

The Evolution of U.S. Retail Concentration

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Disclaimer: Any opinions and conclusions expressed herein are those of the authors and do not necessarily represent the views of the U.S. Census Bureau. All results have been reviewed to ensure that no confidential information is disclosed. References to specific companies are based on public information and do not imply the company is in the confidential data.

The U.S. retail sector

Changes in the aggregate structure of retail

- ↑ national concentration (Hortascu and Syverson 2015; Autor, Dorn, Katz, Patterson, Van Reenan 2020)
- Growth of Walmart, Target, etc.
- Exit of small firms (Basker 2005; Jia 2008; Foster, Haltiwanger, Klimek, Krizan, Ohlmacher 2016)
- Effect on consumers? (Markups, Market Power, Costs)

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Retail markets are local

- Negative effects of concentration operate through local markets
- What does increasing in national concentration imply for local markets?

This paper: 3 Results

1. Measure **local** retail concentration with Census data 1982-2012

- Product sales data for all U.S. retail establishments
- Measure concentration directly for **product markets**
 - Relevant measure for competition in retail

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- Local increases **widespread** across markets, products, and industries
 - Results robust to role of online retail until 2012

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Contribute to understanding of local markets using Census data

(Rossi-Hansberg, Sarte, Trachter 2020; Benkard, Yurucoglu, Zhang 2021; Rinz 2021)

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2. Decomposition of national HHI into local HHI and cross-market HHI

- **New** decomposition based on probabilistic interpretation of HHI
- What does the increase in national concentration imply for local markets?

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- National - Consumers in different markets (99% cross market)
- Local - Consumers in the same market

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Make explicit the relationship between national and local trends

- National firms' expansion (Rossi-Hansberg, Hsieh 2019; Cao, Hyatt, Mukoyama, Saeger 2020)

This paper: 3 Results

3. Effects of increasing local concentration on consumers

- Standard link between HHI and markups under Cournot Competition
(Tirole, 1988; Atkeson & Burstein, 2008)
- **Key:** \uparrow Local concentration \rightarrow \uparrow Markups \rightarrow \downarrow Passthrough of cost savings

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Local concentration explains part of increase in markups

- Room for other channels (Bornstein 2018; Brand 2020)

Roadmap

Census Data on U.S. Retailers

Measuring National and Local Concentration

Decomposing National Concentration

Effect of Local Concentration on Markups

What are retailers?

- Sell final goods to consumers
- NAICS Definition: Perform no transformation of materials
- Not Retailers:
 - Restaurants (transform food), Wholesalers (sell to businesses), Services (no physical good: barber, gym, etc.)
- Excluded Retail Industries:
 - Auto dealers and gasoline stations (ownership issues)
 - Non-store retailers (measurement)

Store-level sales data

- Census of Retail Trade (CRT)
 - All retail stores in the U.S. (with at least one employee)
 - 1982-2012 - Years ending in 2 and 7
- Location: **Commuting Zone**, Zip Code, County, MSA.
 - Also observe national e-commerce share.
- Industry: 6-digit NAICS
- Sales by 20 product categories (clothing, groceries, etc.)

Definition of markets - Industry vs Product

- Problems at high levels of aggregation (NAICS-3):



Definition of markets - Industry vs Product

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Definition of markets - Industry vs Product

- Problems at high levels of aggregation (NAICS-3):



- Similar problems with disaggregated industries (NAICS-6).

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Effect of Local Concentration on Markups

Measuring concentration

Herfindahl-Hirschman Index (for a product market j)

$$HHI^j = \sum_{i=1}^N (s_i^j)^2 \quad s_i^j : \text{Sales share of firm } i \text{ in product } j$$

Measuring concentration

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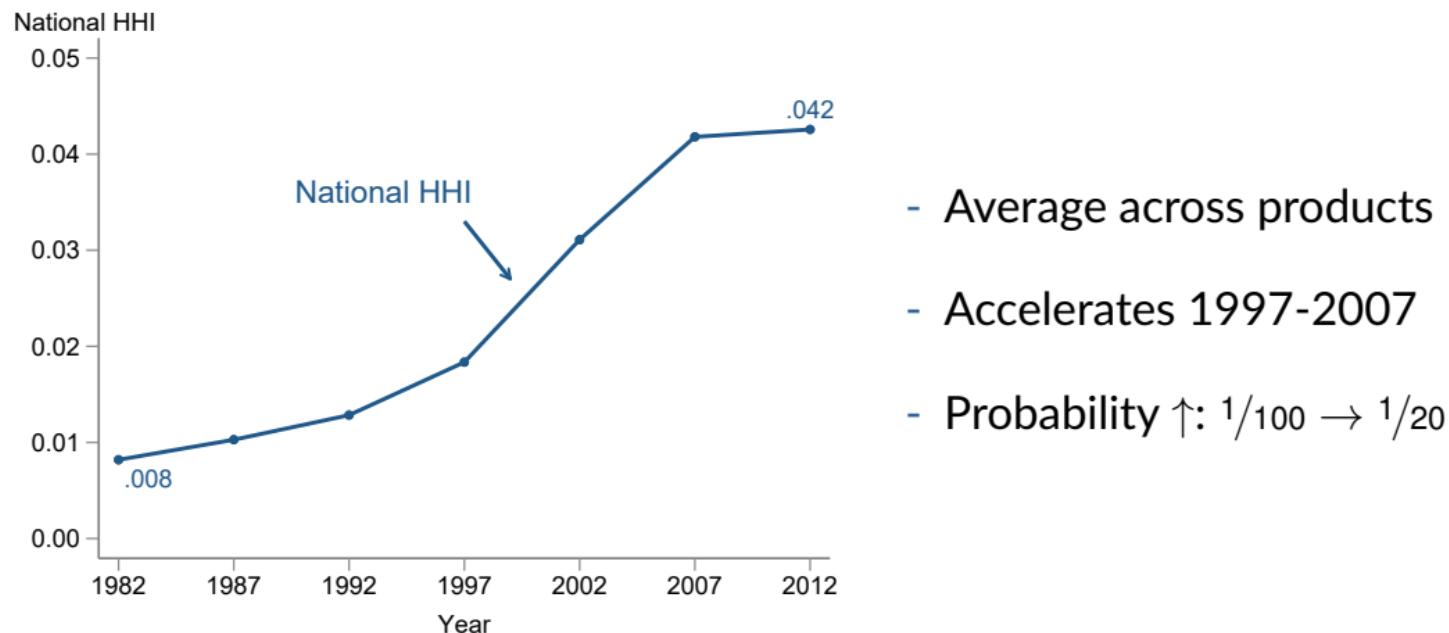
$$HHI^j = \sum_{i=1}^N (s_i^j)^2 \quad s_i^j : \text{Sales share of firm } i \text{ in product } j$$

What does the HHI mean?

- Probability two random dollars (x, y) are spent at the same firm (i)

$$HHI = \Pr(i_x = i_y)$$

National U.S. retail concentration

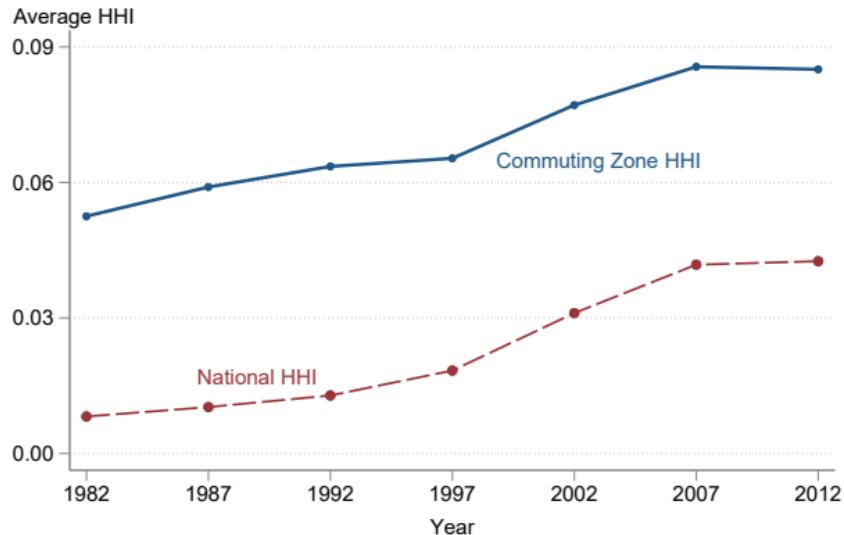


Local U.S. retail concentration



- Steady increase of ~ 3pp

Local U.S. retail concentration



- Steady increase of ~ 3pp
- Parallel increase with national concentration
- Similar across geographies
- Similar for Top 4 Shares

details

details

Additional results (1992-2012)

1. Concentration changes across products

details

- Concentration increases in almost all products (clothing)

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2. Changes across locations

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- Majority of locations increase concentration (~60% of markets, ~70% of dollars)

Additional results (1992-2012)

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- Majority of locations increase concentration ($\sim 60\%$ of markets, $\sim 70\%$ of dollars)

3. Effect of e-commerce (non-store retailers)

details

- Derive bounds on effect on local concentration
- Small effects until 2012

Additional results (1992-2012)

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details

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4. Concentration changes in retail industries

details

- Larger increases in concentration (8.7pp Nat. - 12.6pp Local)
- General Merchandisers local concentration $\uparrow 28\text{pp}$

Roadmap

Census Data on U.S. Retailers

Measuring National and Local Concentration

Decomposing National Concentration

Effect of Local Concentration on Markups

What does national concentration imply about local?

