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
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Contribute to understanding of local markets using Census data

(Rossi-Hansberg, Sarte, Trachter 2021; Benkard, Yurucoglu, Zhang 2021; Rinz 2022)

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2. Link national and local trends through single- and multi-market retailers

- New decomposition based on probabilistic interpretation of HHI
- Disentangle role of consolidation and expansion of retailers

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Make explicit the relationship between national and local trends

- National firms' expansion (Rossi-Hansberg, Hsieh 2023; Cao, Hyatt, Mukoyama, Saeger 2020) particularly in groceries (Basker 2007; Holmes 2011)

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

Linking National and Local Concentration

Effect of Local Concentration on Markups

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
- Sales by 20 product categories (clothing, groceries, etc.)

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
- Sales by 20 product categories (clothing, groceries, etc.)
- Location: **Commuting Zone**, Zip Code, County, MSA.
  - Also observe national e-commerce share.
- Industry: 6-digit NAICS (perform no transformation of materials)
  - Exclude auto dealers and gasoline stations (ownership issues) and non-store retailers (measurement)

Definition of markets - Industry vs Product

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

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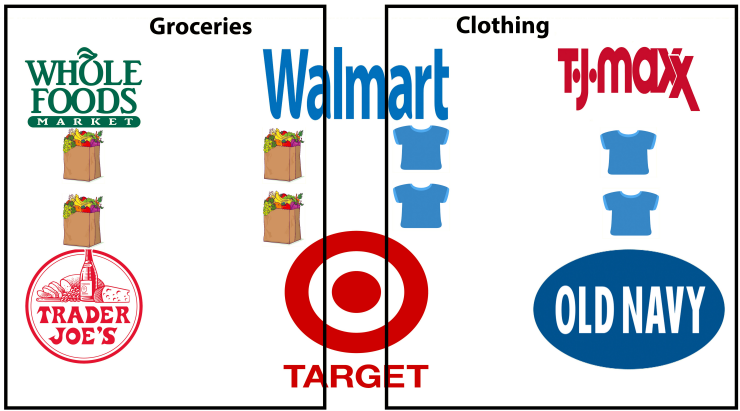

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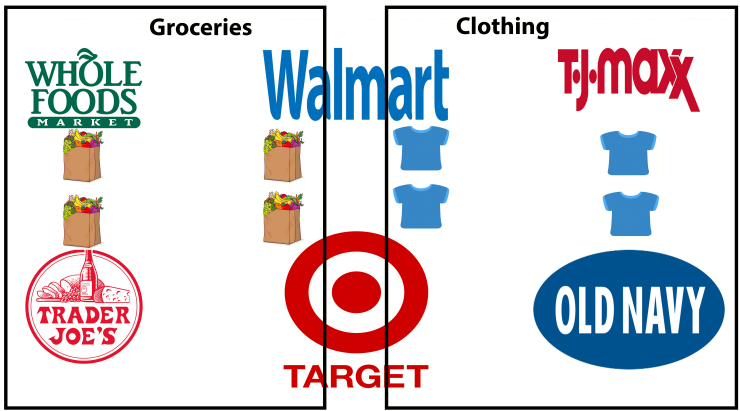

- Similar problems with disaggregated industries (NAICS-6).

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Measuring concentration

Herfindahl-Hirschman Index (for a product market *j*)

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

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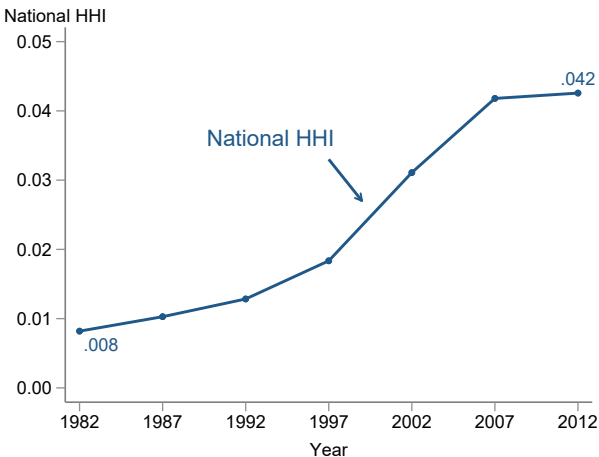
What does the HHI mean?

