Local Concentration, National Concentration, and the Spatial Distribution of Markups

Jonathan Becker[a] Chris Edmond Virgiliu Midrigan[a,d] Daniel Yi Xu[b,d]

[a] New York University

[b] Duke University

[c] NBER

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Motivation

- **Rising** national and local production concentration
  - Autor *et al.* (2020) and Autor *et al.* (2023)
- In a model with endogenously variable markups this might be concerning
  - Edmond, Midrigan, and Xu (2023)
- But, evidence of **divergence** of national and local sales concentration
  - Rossi-Hansberg and Hsieh (2023) and Benkard *et al.* (2023)
- **This paper:** quantitative model where **local sales concentration** matters for markups

This Paper

- General equilibrium model of intra-national trade with
  - Heterogenous **multi-unit** manufacturing firms **shipping** across many locations
  - Oligopolistic competition in each destination market
- Calibrate model to match
  - **National concentration** of 6-digit NAICS industries
  - Operation of **multi-unit** firms
  - **Gravity** of each industry in Commodity Flow Survey
- Study implications for spatial markup dispersion and quantify welfare implications

Findings

- Unobserved in data; model implies a **local sales HHI** of **0.21**

- Spatial correlation between local production and local sales HHI is **noisy**
  - Increases with the strength of industry level gravity

- Model with no geography and same national concentration implies much **lower** markups

- Decreasing spatial trade frictions
  - **Increase** national and local production concentration
  - **Decrease** local sales concentration and markups

Outline

- Model Environment
- Quantification
- Quantitative Exercises
  - Spatial Distribution of Markups
  - Geography and Aggregate Markups
  - Trade Cost Reduction

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The Environment

- J locations indexed at $j, k = 1, \ldots, J$
- Continuum of sectors $s \in (0, 1)$
- There are $n(s)$ firms i in each sector s
  - Firms can have multiple establishments
  - Firm-location productivity $z_{ij}(s) = \bar{z}_i(s)\,\hat{z}_{ij}(s)$
- Sector-specific iceberg trade-cost $\tau_{jk}(s) \geq 1$
- L_j workers inelastically supply e_j units of labor in location j
- Representative household's budget is $P_j c_j = w_j e_j + \bar{\pi}$ and $C_j = L_j c_j$

Final Good

- In destination k the non-tradable final good is produced as

$$C_k = \left(\int C_k(s)^{\frac{\theta-1}{\theta}} ds \right)^{\frac{\theta}{\theta-1}} \text{ with } \theta > 1 \quad \text{and} \quad C_k(s) = \left(\sum_{i=1}^{n(s)} c_{ik}(s)^{\frac{\gamma-1}{\gamma}} \right)^{\frac{\gamma}{\gamma-1}} \text{ with } \gamma > \theta$$

- Firm i's shipment to k is itself a CES aggregate over different establishments

$$c_{ik}(s) = \left(\sum_{j=1}^{J} c_{ijk}(s)^{\frac{\lambda-1}{\lambda}} \right)^{\frac{\lambda}{\lambda-1}}$$

with special cases $\lambda = \gamma$ and $\lambda \to \infty$

- Resource constraint $y_{ijk}(s) = \tau_{jk}(s)\, c_{ijk}(s)$

▸ Demand Functions

Intermediate Producers

- Production of firm i in origin j for destination k is

$$y_{ijk}(s) = z_{ij}(s)\,\ell_{ijk}(s)$$

- At local wages $\{w_j\}$, firm i's profits from destination market k are

$$\sum_{j=1}^{J}\left(p_{ijk}(s) - \frac{w_j}{z_{ij}(s)}\right) y_{ijk}(s)$$

- Given CRS, firms maximize profits for each market k separately in two steps

  1. Within-firm allocation: cheapest way to deliver $c_{ik}(s) = 1$ subject to price-index
  2. Local competition: oligopolistically competitive choice of $c_{ik}(s)$ à la Cournot