Not Much:

example

- As local concentration increases so does national concentration
 - Consumers in the **same market** buying from the **same firms**
- As firms expand across markets they increase national concentration
 - Consumers in **different markets** buying from the **same firms**
 - We call this **Cross-Market Concentration**

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Objective:

Decompose National HHI into Local and Cross-Market concentration

Relationship between National and Local HHI

- Use probabilistic interpretation of the HHI

$$HHI = \Pr(i_x = i_y)$$

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- **Key:** Law of Total Probability
 - **Local HHI:** Probability conditional on dollars spent in the same market ($m_x = m_y$)

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- **Local HHI:** Probability conditional on dollars spent in the same market ($m_x = m_y$)

$$HHI^N = \overbrace{P(m_x = m_y)}^{\text{Collocation}} \underbrace{P(i_x = i_y | m_x = m_y)}_{\text{Av. Local HHI}} + (1 - P(m_x = m_y)) \underbrace{P(i_x = i_y | m_x \neq m_y)}_{\text{Av. Cross-Market HHI}}$$

National HHI driven by rise of national firms

$$HHI^N = \underbrace{0.02}_{\text{Collocation}} + \underbrace{P(i_x = i_y | m_x = m_y)}_{\text{Av. Local HHI}} + 0.98 \underbrace{P(i_x = i_y | m_x \neq m_y)}_{\text{Av. Cross-Market HHI}}$$

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National index contains little information on local concentration

details

- Collocation term is less than 2 percent (Higher in other countries/industries)

Increase in national HHI reflects increasing cross market concentration

- Consumers in different markets shop at the same firms

Roadmap

Census Data on U.S. Retailers

Measuring National and Local Concentration

Decomposing National Concentration

Effect of Local Concentration on Markups

Consequences of increasing concentration

- Key Question:
 - Effect of increase in concentration on passthrough of lower costs
- Firms with higher market shares can charge higher markups
 - Standard result under Cournot competition (Tirole, 1988)
- Aggregate markups linked to **local HHI**
 - Generalizes to model of oligopolistic competition (Atkeson & Burstein, 2008)

Markups and market shares

- Firm's problem:

$$\max_{q_i} P(Q) q_i - c_i q_i.$$

- Optimal pricing (markups):

$$P(Q) = \left[1 - \frac{s_i}{\varepsilon}\right]^{-1} c_i,$$

$\varepsilon^{-1} \equiv -Q/P \partial P/\partial Q$ is demand elasticity and $s_i \equiv Pq_i/PQ$ is market share.

- Market's gross margins:

$$\mu \equiv \frac{\text{Revenue}}{\text{Cost of Goods Sold}} = \frac{\sum c_i q_i}{PQ} = \left[1 - \frac{\text{HHI}}{\varepsilon}\right]^{-1}.$$

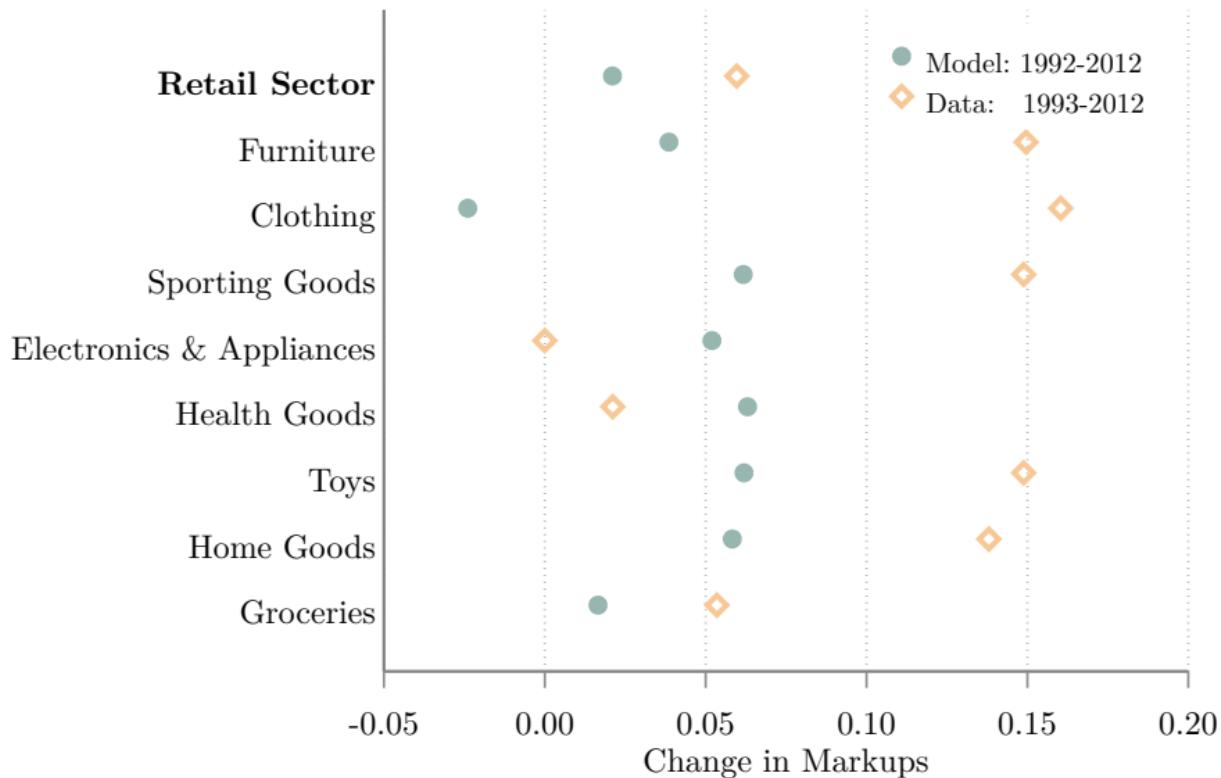
Local HHI and change in markups

	Products ($\Delta\mu$)		
	$\varepsilon = 1.5$	$\varepsilon = 3$	$\varepsilon = 6$
Commuting Zone	1.63	0.77	0.38
Zip Code	1.29	0.52	0.24

- Change is at most 1/4 of that in ARTS (Gross margins ↑ 6%, 1993-2012)
 - Much smaller than in De Loecker, Eeckhout & Unger (2020)
- Industry concentration implies higher rise in margins: 1.7-14 pp
- Oligopolistic competition model implies 2.1 pp increase

details

Model vs Data: change in markups



Conclusion

- Direct measurement of local concentration at product level
 - Retail firms compete in products across industries (e.g. General Merchandisers)
- Both local and national concentration rising in the retail sector
 - They rise for different reasons
 - 99% of national concentration is cross market
- National trends are not informative about local concentration
- Higher **local** concentration increased markups 1.6pp (1992-2012)
 - Explains about 1/4 of the rise in markups.

