

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  2. Price elasticity to DC ratio pins down cost contribution $(1 - \gamma)$
  3. Quantity elasticity to DC ratio pins down common contribution ρ

- At calibrated values, empirical statistics suggest most market changes are demand driven $(\gamma \approx 0.9)$, with about a quarter $(\rho \approx 0.25)$ driven by correlated, global demand changes across markets.

Welfare Implications from Multi-Country GE Model

Calibrate a multi-country GE model to match empirical moments and quantify aggregate implications of these granular shocks and market changes

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- some shocks to residual demand to arise endogenously from other firms' demand or supply shocks
- entry and exit of exporters to have GE effects on production cost (by influencing wage) and total output (by changing allocation of resources)

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- entry and exit of exporters to have GE effects on production cost (by influencing wage) and total output (by changing allocation of resources)

Adding calibrated granular shocks increases aggregate consumption by 3.5%:

- driven by extensive margin adjustment
- negative shocks no longer offset positive ones due to market selection

Calibration and Key Moments

Simulate a model of 20 countries with 10,000 firms from each country:

Parameter	Value	
Size of firm-destination specific preference shock σ_a	0.507	
Size of firm-specific preference shock σ_b	0.459	
Size of firm-specific productivity shock σ_c	0.01	
Dispersion of initial preference	0.618	
Dispersion of initial productivity	4.75	
Moment	**Data**	**Model**
Market change to markets ratio	0.67	0.67
Drop-to-change (DC) ratio	0.5	0.497
Elasticity of quantity changes to DC ratio	-0.65	-0.65
Elasticity of price changes to DC ratio	0.01	0.01
Within R^2 (explanatory power of local agg. vars)	0.23	0.26

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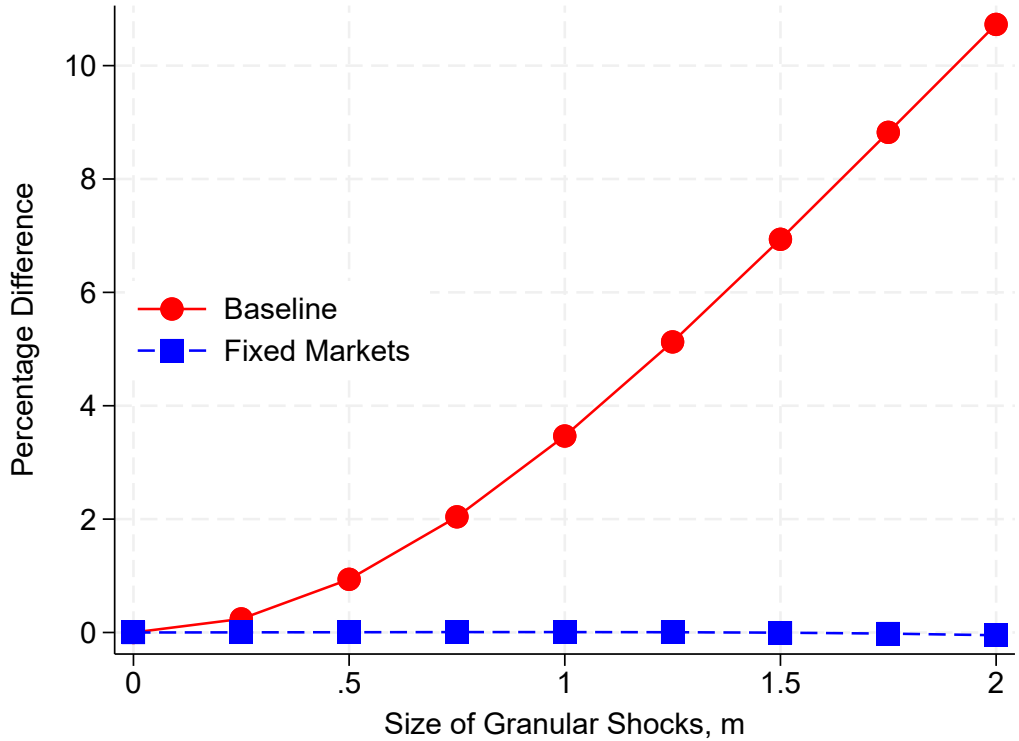
$\Rightarrow$ Firm's market changes mostly driven by demand (preference) shocks

Welfare Implications of Market Changes

With granular shocks and endogenous market participation, consumption increases by 3.5%

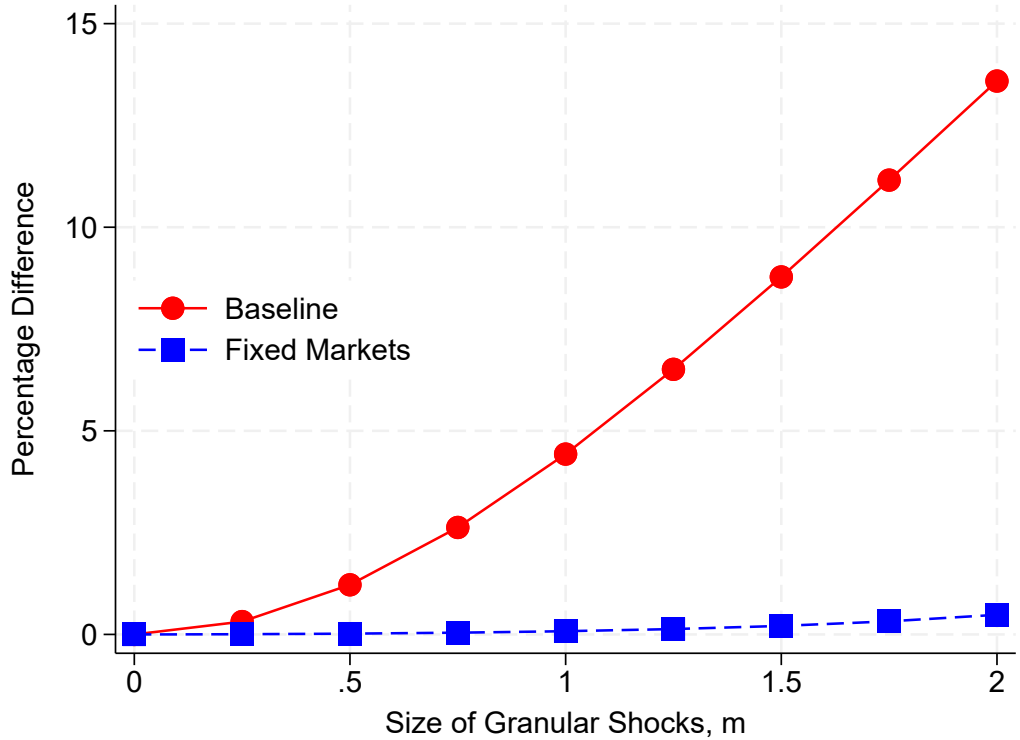
Percentage welfare difference: $[Q_d(m)/Q_d(0) - 1] * 100$



- $Q_d(m)$: agg. consumption under shock size m, with $(\sigma_a, \sigma_b, \sigma_c)$ * m
  - ⋆ $m = 0$: model has no granular shock
  - ⋆ $m = 1$: model is calibrated at $(\sigma_a, \sigma_b, \sigma_c)$ to match empirical moments
- Fixed markets: no extensive margin adjustment