- In 1st step, firms minimize the cost of delivering $c_{ik}(s) = 1$

$$\min_{p_{ijk}(s)} \left\{ \sum_{j=1}^{J} \underbrace{\frac{\tau_{jk}(s)\, w_j}{z_{ij}(s)}}_{\text{cost } \phi_{ijk}(s)} \underbrace{\left(\frac{\tau_{jk}(s)\, p_{ijk}(s)}{P_{ik}(s)}\right)^{-\lambda}}_{\text{demand } c_{ijk}(s) \,|\, c_{ik}(s)=1} + \xi_{ik}(s) \left[\sum_{j=1}^{J} \left(\frac{\tau_{jk}(s)\, p_{ijk}(s)}{P_{ik}(s)}\right)^{1-\lambda} - 1 \right] \right\}$$

- FOCs imply that firms set an origin-independent markup

$$p_{ijk}(s) = \mu_{ik}(s) \frac{w_j}{z_{ij}(s)} \quad \rightsquigarrow \quad P_{ik}(s) = \mu_{ik}(s) \underbrace{\left(\sum_{j=1}^{J} \left(\frac{\tau_{jk}(s)\, w_j}{z_{ij}(s)}\right)^{1-\lambda} \right)^{\frac{1}{1-\lambda}}}_{\text{unit-cost } \phi_{ik}(s) \text{ of } c_{ik}(s)}$$

Profit Maximization: Local Competition

- Using result from within-firm allocation

$$\max_{c_{ik}(s)} \left\{ c_{ik}(s)\Big(P_{ik}(s) - \phi_{ik}(s)\Big) \middle| c_{ik}(s) = \left(\frac{P_{ik}(s)}{P_k(s)}\right)^{-\gamma} \left(\frac{P_k(s)}{P_k}\right)^{-\theta} C_k \right\}$$

- Atkeson and Burstein (2008) at each destination k

$$\mu_{ik}(s) = \frac{\epsilon_{ik}(s)}{\epsilon_{ik}(s) - 1}$$

where the demand elasticity $\epsilon_{ik}(s)$ is

$$\epsilon_{ik}(s) = \left[\omega_{ik}(s)\,\frac{1}{\theta} + \big(1 - \omega_{ik}(s)\big)\,\frac{1}{\gamma}\right]^{-1}$$

Labor Market Clearing

- Labor used in origin j to produce for destination market k

$$\ell_{jk}(s) = \frac{\tau_{jk}(s)}{\bar{z}_{jk}(s)} \left(\frac{P_k(s)}{P_k} \right)^{-\theta} C_k$$

- Labor market clearing in each location j

$$e_j L_j = \int \sum_{k=1}^{J} \ell_{jk}(s)\, ds$$

- Substituting $\ell_{jk}(s)$ into labor market clearing

$$e_j L_j = \sum_{k=1}^{J} P_k C_k \int \frac{\tau_{jk}(s)}{\bar{z}_{jk}(s) P_k(s)} \left(\frac{P_k(s)}{P_k} \right)^{1-\theta} ds$$

- Budget expresses $P_k C_k$ as a function of wages, labor endowments, and markups

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Quantitative Model

- Take $n(s)$ directly from Census data on 6-digit manufacturing firms
  - In total 364 NAICS6 sectors, 51 states + DC, 270K firms
- Firm-level productivity $\bar{z}_i(s)$ Pareto with tail parameter ξ and $\hat{z}_{ij}(s) \in \{0, 1\}$
- Assign "home" for firm i according to business pattern weights
- Additional plants at each location with Prob$\left(\hat{z}_{ij}(s) = 1\right) = \left[1 + \alpha_0\, \bar{z}_i(s)^{\alpha_1}\right]^{-1}$ for each j
- Sector-specific trade cost $\tau_{jk}(s)$ from CFS gravity regressions