Appendix

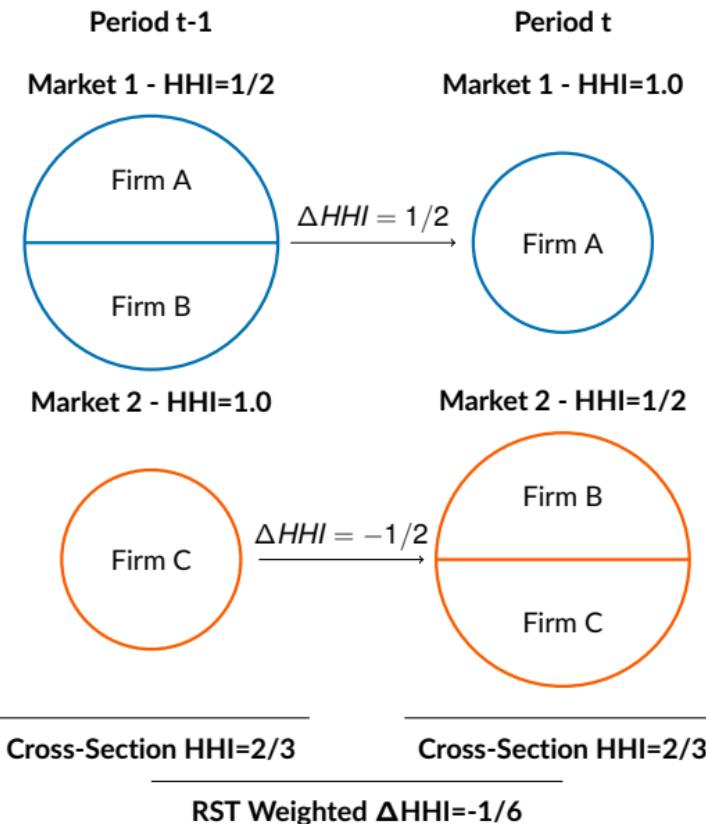
Comparison to RST

Three main differences:

- Data source - Census vs NETS
 - Census covers universe of retailers
 - Administrative records
- Market definition - Product vs (detailed) Industry
 - Industry markets miss cross-industry competition
 - Problem is worse for detailed industries
- Aggregation methodology
 - RST aggregate change in local concentration with end-of-period weights
 - Bias towards decrease in concentration
 - We report changes in cross-sectional concentration

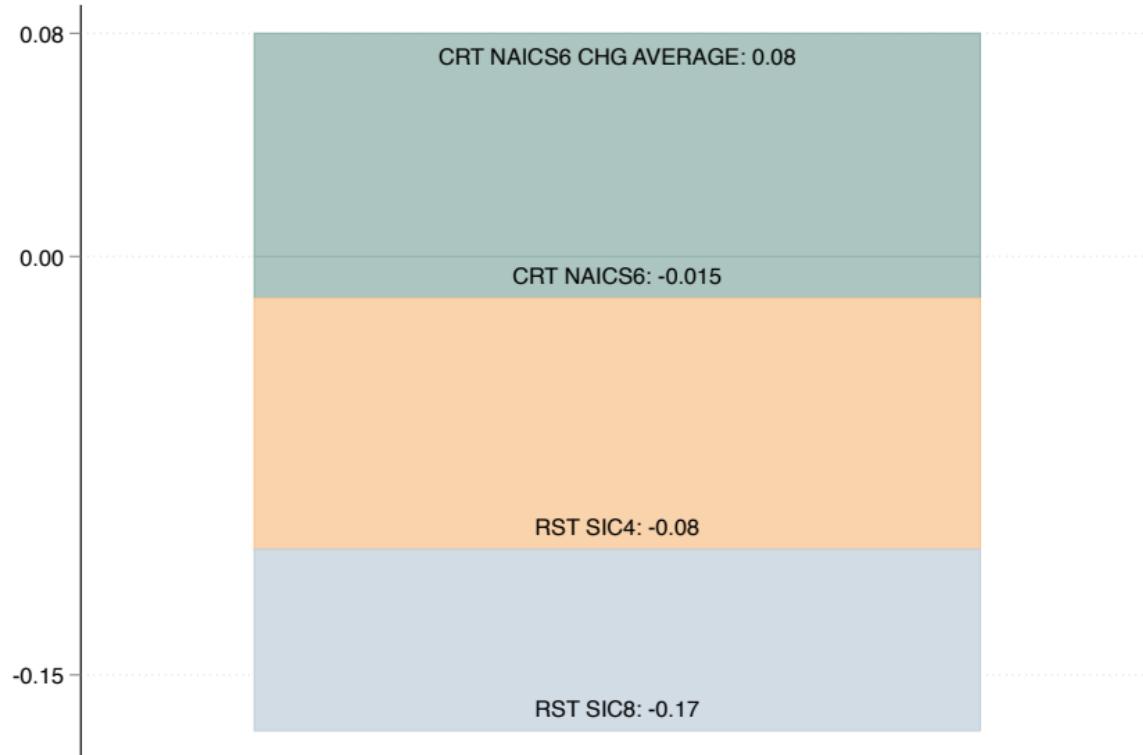
Each difference explains about 1/3 of discrepancy

Weighting Comparison



- Growing markets less concentrated
- RST find decreasing concentration w/ no change in cross section

Comparison to RST



RST Comparison

National Concentration					
	Level	Change from 1992			
		1992	1997	2002	2007
RST	N/A	0.020	0.030	0.050	
NAICS-based	0.029	0.017	0.056	0.076	
Select NAICS	0.046	0.034	0.097	0.136	

Zip Code Concentration - End-of-Period Weights

	Level 1992	Change from 1992		
		1997	2002	2007
RST	N/A	-0.070	-0.100	-0.140
NAICS-based	0.507	0.024	-0.018	-0.019
Select NAICS	0.552	-0.021	-0.018	-0.015

Zip Code Concentration - Current Period Weights

	Level	Change from 1992		
		0.022	0.057	0.072
NAICS-based	0.507	0.022	0.057	0.072
Select NAICS	0.552	0.026	0.067	0.083

Map of Commuting Zones

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Constructing sales by product category

[back](#)

Item 10. MERCHANTISE LINES				
Report sales for each merchandise line sold by this establishment, either as a dollar figure or as a whole percent of total sales. (See HOW TO REPORT DOLLAR FIGURES on page 1 and HOW TO REPORT PERCENTS below)				
HOW TO REPORT PERCENTS	If figure is 38.76% of total sales:		Mil.	Thou.
	• Report whole percents	Not acceptable	Dol.	Percent
				39
				38.76
Merchandise lines	Cen-sus use	ESTIMATES are acceptable. Report dollars OR percents.		
		Mil.	Thou.	Dol.
1. Women's, juniors', and misses' wear (Report girls' and infants' and toddlers' wear on line 3 and footwear on line 4)	0220	230	231	232
2. Men's wear (Report boys' wear on line 3 and footwear on line 4)	0200			
3. Children's wear (Include boys' (sizes 2 to 7 and 8 to 20), girls' (sizes 4 to 6x and 7 to 14), and infants' and toddlers' clothing and accessories. Report footwear on line 4.)	0240			
4. Footwear (include accessories)	0260			

FORM RT-5302

Data: Census of Retail Trade

- Observe store sales for **entire sample**
- Sales by product line for 80 percent of sales
- Aggregate lines into product categories
- Impute for stores with missing data [Details](#)

Imputing Data

1. Data collection with Census of Retail Trade (every 5 years)

- Sales data by product for 80% of sales

2. Aggregation to product categories

- Goal: Aggregate so industries primarily sell one category

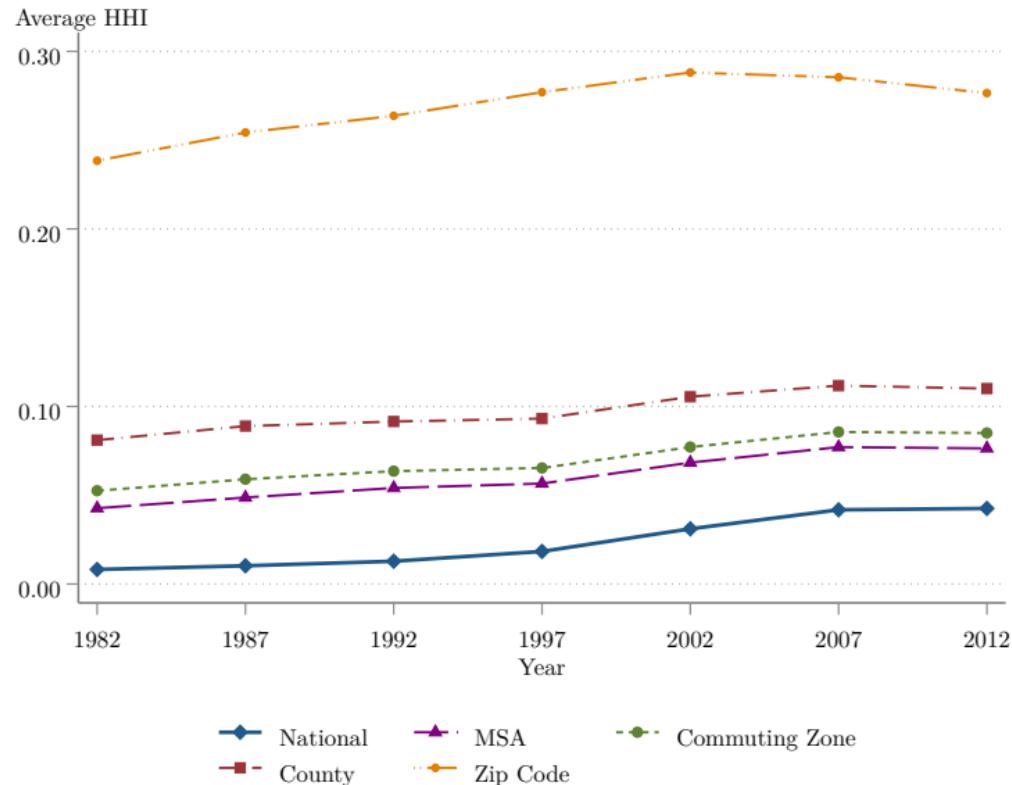
Broad Line	Product Category
Footwear	Clothing
Curtains	Clothing
Sewing	Clothing
Drugs, health aids, etc	Health
Optical goods	Optical Goods