Welfare Implications of Market Changes

Export difference: $[Q_{od}(m)/Q_{od}(0) - 1] * 100$



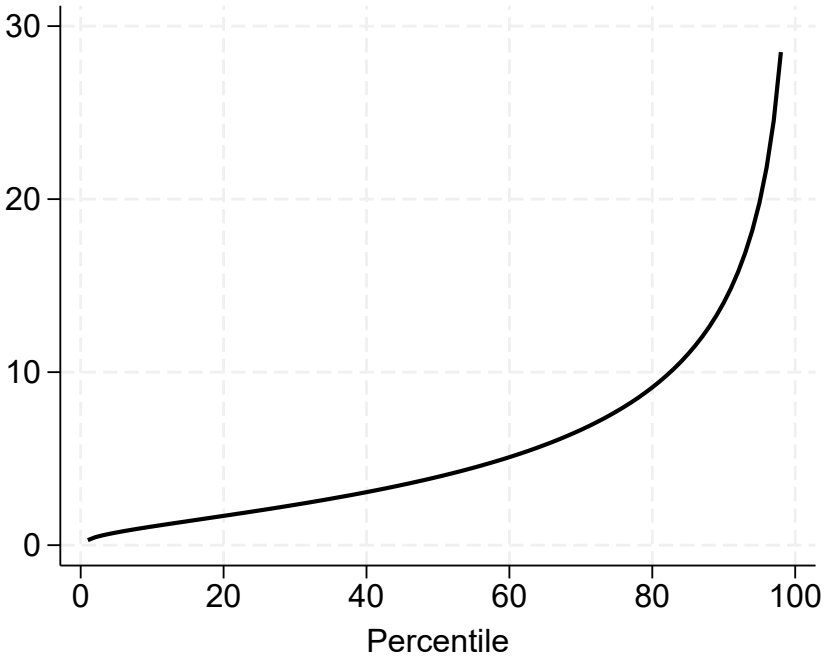
- Significant increases in exports, resulting in larger gains from trade
- Why? Granular shocks + extensive margin adjustment

Impact of trade cost change

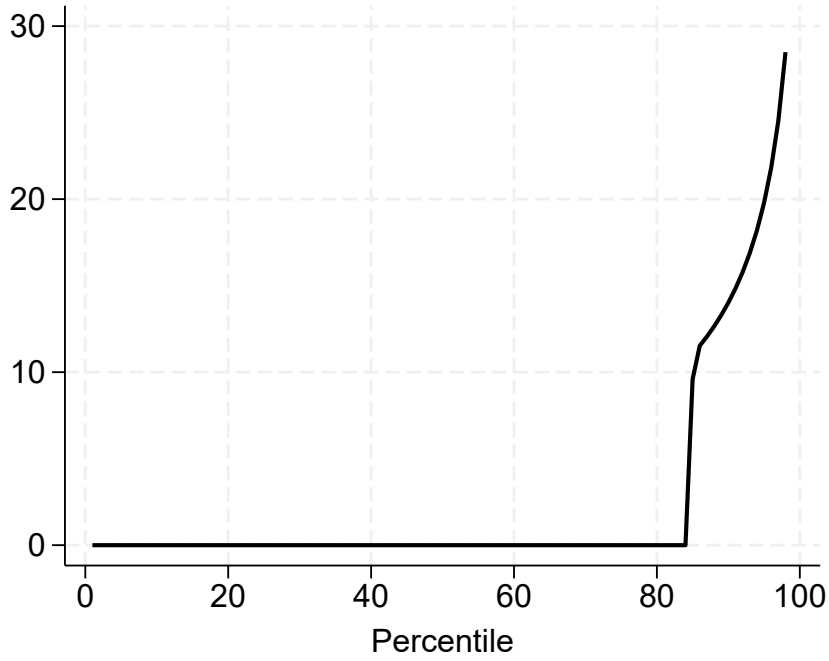
Illustrating the Mechanism

Initial distribution without granular shocks

(a) Potential sales



(b) Sales conditional on exporting



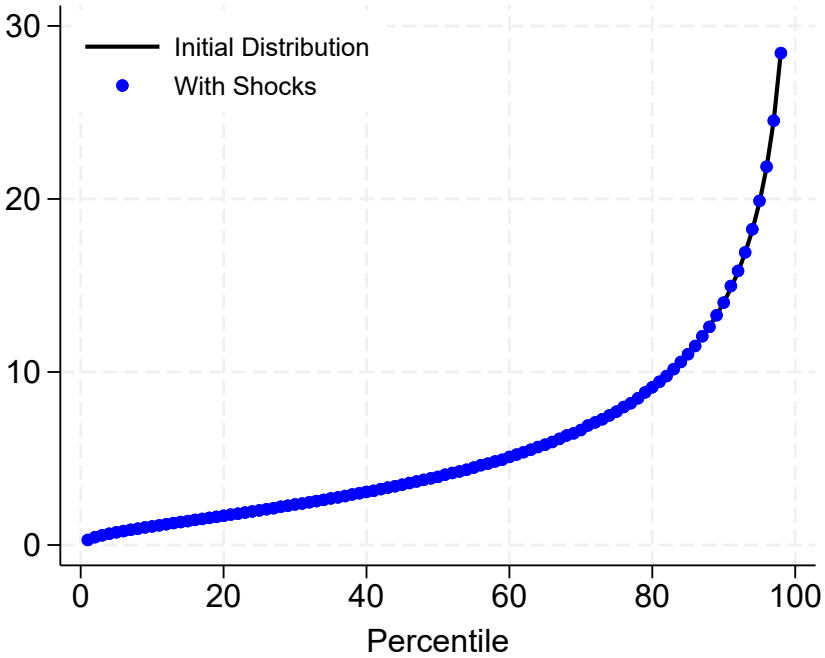
- Focusing on a particular destination market, plot
  (a) percentile distribution of potential sales
  (b) percentile distribution conditional on entry

Details

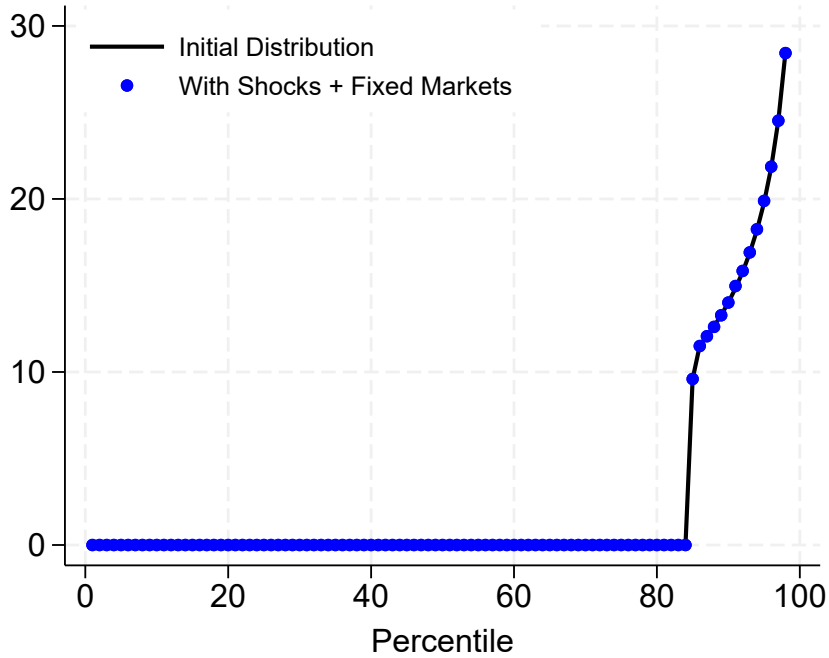
Illustrating the Mechanism

No change in distribution with granular shocks but no extensive margin adjustment