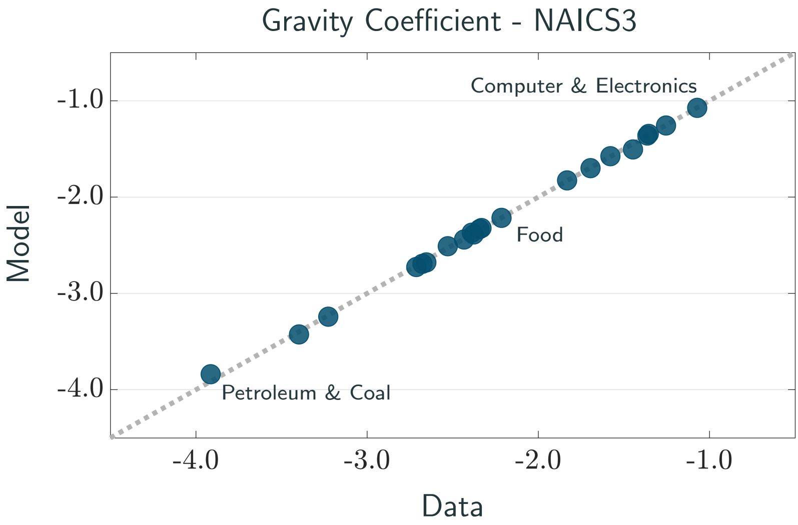
Calibration

Parameter		Value	Target
1. Assigned			
Substitution across sectors	θ	1.25	Edmond, Midrigan, Xu (2023)
Substitution within sectors	$\gamma = \lambda$	10	Edmond, Midrigan, Xu (2023)
2. Calibrated			
Firm productivity	ξ	7.35	National concentration
Trade elasticities	$\delta(s)$	$\sim$	Gravity coefficients NAICS3
Multi-unit probability	α_0	0.0003	Fraction of multi-unit firms
	α_1	0.082	Sales share of multi-unit firms

Model Fit

Moments	Data	Model
1. National Concentration		
Top 4 sales share	0.42	0.46
Top 20 sales share	0.73	0.70
Sales HHI	**0.10**	**0.11**
2. Multi-Unit Firms		
Fraction of multi-unit firms	0.04	0.09
Sales share of multi-unit firms	0.79	0.63
3. Untargeted		
Local Production HHI	0.36	0.35
Across State HHI	0.08	0.08

Model Fit - Gravity



Model-Implied Local Sales Concentration

Local Concentration	Model
Top 1 sales share	0.33
Top 4 sales share	0.69
Top 20 sales share	0.94
Sales HHI	**0.21**

- Local sales concentration is **higher** than national concentration
- Local sales concentration is **lower** than local production concentration

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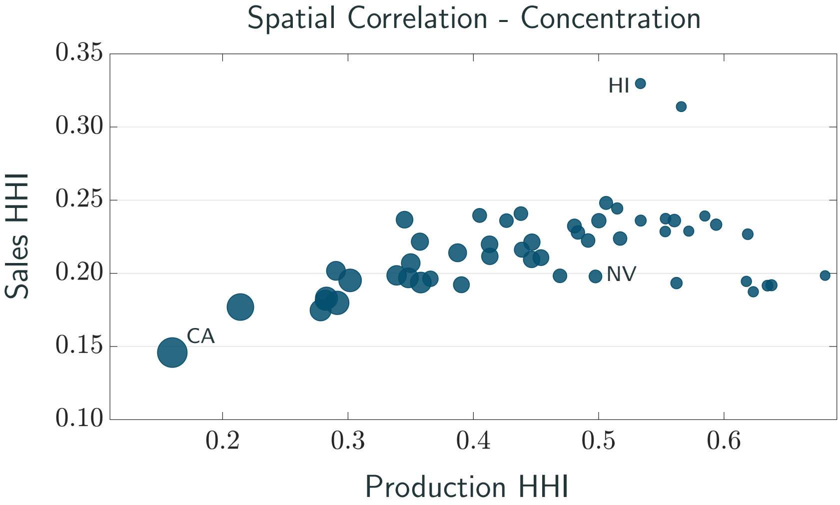
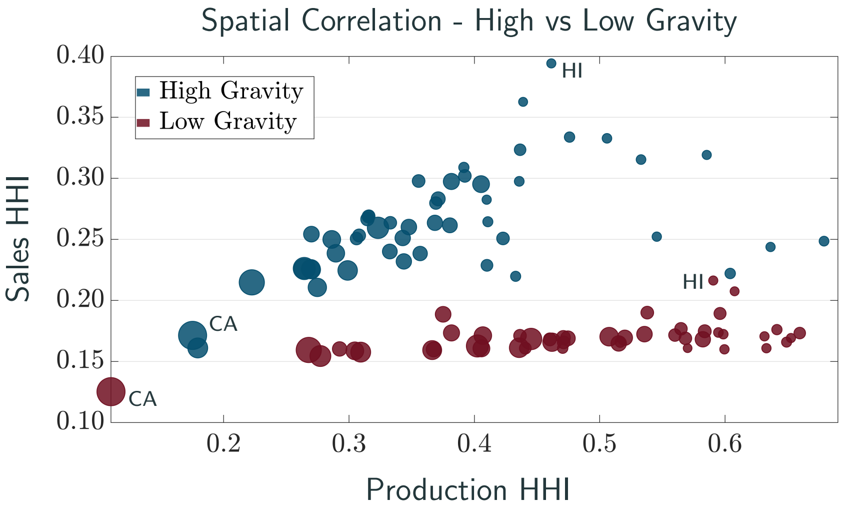
Spatial Correlation of Concentration Measures