3. Imputation - depending on data availability use

- Sales of other stores of the same firms
- Sales of the store in other years
- Industry, kind of business, and multi-unit status

Local Concentration Increases

back



Local Concentration: Top 4 Shares

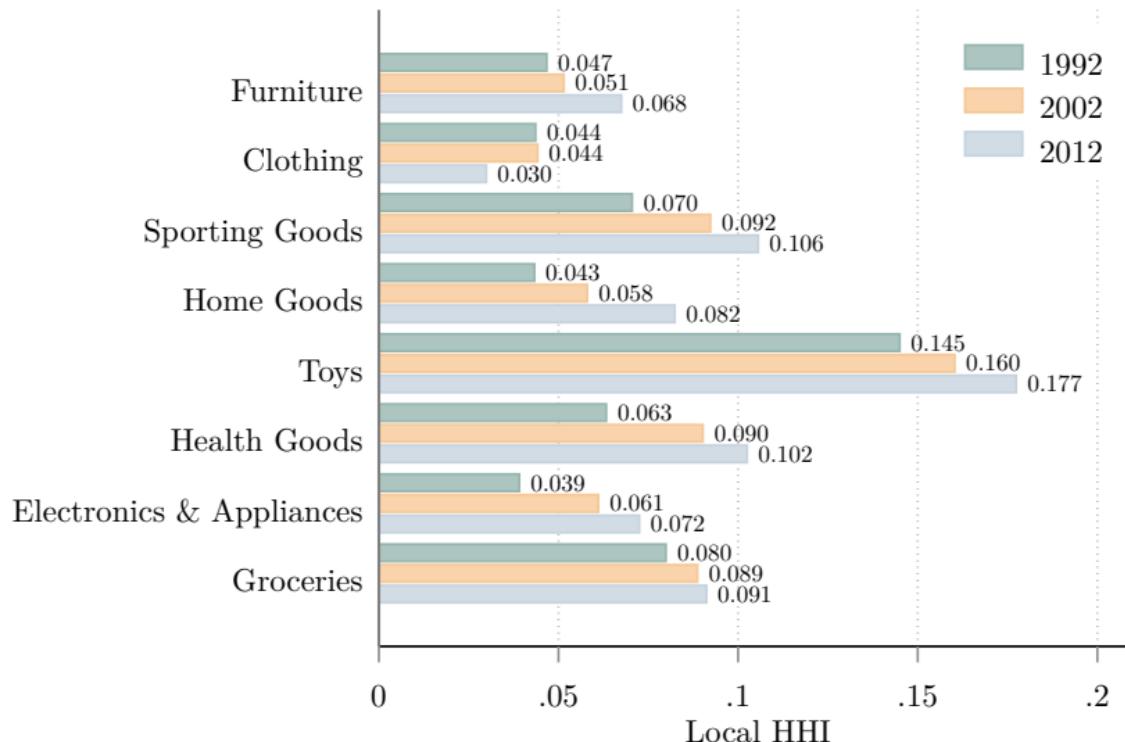
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	1982	1987	1992	1997	2002	2007	2012
Commuting Zone	0.35	0.37	0.38	0.38	0.41	0.42	0.42
MSA	0.31	0.33	0.34	0.35	0.38	0.40	0.39
County	0.43	0.45	0.45	0.45	0.47	0.47	0.47
Zip	0.70	0.71	0.72	0.72	0.72	0.70	0.68

Notes: Results come from the Census of Retail Trade. The market share of the 4 firms with the greatest sales in each product category and location in each year are summed. These results are then aggregated using a weighted average of the sales share of each product and location in a year.

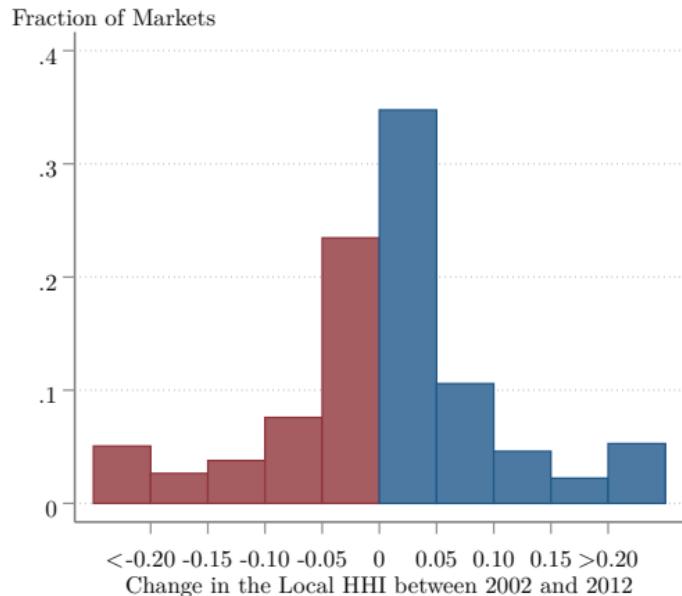
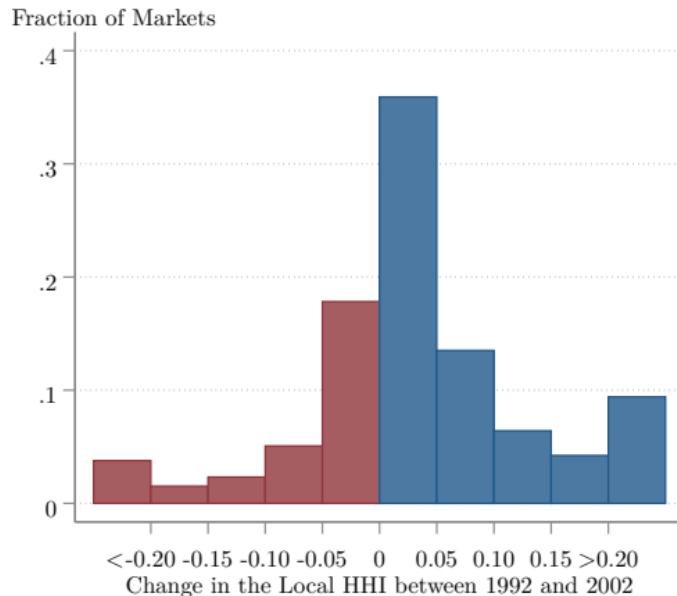
Local Concentration Across Products

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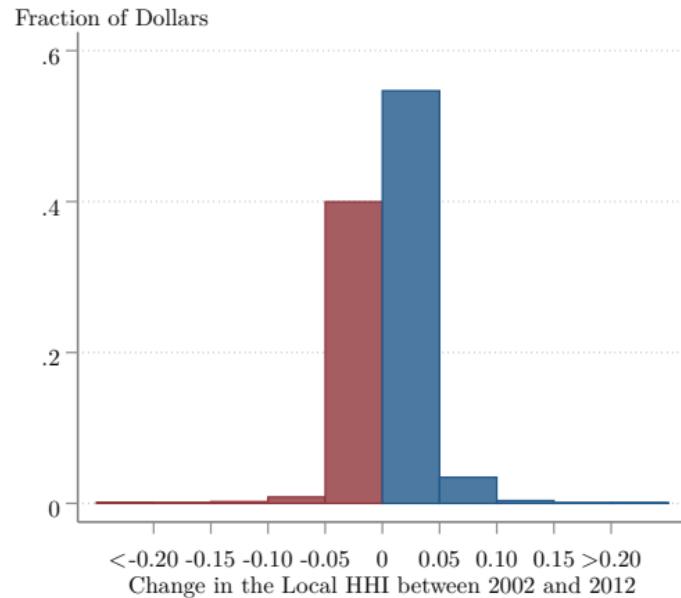
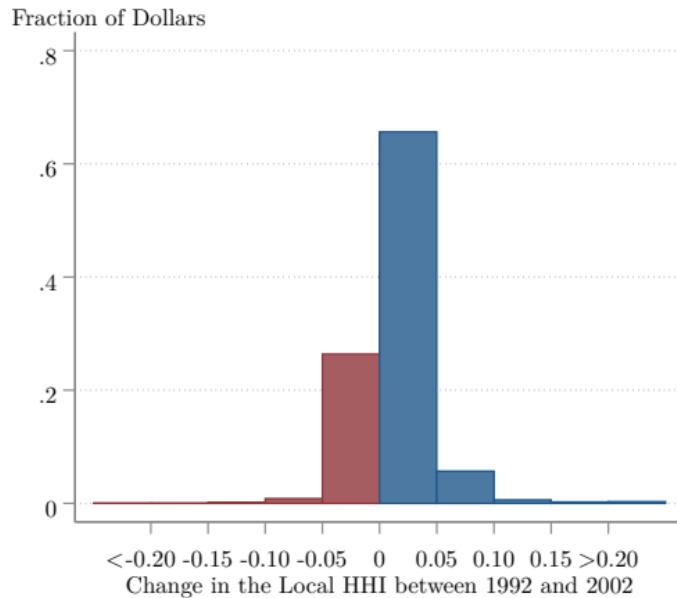
Changes in Concentration Across Locations - I