(a) Potential sales



(b) Sales conditional on exporting



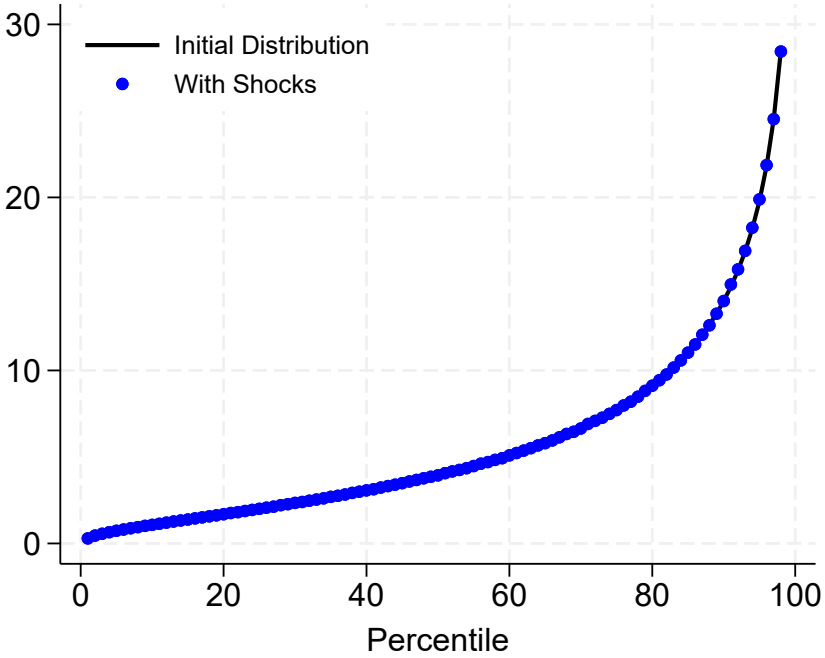
- Blue dots: show the distribution after adding mean zero granular shocks, while fixing the set of firms in the market

Details

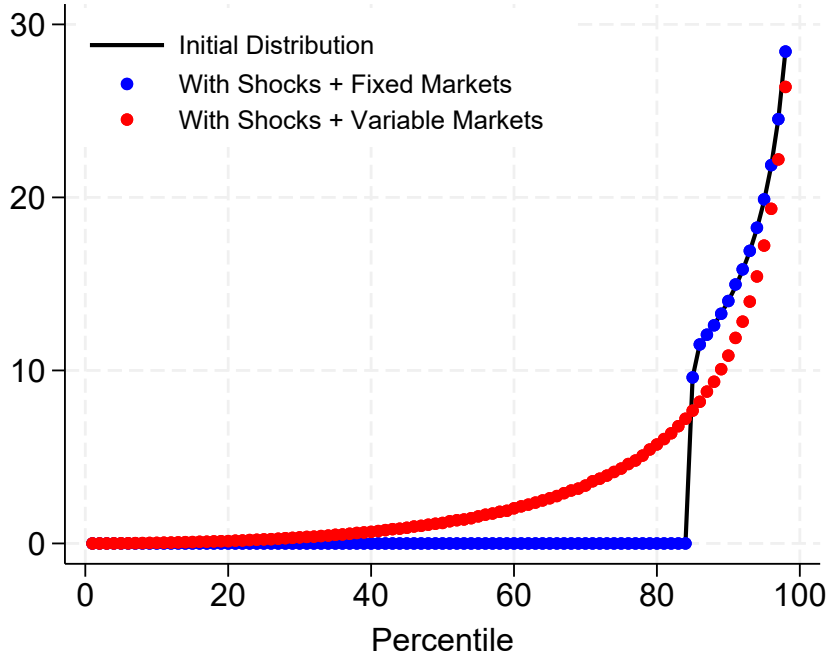
Illustrating the Mechanism

Change in distribution due to endogenous market changes

(a) Potential sales



(b) Sales conditional on exporting



- Red dots: Small firms receiving positive shocks start exporting, while some big firms stop exporting
- Positive effects prevail → Bigger trade flows → Larger gains from trade

Details

Conclusion

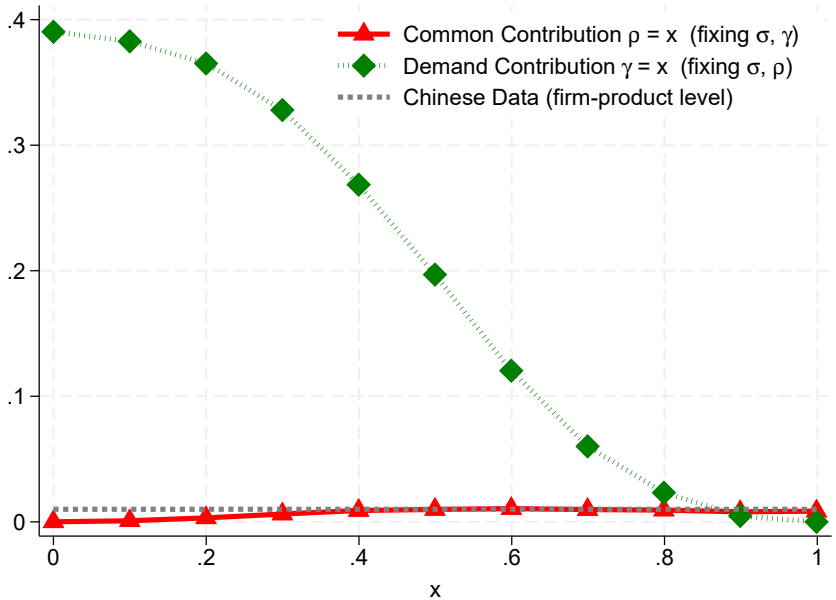
This paper studies within-firm market changes of Chinese and UK exporters:

- New measures and new facts
  - ⋆ A typical exporter changes $> 1/2$ of its markets
  - ⋆ Firms dropping more markets also face large drop in quantity with little change in price in their continuing markets
- Simple analytical model to interpret these facts
  - ⋆ Most market changes are driven by residual demand shocks
- These market changes matter for welfare
  - ⋆ Mean zero idio. shocks can have agg. implications due to market selection

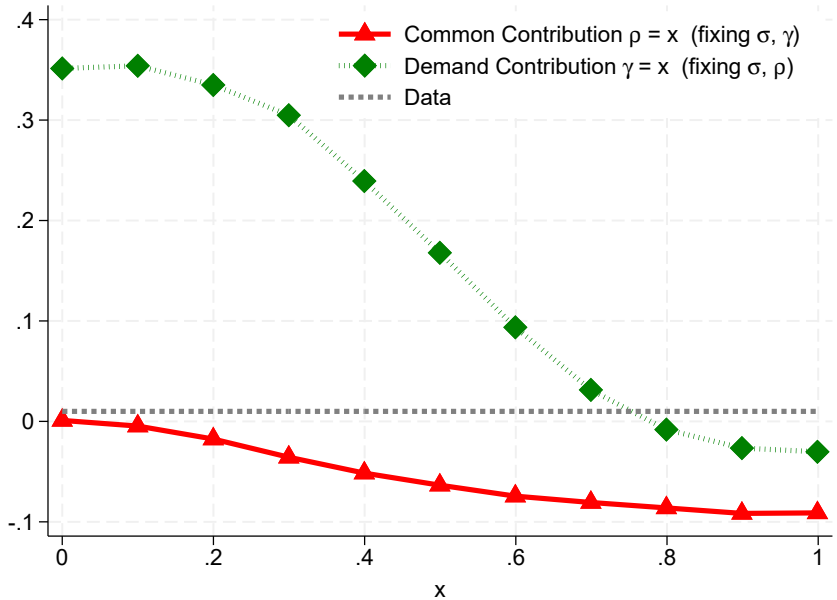
Constant versus Variable Markups

(c) Price Elasticity wrt Drop-to-Change Ratio

Baseline: Constant Markup



Kimball: Variable Markup



- With Kimball, negative demand shocks reduce markup and price

$\Rightarrow$ When $\gamma = 1$ (only demand shocks), price elasticity becomes negative

$\Rightarrow$ At $\gamma = 0.9$, price elasticity becomes more negative as ρ increases