▸ Map: Production HHI ▸ Map: Sales HHI

The Role of Gravity



▸ Map: Production HHI ▸ Map: Sales HHI

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Model with No Geography

- Special case with **no trade cost** and fully **mobile labor**
- Essentially a closed-economy version of Edmond, Midrigan, and Xu (2015, AER)
- Pareto productivity parameter $\xi = 6.87$ to match national concentration

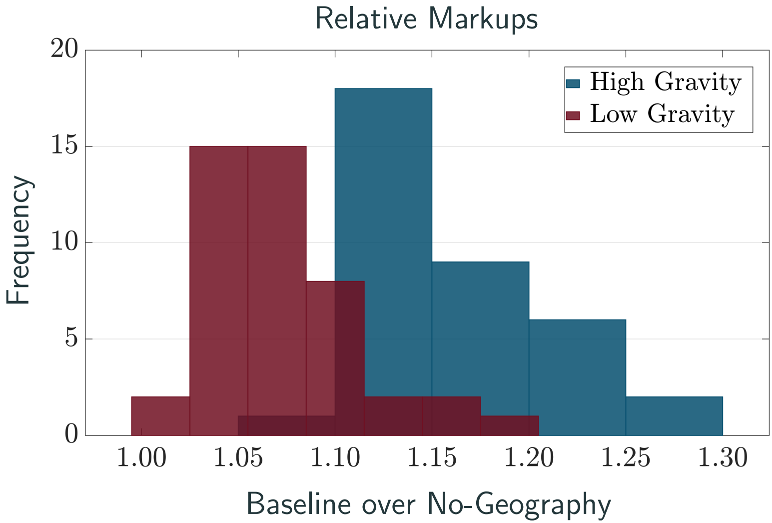
Moments	Data	Model
National Concentration		
Top 4 sales share	0.42	0.47
Top 20 sales share	0.73	0.72
Sales HHI	0.10	0.08

Markup Distribution

Percentile	Baseline Model	No Geography
p1	1.17	1.12
p10	1.21	1.14
p25	1.25	1.15
p50	1.29	1.17
p75	1.36	1.20
p90	1.46	1.25
p99	1.62	1.40
aggregate	1.31	1.18

- Trade cost and geography matter for sectoral and aggregate markups

The Role of Gravity



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Diverging National and Local Sales Concentration

	20% increase	baseline	20% decrease	free trade
1. National Concentration				
Top 4 sales share	0.44	0.46	0.49	0.57
Top 20 sales share	0.67	0.70	0.73	0.83
Sales HHI	**0.10**	**0.11**	**0.11**	**0.13**
2. Local Production Concentration				
Production HHI	**0.34**	**0.35**	**0.37**	**0.42**
3. Local Sales Concentration				
Top 4 sales share	0.72	0.69	0.66	0.57
Top 20 sales share	0.95	0.94	0.92	0.83
Sales HHI	0.21	0.20	0.18	0.13

▸ Trade Cost Reduction

Diverging National and Local Sales Concentration

	20% increase	baseline	20% decrease	free trade
1. National Concentration				
Top 4 sales share	0.44	0.46	0.49	0.57
Top 20 sales share	0.67	0.70	0.73	0.83
Sales HHI	0.10	0.11	0.11	0.13
2. Local Production Concentration				
Production HHI	0.34	0.35	0.37	0.42
3. Local Sales Concentration				
Top 4 sales share	0.72	0.69	0.66	0.57
Top 20 sales share	0.95	0.94	0.92	0.83
Sales HHI	**0.21**	**0.20**	**0.18**	**0.13**