back



Changes in Concentration Across Locations - II

back



Accounting for Non-Store Retailers

back

- Non-store retailers (e-commerce, catalogue) only report national sales
- Historically online sales are low for most product categories
 - Moderately important by 2012 (2.7% of sales 1992 → 9.5% in 2012)
 - Low share in most products (Groceries 1.3%→0.7%)
 - High share in some products (Electronics and Appliances 7.5%→20.9%)

details

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back

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 - Low share in most products (Groceries 1.3%→0.7%)
 - High share in some products (Electronics and Appliances 7.5%→20.9%)
- Use national numbers for e-commerce shares to **obtain bounds**
 - Assumption: Online sales proportionally distributed across markets

$$\underbrace{H\bar{H}I = (1 - s_{NS})^2 H\bar{H}I_{BM}}_{\text{Lower Bound: Diluted Sales}}$$

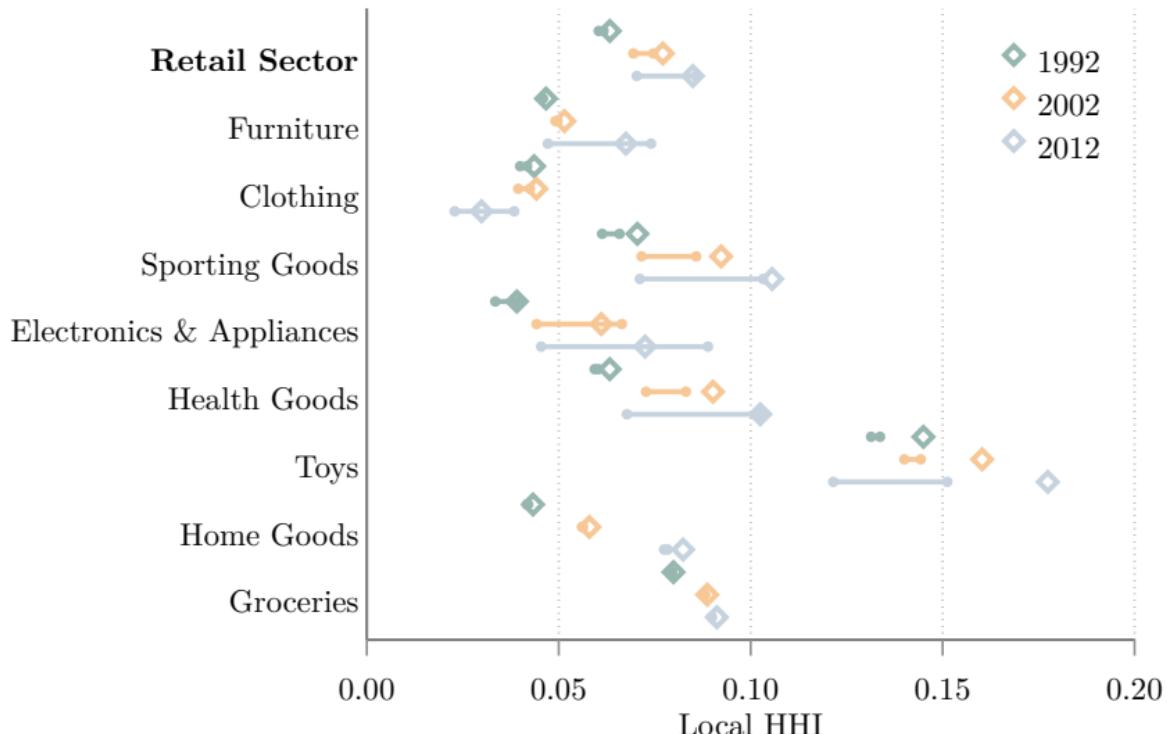
and

$$\overline{H\bar{H}I} = (1 - s_{HS})^2 H\bar{H}I_{BM} + s_{NS}^2$$

Upper Bound: Concentrated Sales

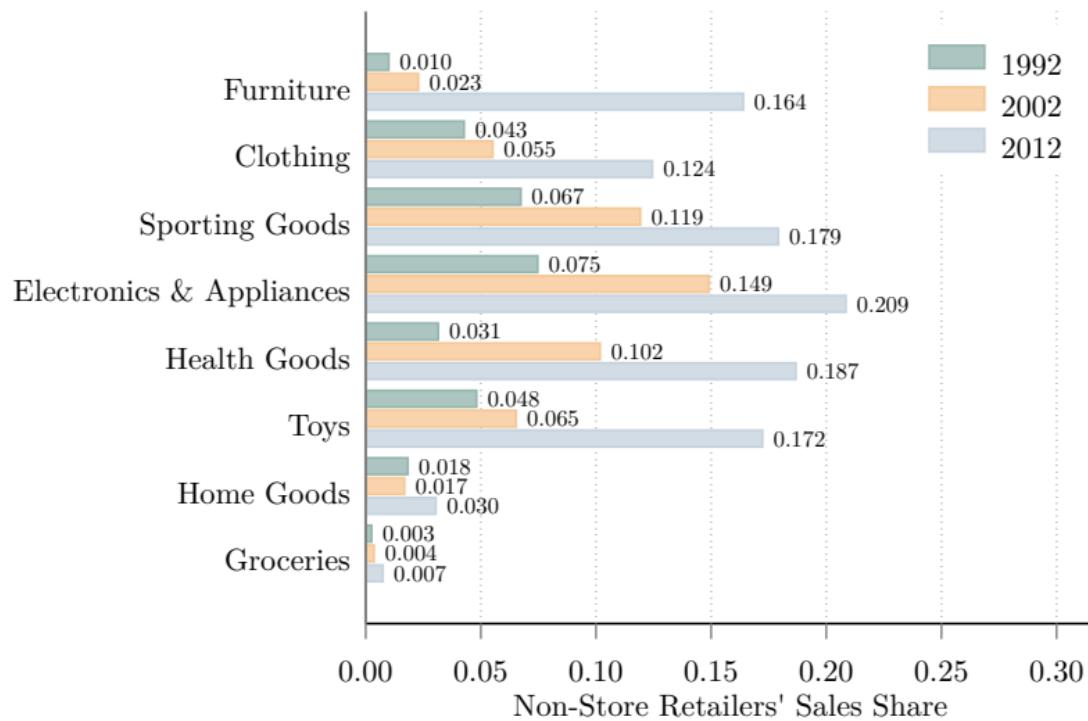
Bounds on Local Concentration

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Non-Store Retailers Share by Product

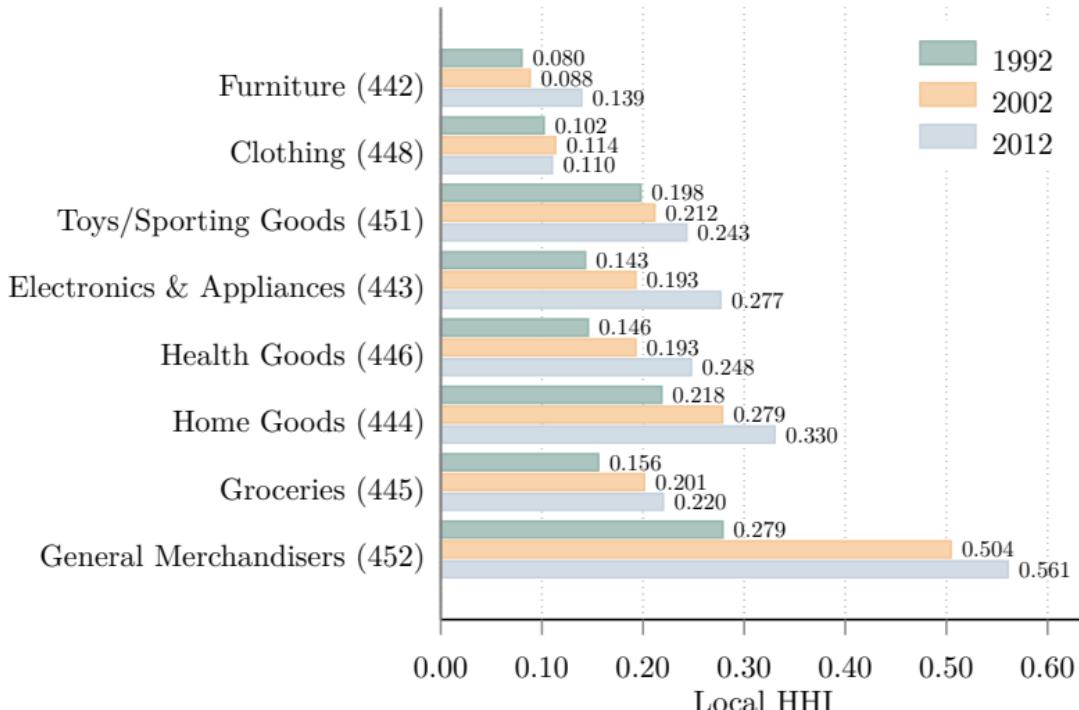
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Average Industry Concentration