Constant versus Variable Markups

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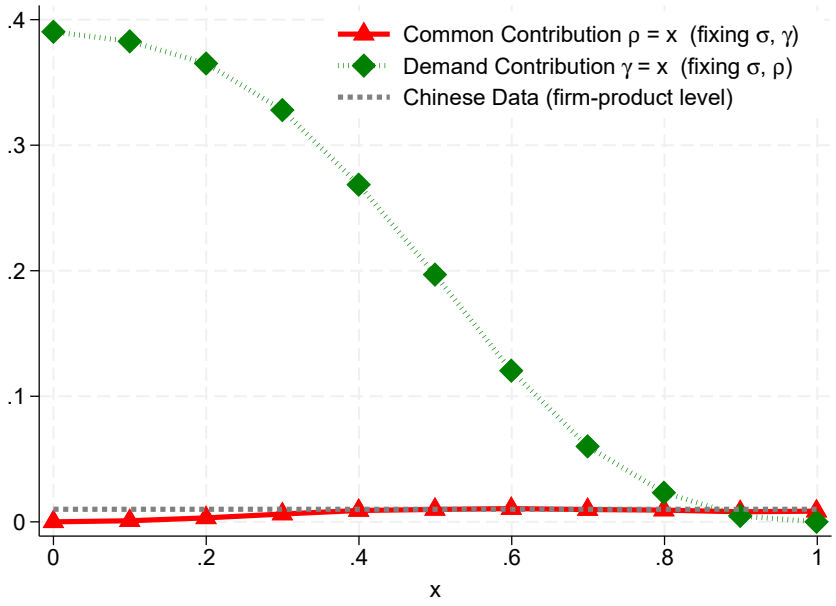
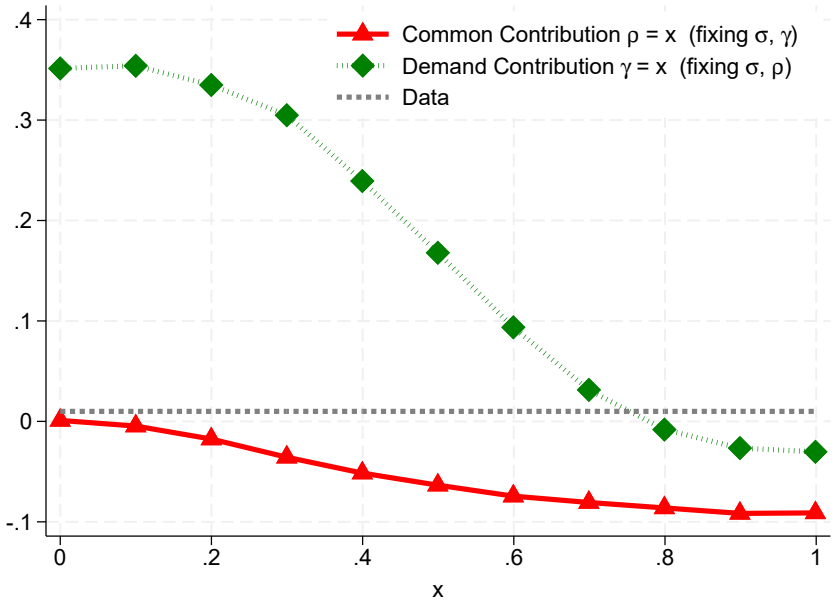


Kimball: Variable Markup



- With Kimball, negative demand shocks reduce markup and price

$\Rightarrow$ When $\gamma = 1$ (only demand shocks), price elasticity becomes negative

$\Rightarrow$ At $\gamma = 0.9$, price elasticity becomes more negative as ρ increases

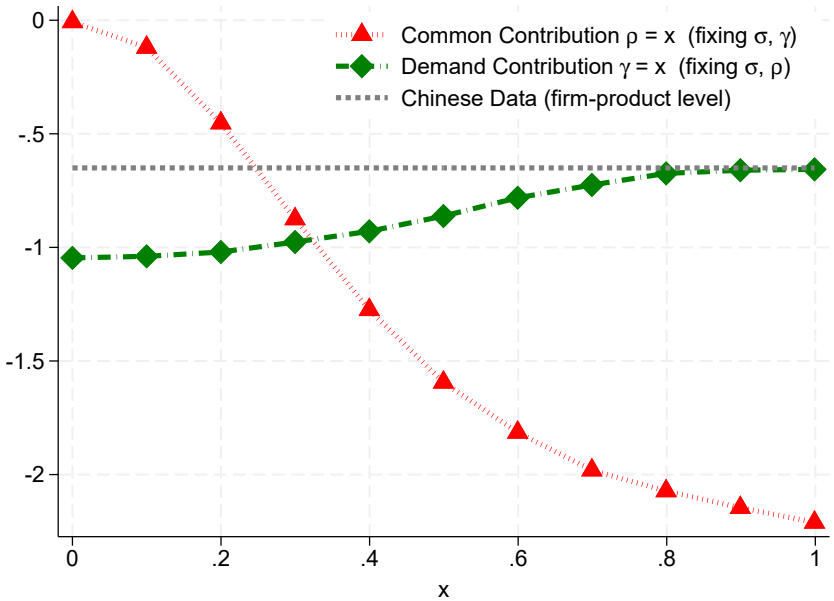
$\Rightarrow$ Variable markup model implies a higher cost contribution: 10% $\rightarrow$ 20%

Back

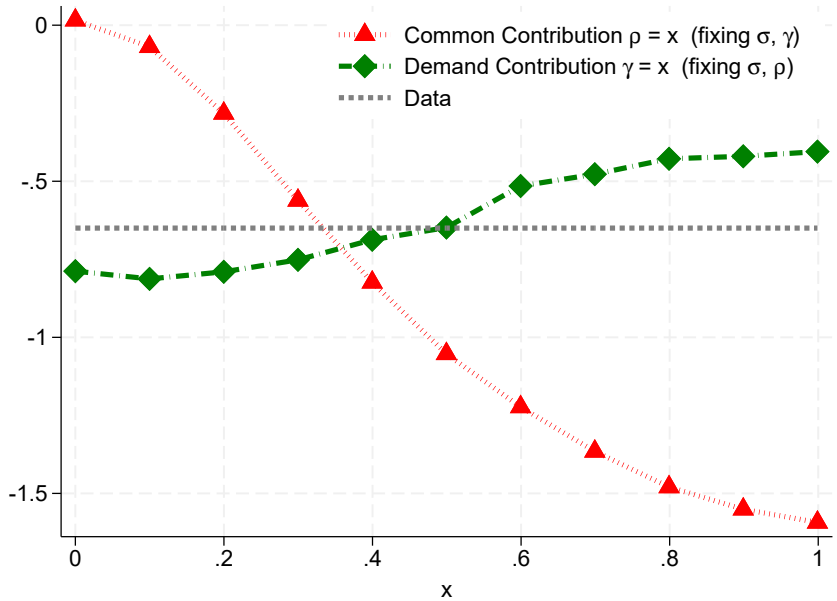
Constant versus Variable Markups

(b) Quantity Elasticity wrt Drop-to-Change Ratio

Baseline: Constant Markup



Kimball: Variable Markup



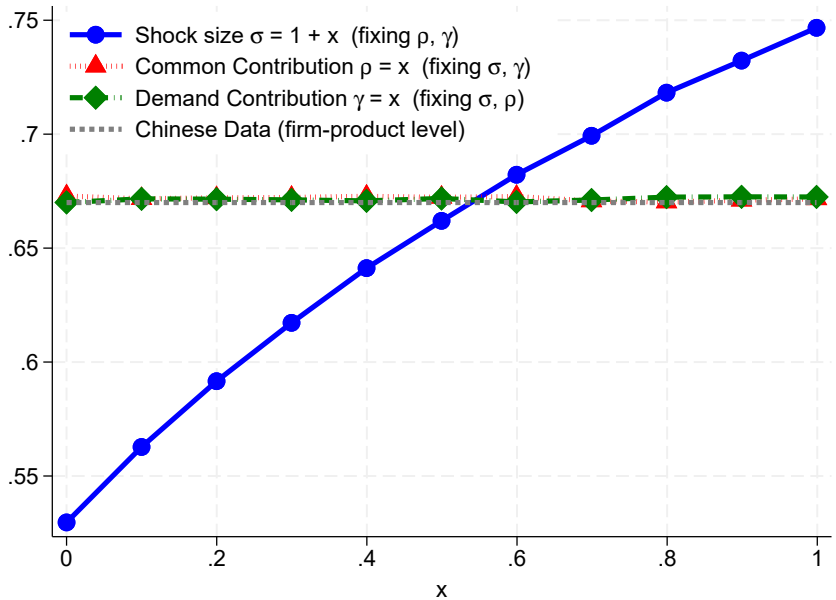
- Same qualitative pattern with different quantitative magnitude