▸ Trade Cost Reduction

Counterfactual Markup Distribution

Percentile	20% increase	baseline	20% decrease	free trade
p1	1.18	1.17	1.16	1.13
p10	1.23	1.21	1.20	1.16
p25	1.27	1.25	1.23	1.18
p50	1.32	1.29	1.27	1.22
p75	1.38	1.36	1.34	1.28
p90	1.49	1.46	1.43	1.39
p99	1.66	1.62	1.60	1.55
aggregate	1.33	1.31	1.29	1.24

- Reduction in trade costs **promotes competition** in destination markets
- Rising national and local production concentration are consistent with **lower** markups

Next Steps & Outlook

- Incorporate imports both into model and data
- "China shock" and market structure changes
- Market power implications for domestic producers at industry-state level

Appendix

Demand

- Hicksian demand in destination market k is

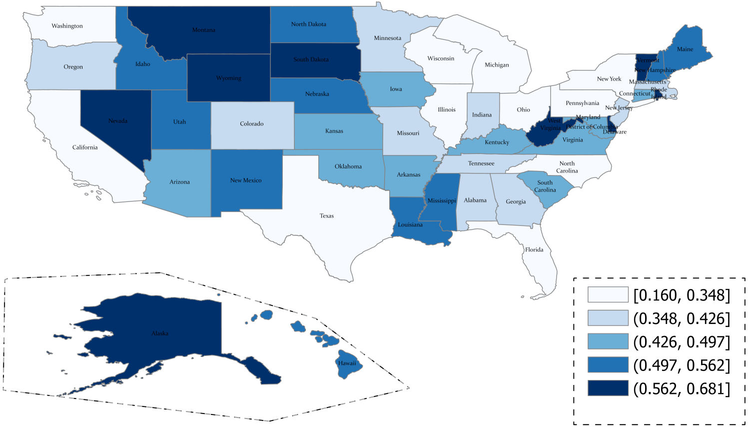
$$c_{ijk}(s) = \left(\frac{\tau_{jk}(s)\, p_{ijk}(s)}{P_{ik}(s)}\right)^{-\lambda} \left(\frac{P_{ik}(s)}{P_k(s)}\right)^{-\gamma} \left(\frac{P_k(s)}{P_k}\right)^{-\theta} C_k$$

- With CES price-indices

$$\begin{aligned} P_k &= \left(\int P_k(s)^{1-\theta} ds\right)^{\frac{1}{1-\theta}} \\ P_k(s) &= \left(\sum_{i=1}^{n(s)} P_{ik}(s)^{1-\gamma}\right)^{\frac{1}{1-\gamma}} \\ P_{ik}(s) &= \left(\sum_{j=1}^{J} \left(\tau_{jk}(s)\, p_{ijk}(s)\right)^{1-\lambda}\right)^{\frac{1}{1-\lambda}} \end{aligned}$$

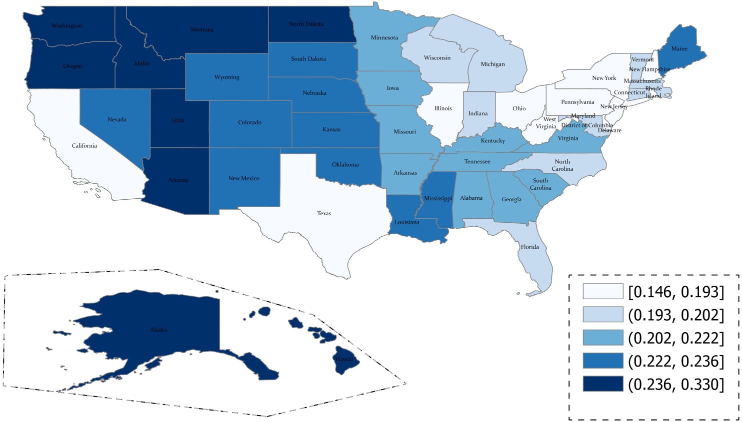
back

Spatial Distribution of Production HHI



back

Spatial Distribution of Sales HHI



back

Trade Cost Reduction over Time

- Rising labor productivity in the U.S. transportation sector and a decreasing gravity
  - Cosar *et al.* (2023) find distance elasticities decreased around 15 - 20%
- Could this explain the increase in national and local production concentration?
- Welfare implication of rising national concentration due to the trade cost reduction

back