National Concentration					
	1992	1997	2002	2007	2012
Product Based	0.013	0.019	0.031	0.042	0.043
Industry Based	0.029	0.046	0.085	0.105	0.116
Commuting Zone Concentration					
Product Based	0.064	0.066	0.078	0.086	0.086
Industry Based	0.177	0.199	0.263	0.287	0.303
Zip Code Concentration					
Product Based	0.264	0.277	0.288	0.286	0.277
Industry Based	0.530	0.552	0.603	0.611	0.615

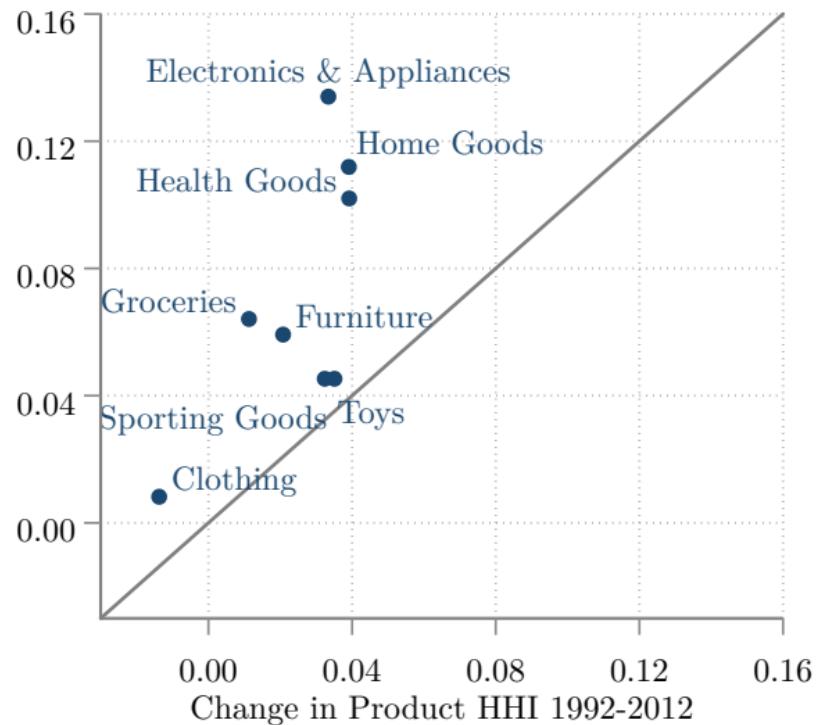
Local Concentration Across Industries



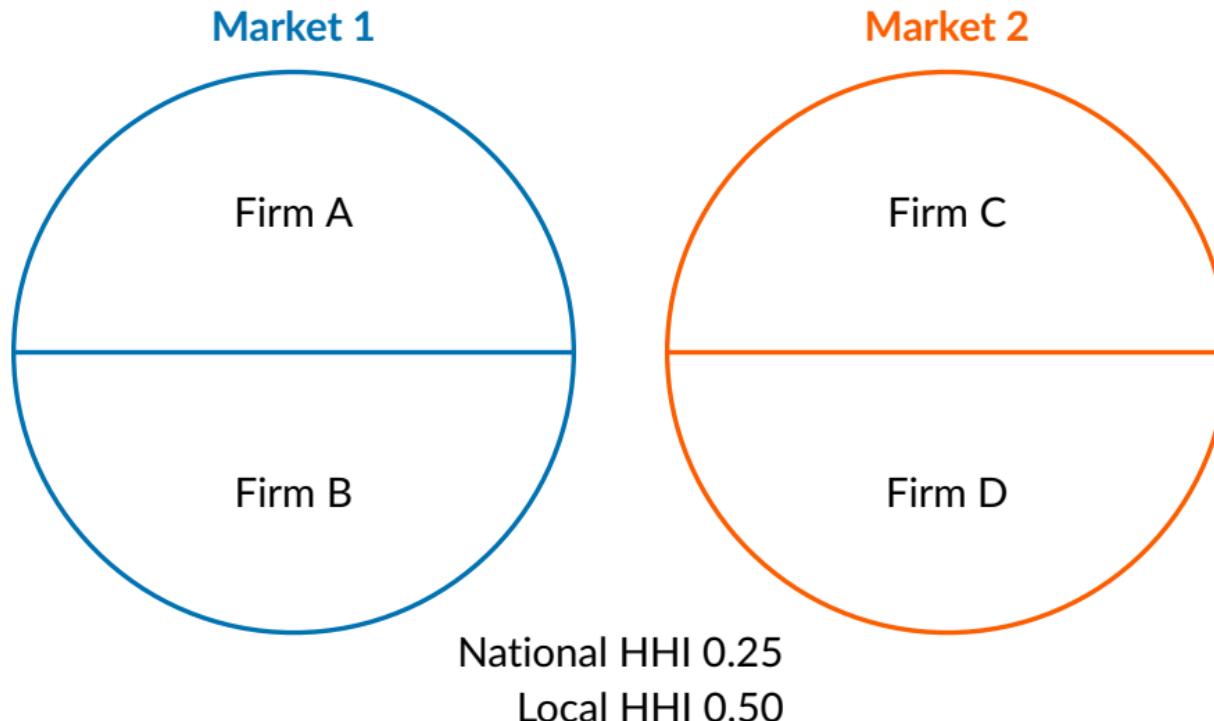
Local Concentration Products vs Industries

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Change in Industry HHI 1992-2012



What does national concentration imply about local?



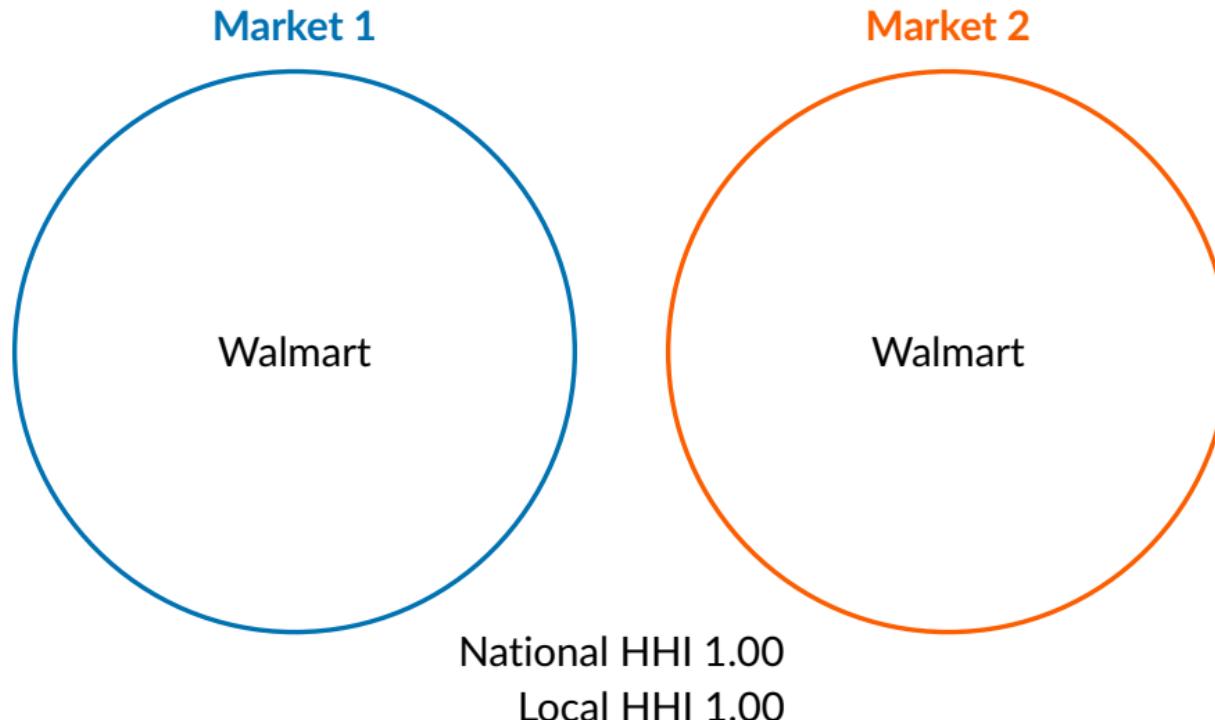
Scenario 1: Increasing national, local unchanged