Back

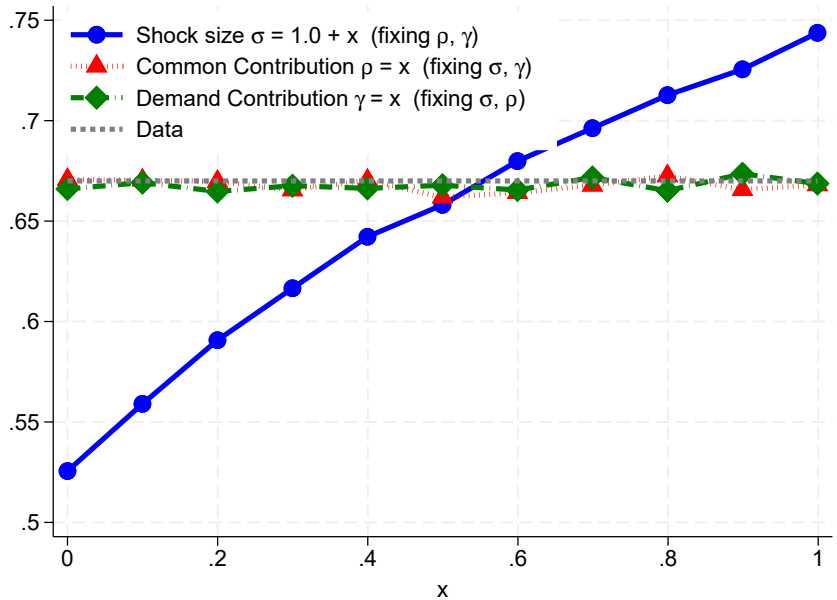
Constant versus Variable Markups

(a) Market Changes to Markets

Baseline: Constant Markup



Kimball: Variable Markup



- Similar results for MCM

Back

Data

1. Chinese Customs Data, 2000-2006

	Products (HS8)	Exporters	Observations	Value (billion US$)
All	7,620	183,993	18,676,554	2,917

2. UK Customs Data, 2010-2016 (HMRC administrative datasets)

	Products (CN8)	Exporters	Observations	Value (billion £)
All	10,457	165,798	16,357,110	1,987
Non-EU	10,032	159,328	6,772,946	990
EU*	10,249	35,751	9,584,164	997

- An observation is a firm-product-destination-year quartet.

Note: * UK-EU transactions are available only for firms whose trade value exceeds £250,000 in a given calendar year; these firms account for 96-98% of total trade values.

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Breakdown by Firm and Product Types (Median, China Results)

	Market Changes / Markets	
	Count Measure	Value Measure
By Form of Commerce		
— General Trade	0.83	0.40
— Processing Trade	0.40	0.01
— Mixture	0.00	0.00
By Rauch Classification		
— Differentiated Products	0.75	0.29
— Reference Priced	0.50	0.10
— Organised Exchange	0.41	0.03
By Firm Ownership		
— State-owned Enterprises	1.00	0.47
— Private Enterprises	0.80	0.39
— Foreign Invested Enterprises	0.40	0.01

Back

Measures Based on Deviation from the **Common Trade Pattern within Firm**

					Common Trade Pattern	**Deviation**	**N. of Deviations/ Markets**
$t=1$	A	B			A-C	$B \quad -C$	2/2
$t=2$	A		C		A-C		0
$t=3$	A		C	D	A-C	D	1/3
$t=4$	A		C		A-C		0

Statistics Based on Chinese Exporters, 2000-2006:

			Distribution (Percentile)				
	Mean	Median	1st	25th	75th	99th	Obs.
8-digit level deviation from the CTP within firm	0.64	0.00	0.00	0.00	1.00	5.00	6,042,761
2-digit level deviation from the CTP within firm	0.71	0.00	0.00	0.00	1.00	7.00	1,927,599

Measures Based on Deviation from the **Common Trade Pattern** across Firms

					Common Trade Pattern	**Deviation**	**N. of Deviations/ Markets**
$t = 1$	A	B			A	B	1/2
$t = 2$	A		C		A-C		0
$t = 3$	A		C	D	A-C	D	1/3
$t = 4$	A		C		A	C	1/2

Statistics Based on Chinese Exporters, 2000-2006:

			Distribution (Percentile)				
	Mean	Median	1st	25th	75th	99th	Obs.
8-digit level deviation from							
the CTP across firms	1.28	1.50	0.00	0.75	2.00	2.00	6,042,761
the CTP within firm	0.64	0.00	0.00	0.00	1.00	5.00	6,042,761
2-digit level deviation from							
the CTP across firms	1.23	1.25	0.00	0.83	2.00	2.00	1,927,599
the CTP within firm	0.71	0.00	0.00	0.00	1.00	7.00	1,927,599

To what extent, are these market changes explained by fluctuations in local market conditions?

Step 1: Constructing firm(-product) level measures of changes in local market conditions (focusing on those changed markets)

Step 2: Regressing drop-to-change (DC) ratio on the constructed measures

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Step 1: Constructing firm(-product) level measures of changes in local market conditions (focusing on those changed markets)

					Continuing Markets	Changed Markets	Changes in Relative Exchange Rates
$t=1$	A	(B)	( )		–	–	–
$t=2$	A	( )	(C)	( )	A	B, C	$log(e_{C,2}/e_{C,1}) - log(e_{B,2}/e_{B,1})$
$t=3$	A		C	(D)	A, C	D	$log(e_{D,3}/e_{D,2})$
$t=4$	A		C	( )	A, C	D	$-log(e_{D,4}/e_{D,3})$

Note: Circled cells mark the variation used to construct relative exchange rates.

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$t=2$	A	▢	(C)	▢	A	B, C	$log(e_{C,2}/e_{C,1}) - log(e_{B,2}/e_{B,1})$
$t=3$	A		C	(D)	A, C	D	$log(e_{D,3}/e_{D,2})$
$t=4$	A		C	▢	A, C	D	$-log(e_{D,4}/e_{D,3})$

Note: Circled cells mark the variation used to construct relative exchange rates.

Step 2: Regressing drop-to-change (DC) ratio on the constructed measures

$$DC_{f,i,t} = \beta_e \widetilde{e}_{f,i,t} + \beta_P \widetilde{P}_{f,i,t} + \delta_{f,i} + \delta_t + \epsilon_{f,i,t}$$

where $DC_{f,i,t}$ is drop-to-change ratio; $\widetilde{e}_{f,i,t}$ is relative exchange rates; $\widetilde{P}_{f,i,t}$ is relative local CPI rate; $\delta_{f,i}$ and δ_t are firm-product and time fixed effects respectively. f, i, t = firm, product, time.

To what extent, are these market changes explained by fluctuations in local market conditions?