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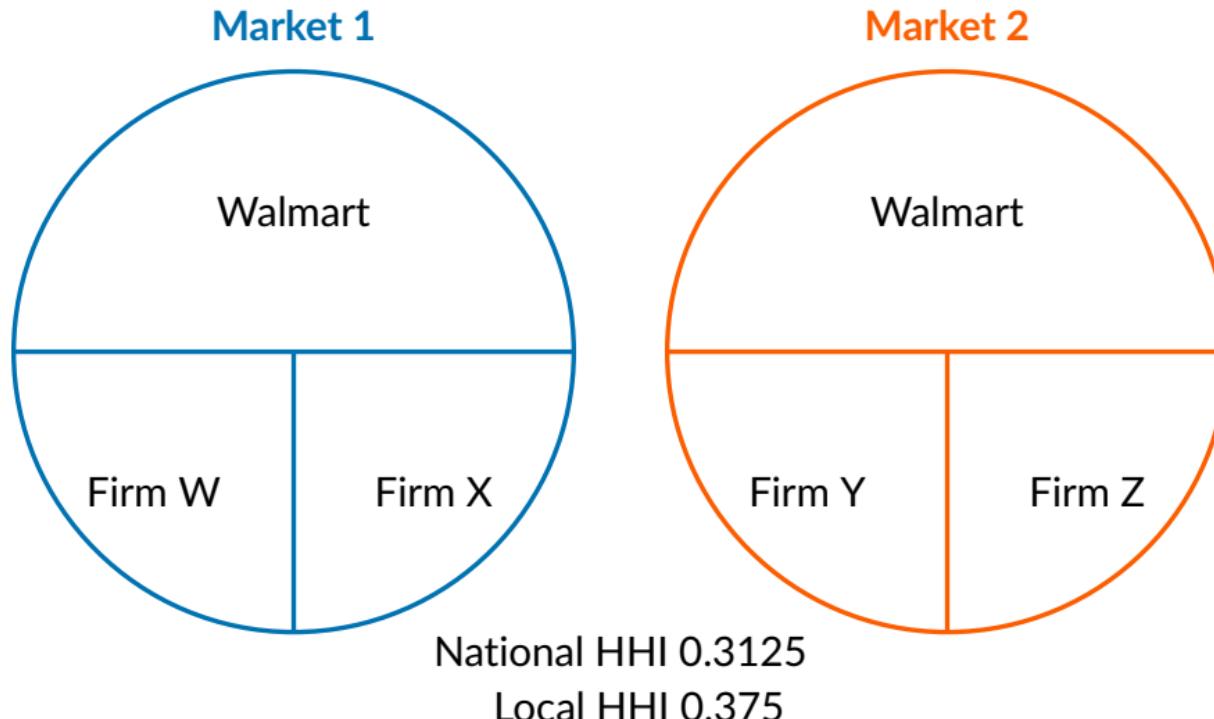
Scenario 2: Increasing national and local

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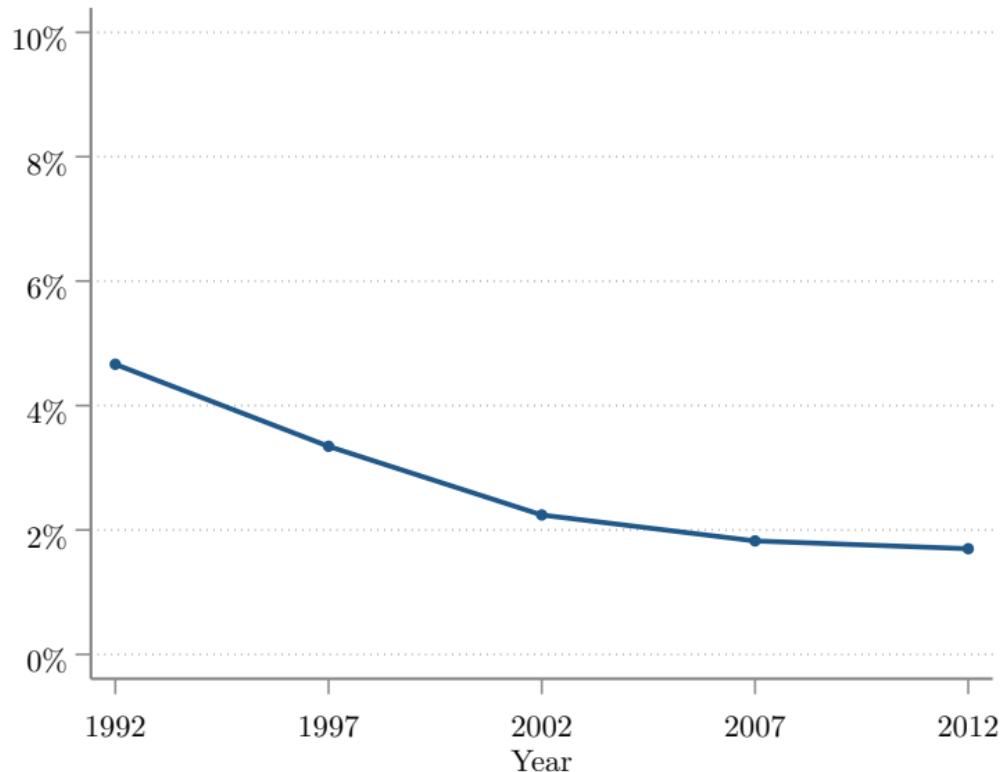
Scenario 3: Increasing national, decreasing local

back



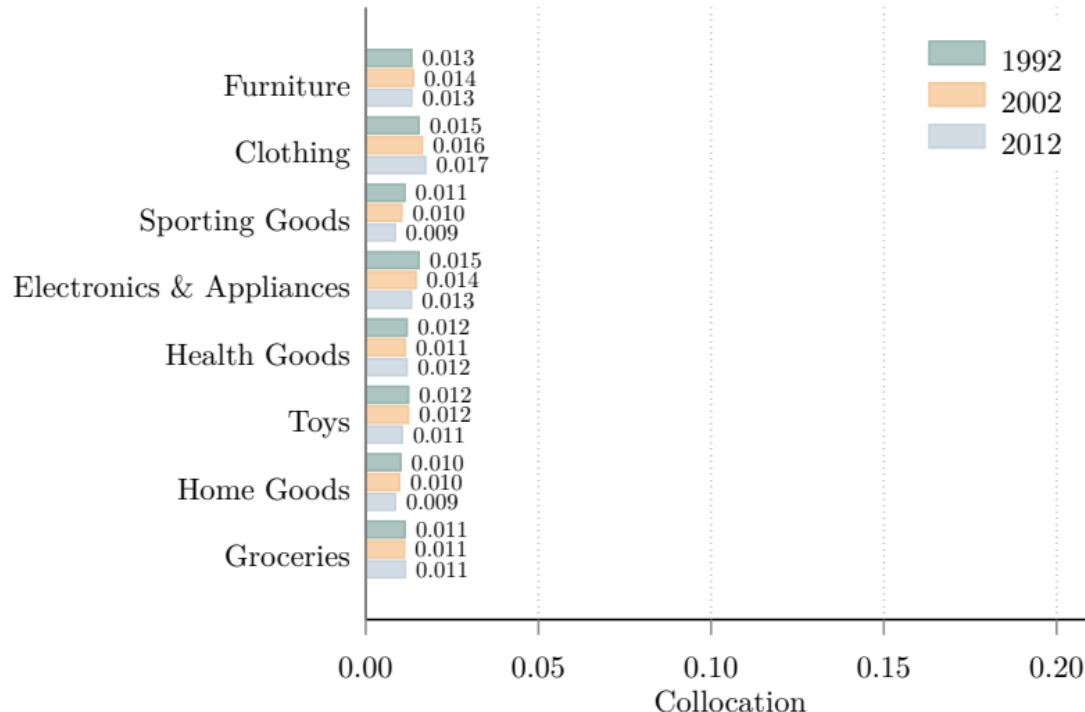
Contribution of Local HHI to National HHI

back



Collocation Across Products

back



Decomposition Equation - Local HHI

$$\text{Local HHI} = \sum_m s_m \sum_{i=1}^{N_m} (s_i^m)^2 = \sum_m s_m \underbrace{\sum_{i \in N_m^{new}} (s_i^m)^2}_{\text{Entry}} + \overbrace{\sum_{i \in N_m^{old}} (s_i^m)^2}^{\text{Continuers}}$$

- Results depend on entry timeframe
- Entrants within past 10 years play small role in Local HHI
- Entrants within the past 20 years play a large role
- Recently importance of continuers increasing