Regressing drop-to-change (DC) ratio on changes in local market conditions
(results from Chinese exporters, 2000-2006)

	Exchange Rate	Destination CPI	Within R^2	Observations
Count Measure				
Firm-product (8-digit) level	-0.22***	-0.81***	0.23	1,791,353
Firm-industry (2-digit) level	-0.14***	-0.59***	0.21	875,096
Firm level	-0.12***	-0.45***	0.20	301,455
Trade Value Measure				
Firm-product (8-digit) level	-0.21***	-0.83***	0.17	1,791,353
Firm-industry (2-digit) level	-0.14***	-0.61***	0.16	875,095
Firm level	-0.11***	-0.46***	0.16	301,455

Data source: Chinese Customs Database, 2000-2006
Note: Firm(-product/industry) and year fixed effects are added in all specifications.

Mechanism: Exchange rate appreciation or a higher price level $\rightarrow$ make the product of the exporter relatively cheaper $\rightarrow$ higher demand $\rightarrow$ more profitable in selling to the market $\rightarrow$ less likely to drop

DC Ratio to Changes in Relative Market Conditions (Based on UK to Non-EU exports)

	Exchange Rate	Destination CPI	Within R^2	Observations
Count Measure				
Firm-product (8-digit) level	-0.12***	-1.06***	0.20	805,626
Firm-sector (2-digit) level	-0.11***	-0.97***	0.19	405,255
Firm-level	-0.09***	-0.92***	0.19	259,026
Value Measure				
Firm-product (8-digit) level	-0.12***	-1.07***	0.15	805,626
Firm-sector (2-digit) level	-0.10***	-0.99***	0.14	405,255
Firm level	-0.09***	-0.93***	0.14	259,026

Note: This table shows estimates from regressing drop-change ratio on augmented exchange rates and destination CPI measures. The upper panel shows results using non-weighted drop-change ratio as the dependent variable and the bottom panels shows results using trade-weighted drop-change ratio as the dependent variable. The subsections of the first column indicate the level of disaggregation at which the trade pattern measures are constructed. Firm-product and year fixed effects are added for firm-product and firm-sector specifications. Firm and year fixed effects are added for firm level specifications. The statistical significance is calculated based on robust standard errors with ***, **, * representing statistical significance at 1%, 5%, 10% respectively. Source: Calculations based on HMRC administrative datasets, non-EU exports, 2010-2016.

Long distance markets are more likely to be dropped

Mean Distance to Drop-Change Ratio

	Mean Distance	Within R^2	Observations
China results (2000-2016)			
Firm-product (8-digit) level	-0.16***	0.01	1,791,353
Firm-sector (2-digit) level	-0.13***	0.01	875,096
Firm-level	-0.20***	0.04	301,455
UK results (2010-2016)			
Firm-product (8-digit) level	-0.21***	0.01	805,626
Firm-sector (2-digit) level	-0.10***	0.00	405,255
Firm level	-0.20***	0.02	259,026

Back

Price Elasticity to Drop-to-Change Ratio (PDC)

Elasticity of price in continuing market (market 1) to drop-to-change ratio:

$$\mathbb{E}(\widehat{p}_{ft}|\widehat{\pi}_{f2t} \leq -\overline{\xi} \bigcap \xi_{f2t-1} = -\overline{\xi}) - \mathbb{E}(\widehat{p}_{ft}|\widehat{\pi}_{f2t} > \overline{\xi} \bigcap \xi_{f2t-1} = \overline{\xi})$$

where

- $\widehat{p}_{ft} = \frac{1}{1-\eta}\rho(1-\gamma)C_{ft}$
- $\widehat{\pi}_{f2t} = (1-\rho)A_{f2t} + \rho\gamma B_{ft} + \rho(1-\gamma)C_{ft}$

In closed-form:

$$PDC = 2\sigma \frac{\phi(\overline{\xi}/\sigma)}{\Phi(-\overline{\xi}/\sigma)} \frac{\rho^2(1-\gamma)^2}{[(1-\rho)^2+\rho^2][(1-\gamma)^2+\gamma^2]} \frac{1}{\eta-1} \geq 0$$

- increases with the profit volatility σ
- increases in contribution of firm-specific shocks ρ
- decreases in demand contribution γ (eg $PDC = 0$ when $\gamma = 1$)

Back

Market Change to Markets (MCM)

Market change to markets ratio (MCM)

$$= \frac{1}{2} \underbrace{Pr(\widehat{\pi}_{f2t} > \overline{\xi} \bigcap \xi_{f2t-1} = \overline{\xi})}_{\text{Market 2 is added}} + \frac{1}{1} \underbrace{Pr(\widehat{\pi}_{f2t} \leq -\overline{\xi} \bigcap \xi_{f2t-1} = -\overline{\xi})}_{\text{Market 2 is dropped}}$$

Back

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$$= \frac{3}{4}\Phi(-\overline{\xi}/\sigma)$$

where $\Phi(.)$ is CDF of standard normal

- MCM increases in volatility of operating profits σ
- MCM is unaffected by the relative contributions of the shocks

Back

Impact of trade cost change

In response to trade cost changes, aggregate welfare adjustments can be analyzed by calculating:

$$\widetilde{Q}_d(m) = \frac{Q_d^{\text{with trade cost change}}(m)}{Q_d^{\text{without trade cost change}}(m)} - 1$$

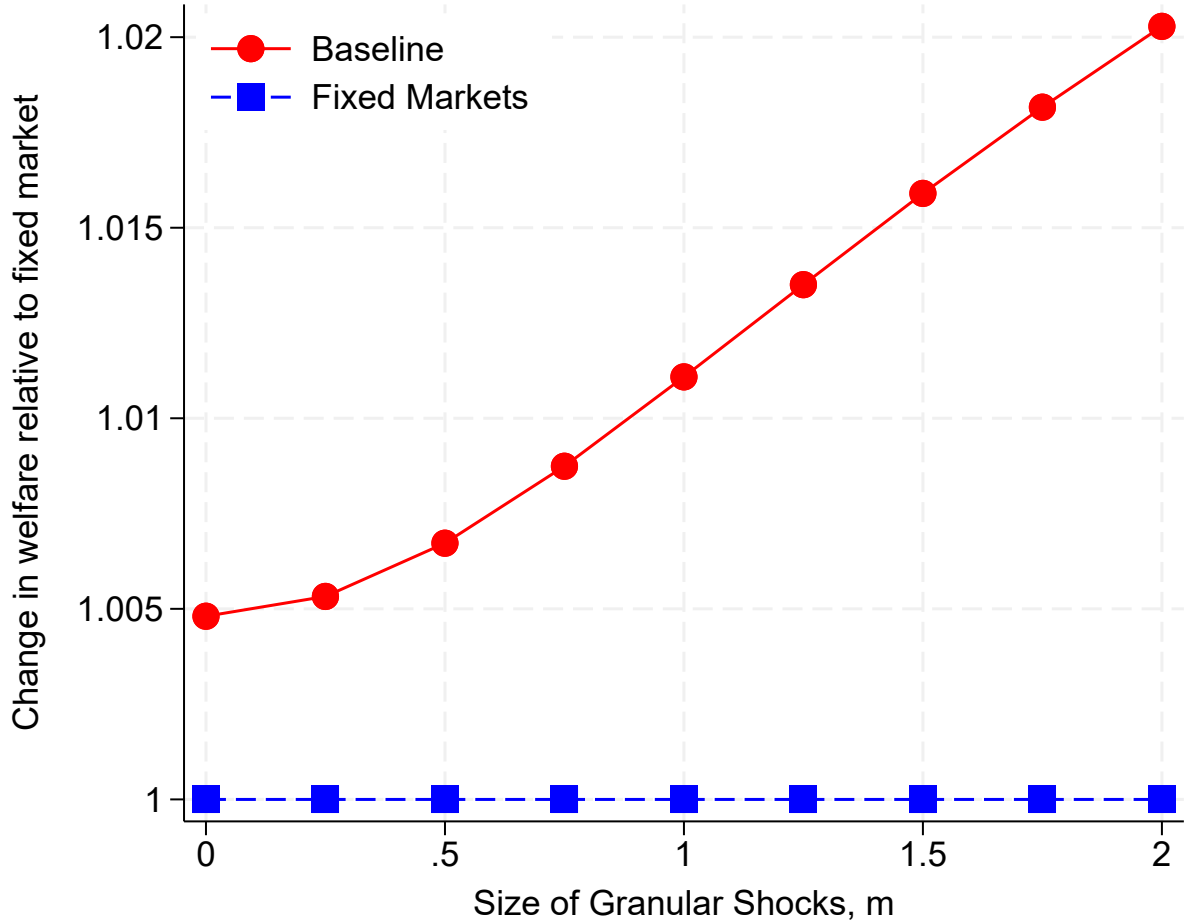
where m is size of micro shocks.