Decomposition Equation - Cross Market HHI

$$\begin{aligned}\text{Cross HHI} &= \sum_m \sum_{n \neq m} s_m s_n \sum_{i=1}^N s_i^m s_i^n \\ &= \sum_m \sum_{n \neq m} s_m s_n \left(\underbrace{\sum_{i \in N_{mn}^{new}} s_i^m s_i^n}_{\text{Entry}} + \overbrace{\sum_{i \in N_{mn}^{old}} s_i^m s_i^n}^{\text{Continuers}} \right)\end{aligned}$$

- Entrants within past 10 years play small role in Cross Market HHI
- Entrants within the past 20 years play a large role
- Recently importance of continuers increasing

Model of firms' markups

details

- **Market:** product-location pair
 - J products in L locations
 - $I(j, \ell)$ firm compete in quantities (Cournot) in a market
- **Demand:** product demand is CES (ε_j)
- **Pricing:** market-specific pricing ($p_i^{j\ell}$)
- **Technology:** firms vary in market-specific marginal cost ($\lambda_i^{j\ell}$)

Pricing to market: Cournot competition

Details

$$p_i^{j\ell} = \mu_i^{j\ell} \lambda_i^{j\ell} \quad \mu_i^{j\ell} = \frac{\varepsilon_j}{\varepsilon_j - 1} \left[1 - s_i^{j\ell} \right]^{-1}$$

Markup μ_i^{jm} depends on firm i 's sales share in product-market (s_i^{jm}) :

- Higher share \rightarrow Higher markup
- Higher share \rightarrow Lower prices, Higher productivity

Pricing to market: Cournot competition

Details

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- Higher share \rightarrow Higher markup
- Higher share \rightarrow Lower prices, Higher productivity

Key: Aggregate to equation linking **Local HHI** and markups (Grassi, 2017)

$$\mu_j = \frac{\varepsilon_j}{\varepsilon_j - 1} [1 - \text{HHI}_j]^{-1} \quad \left(\text{HHI}_j = \sum_{\ell} s_{\ell}^j \cdot \text{HHI}_{j\ell}^{\ell} \right)$$

Data: Concentration and Markups

- Data from the Annual Retail Trade Survey (ARTS: 1993-2012)
 - Gross margin (revenue/cost-of-goods-sold) by retail industry
- Estimate markups by product category from ARTS
 - Make markups consistent with share of general merchandisers
- Estimate ε_j to match 1993 markups given measured local HHI

details

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Results:

- Obtain implied markups from change in local concentration
- Change in local HHI implies 2pp increase in markups
- 1/3 of increase 1993-2012 increase in ARTS data

Model details

- Economy has L locations and J products
- Without loss, there are I firms in each market (j, ℓ)
- Firms produce using only labor: $y_i^{j\ell} = z_i^{j\ell} n_i^{j\ell}$
 - Firms differ in productivity $z_i^{j\ell}$
 - Labor is immobile across locations
 - Location specific wage w_ℓ such that: $\sum_j \sum_i n_i^{j\ell} = N_\ell^S$
 - Firm's marginal cost: $\lambda_i^{j\ell} = w_\ell / z_i^{j\ell}$
- CES demand for varieties of product j in location ℓ : elasticity ϵ_j
- Cobb-Douglas aggregators:
 - Products in location ℓ - Match product share by location
 - Retail output across location - Match location share

Functional forms: Aggregation

- Aggregate retail output:

$$Y = \prod_{m=1}^M (y_m)^{\beta_m} \quad \sum_{m=1}^M \beta_m = 1$$

- Market retail output:

$$y_m = \prod_{j=1}^J (y_j^m)^{\gamma_j^m} \quad \sum_{j=1}^J \gamma_j^m = 1$$

- Product output (market m):

$$y_j^m = \left(\sum_{i=1}^N \left(y_i^{jm} \right)^{\frac{\epsilon_j - 1}{\epsilon_j}} \right)^{\frac{\epsilon_j}{\epsilon_j - 1}} \quad \epsilon_j > 1$$

Functional forms: Demand and prices

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- Demand for market m and aggregate price p :

$$p_m y_m = \beta_m P \cdot Y \quad P = \theta \prod_{m=1}^M (p_m)^{\beta_m} \quad \text{where } \theta = \prod_{m=1}^M (\beta_m)^{-\beta_m}$$

- Demand for product j in market m and market m 's price:

$$p_j^m y_j^m = \gamma_j^m p_m y_m \quad p_m = \Gamma \prod_{j=1}^J (p_j^m)^{\gamma_j^m} \quad \text{where } \Gamma = \prod_{j=1}^J (\gamma_j^m)^{-\gamma_j^m}$$

- Demand for firm i 's product j in market m and product j 's price in market m :

$$y_i^{jm} = \left(\frac{p_i^{jm}}{p_j^m} \right)^{-\epsilon_j} y_j^m \quad p_j^m = \left(\sum_{i=1}^N \left(p_i^{jm} \right)^{1-\epsilon_j} \right)^{\frac{1}{1-\epsilon_j}}$$

Aggregating markups - I

Average product markup: Ratio of price p_j^ℓ to marginal cost λ_j^ℓ .

- CRS imply λ_j^ℓ is also the average cost:

$$\lambda_j^\ell \equiv \frac{\sum_i \lambda_i^{j\ell} y_i^{j\ell}}{y_j^\ell} = \sum_i \lambda_i^{j\ell} \frac{y_i^{j\ell}}{y_j^\ell}$$

- Replacing on markups:

$$\mu_j^\ell \equiv \frac{p_j^\ell}{\lambda_j^\ell} = \left[\sum_i \lambda_i^{j\ell} \frac{y_i^{j\ell}}{p_j^\ell y_j^\ell} \right]^{-1} = \left[\sum_i \left(\frac{\lambda_i^{j\ell}}{p_i^{j\ell}} \right) \left(\frac{p_i^{j\ell} y_i^{j\ell}}{p_j^\ell y_j^\ell} \right) \right]^{-1}$$

- (Weighted) harmonic mean of individual markups:

$$\mu_j^\ell = \left[\sum_i \left(\mu_i^{j\ell} \right)^{-1} s_i^{j\ell} \right]^{-1}$$

Aggregating markups - II

Relationship to local HHI:

$$\begin{aligned}\mu_j^\ell &= \left[\sum_i \left(\frac{\varepsilon_j}{\varepsilon_j - 1} [1 - s_i^{j\ell}]^{-1} \right)^{-1} s_i^{j\ell} \right]^{-1} = \frac{\varepsilon_j}{\varepsilon_j - 1} \left[\sum_i (1 - s_i^{j\ell}) s_i^{j\ell} \right]^{-1} \\ &= \frac{\varepsilon_j}{\varepsilon_j - 1} \left[1 - \sum_i (s_i^{j\ell})^2 \right]^{-1} = \frac{\varepsilon_j}{\varepsilon_j - 1} \left[1 - \text{HHI}_j^\ell \right]^{-1}\end{aligned}$$

Relationship to product's gross margins:

$$\mu_j \equiv \frac{\sum_\ell p_j^\ell y_j^\ell}{\sum_\ell \lambda_j^\ell l_j^\ell} = \frac{\sum_\ell p_j^\ell y_j^\ell}{\sum_\ell \frac{\lambda_j^\ell}{p_j^\ell} p_j^\ell y_j^\ell} = \left[\sum_\ell (\mu_j^\ell)^{-1} s_j^\ell \right]^{-1} = \frac{\varepsilon_j}{\varepsilon_j - 1} [1 - \text{HHI}_j]^{-1}$$

Matching markups from ARTS

1. Identify main industry of each product category (e.g., Clothing - NAICS 448)
2. Assume that General Merchandisers charge a **product markup** proportional to that of product's industry:

$$\mu_{GM}^j = \lambda \cdot \mu_j^{ARTS}$$

3. Estimate λ to be consistent with General Merchandiers's markup:

$$\mu_{GM}^{ARTS} = \sum_j \omega_{GM}^j \mu_{GM}^j = \lambda \sum_j \omega_{GM}^j \cdot \mu_j^{ARTS}$$

4. Compute product markups - Geometric average of markups

$$\mu_j = \left(\frac{1 - \omega_{GM}^j}{\mu_j^{ARTS}} + \frac{\omega_{GM}^j}{\mu_{GM}^j} \right)^{-1}$$

Estimated parameters by product

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Product Category	1992	ε_j 2002	2012
Furniture	2.70	2.43	2.43
Clothing	3.07	2.83	2.48
Sporting Goods	3.73	3.77	3.20
Electronics & Appliances	4.48	5.74	4.95
Health Goods	4.38	5.30	5.09
Toys	5.55	5.91	4.91
Home Goods	4.85	4.13	3.92
Groceries	5.82	5.39	6.40