Then calculate

$$\widetilde{Q}_d^{\text{Baseline}}(m) / \widetilde{Q}_d^{\text{Fixed Markets}}(m)$$

where $\widetilde{Q}_d^{\text{Fixed Markets}}(m)$ shuts down extensive margin adjustment

Change in Welfare in Response to Trade Cost Change



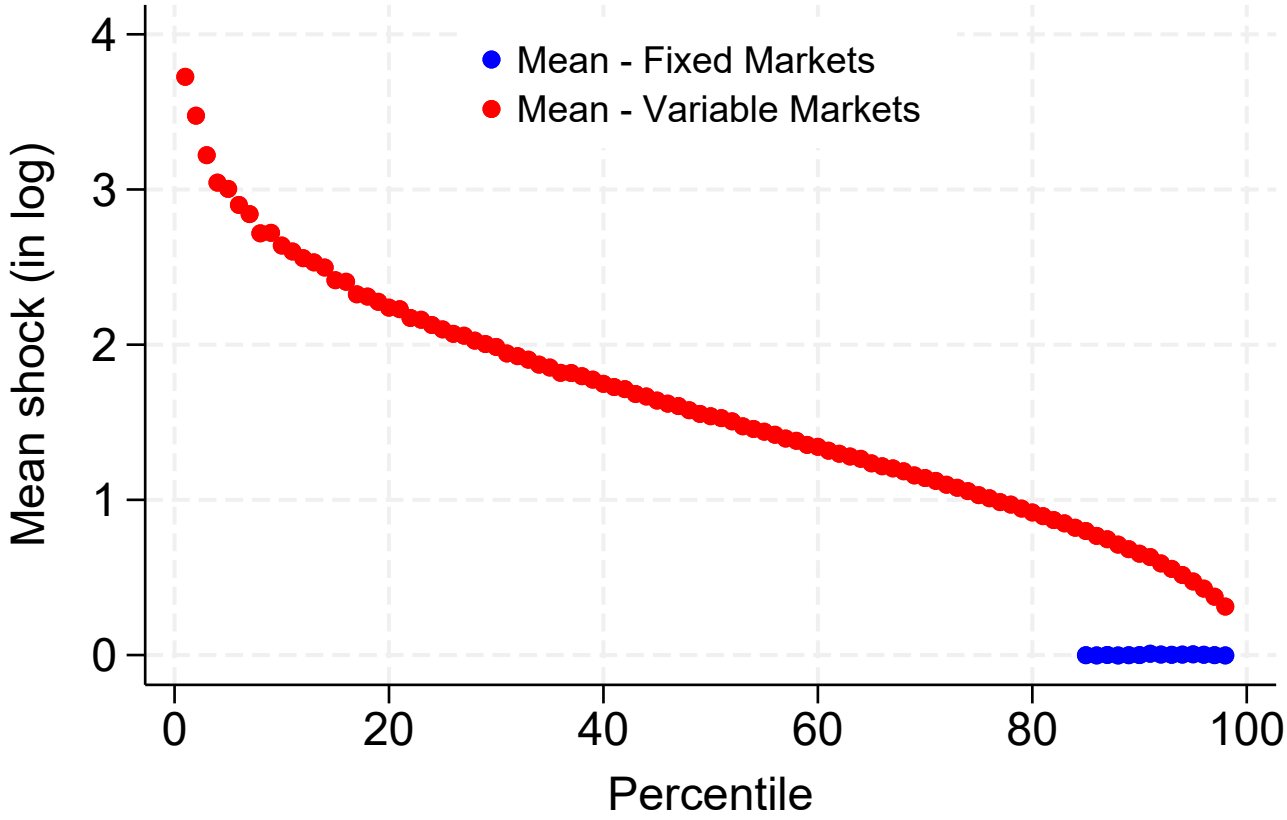
- Bigger welfare impact with micro shocks

Back

Illustrating the mechanism

Positive shocks prevail due to selection

Mean of micro shocks conditioning on exporting



- Blue: without market changes, positive shocks offset negative ones
- Red: positive shocks prevail due to selection

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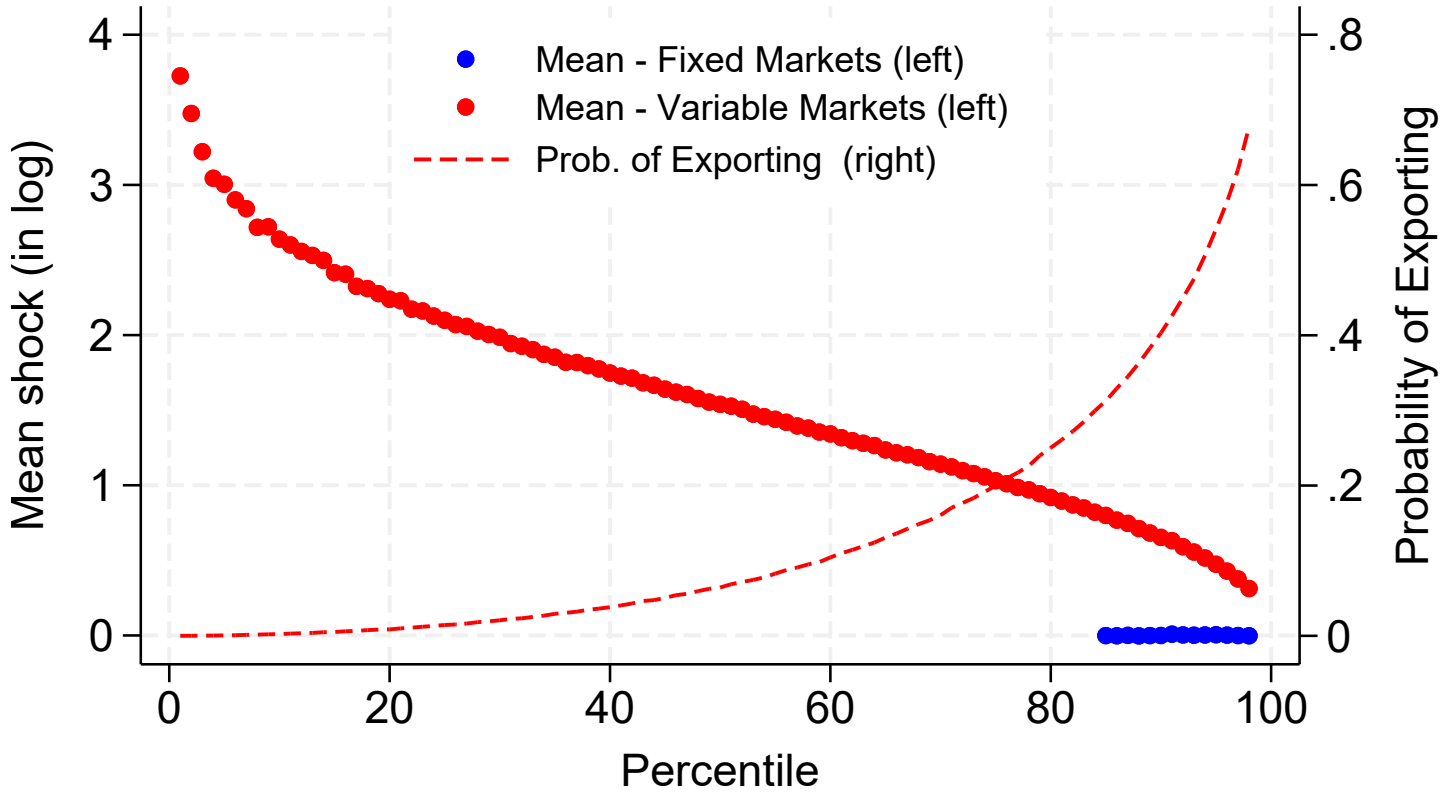
Illustrating the mechanism

Positive shocks prevail due to selection

Mean of micro shocks conditioning on exporting



- Probability of receiving large enough shocks is low for small firms

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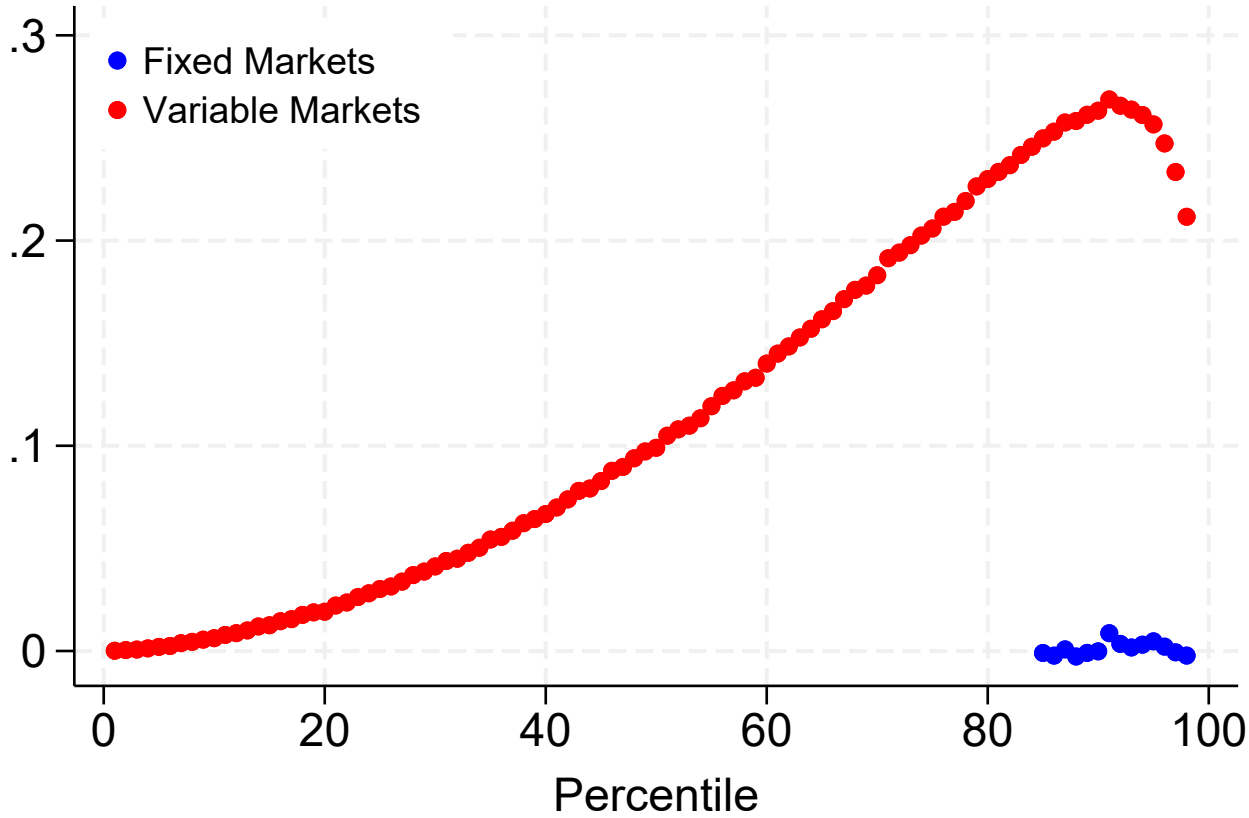
Illustrating the mechanism

Positive shocks prevail due to selection

Mean of micro shocks conditioning on exporting
(after accounting for probability of exporting)



- Medium and large firms account for most of the increase in export value

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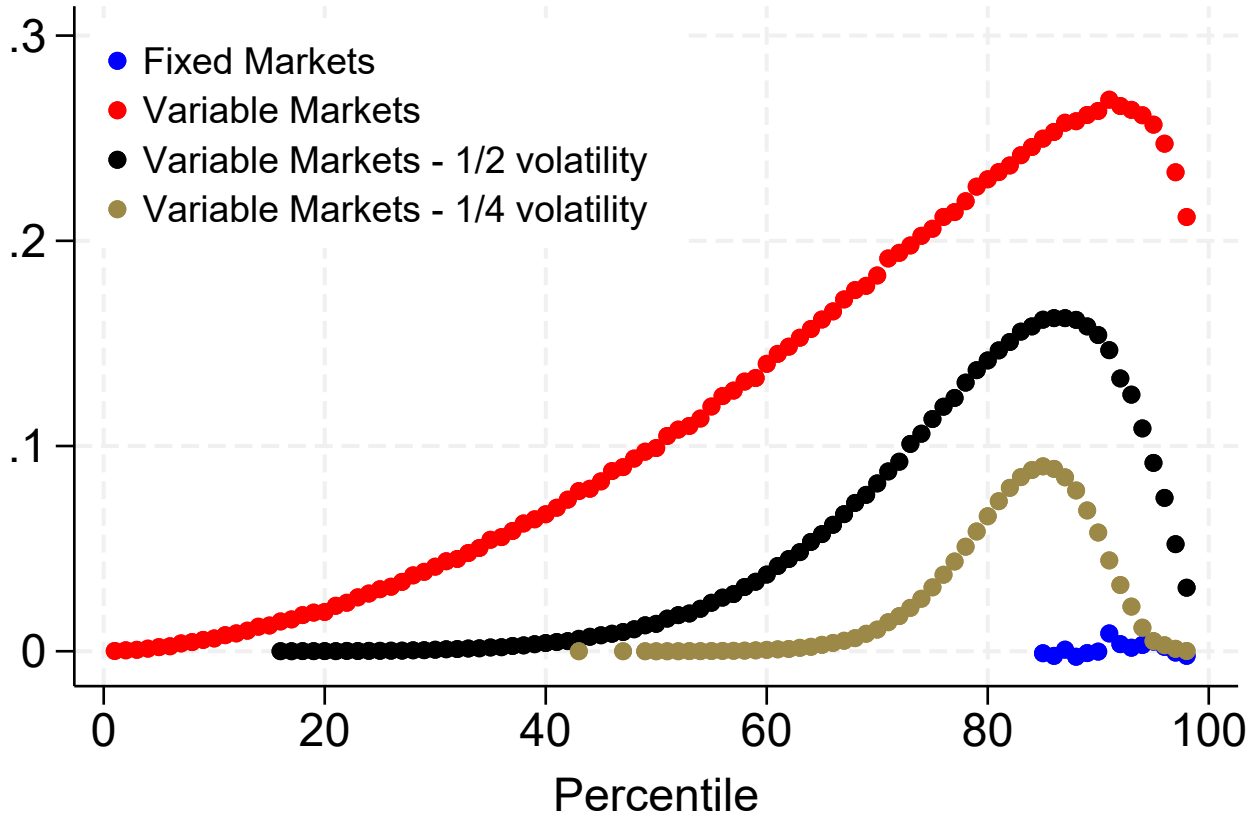
Illustrating the mechanism

Positive shocks prevail due to selection

Mean of micro shocks conditioning on exporting
(after accounting for probability of exporting)



- Reducing volatility of micro shocks shifts the gain to larger firms

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