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

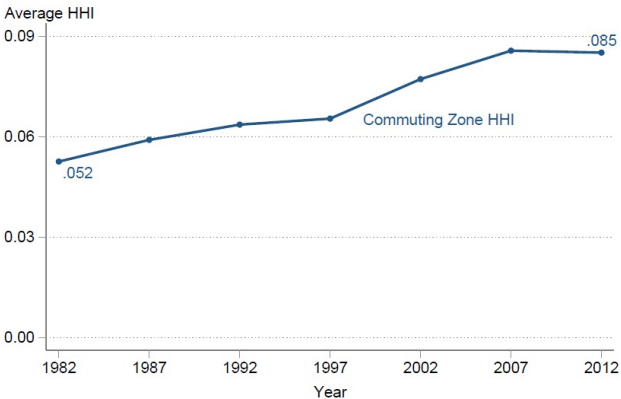
$$HHI = \Pr\left(i_x = i_y\right)$$

National U.S. retail concentration



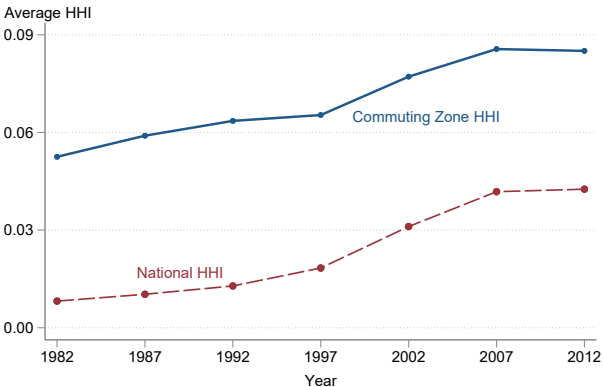
- Average across products
- Accelerates 1997-2007
- Probability ↑: $1/100 \rightarrow 1/20$

Local U.S. retail concentration



- Steady increase of $\sim 3pp$

Local U.S. retail concentration



- Steady increase of $\sim 3pp$
- **Parallel** increase with national concentration
- Similar across geographies

details

- Similar for Top 4 Shares

details

Additional results (1992-2012)

1. Concentration changes across products

details

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3. Effect of e-commerce (non-store retailers) — details
   - Derive bounds on effect on local concentration
   - Small effects until 2012
4. Concentration changes in retail **industries** — details
   - Larger increases in concentration (8.7pp Nat. - 12.6pp Local)
   - General Merchandisers local concentration ↑ **28pp**

Roadmap

Census Data on U.S. Retailers

Measuring National and Local Concentration

Linking National and Local Concentration

Effect of Local Concentration on Markups

What links national and local concentration? example

- As local concentration increases so does national concentration
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Objectives:

1. Decompose role of single- and multi-market retailers
2. Decompose role of expansion and consolidation

Local vs Cross-Market Concentration

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

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- Collocation $< 0.02 \longrightarrow$ National HHI reflects cross-market concentration
- Consumers in different markets shop at the same (multi-market) firms

Expansion vs Consolidation of Multi-Market Retailers

- 350 largest retailers* Nat. share 34→58% while local share 3.2→3.2%
- Hints at expansion over consolidation

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Distinguish expansion and consolidation by fixing market structure

1. Fix the list and rank of active firms in some year t_0
2. Assign sales share of firms in year t according to rank in year t_0
   - If there is net-entry, assign remaining shares to largest new firms
   - If there is net-exit, smaller firms get zero sales

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Counterfactual concentration keeps local HHI unchanged
explains national concentration through consolidation

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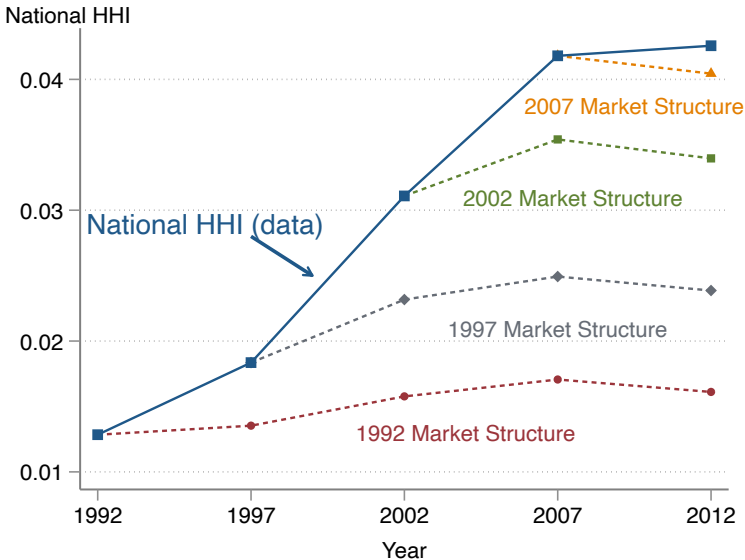


Roadmap

Census Data on U.S. Retailers

Measuring National and Local Concentration

Linking National and Local 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
- Oligopolistic competition model implies 2.1 pp increase details
- Gross margins ↑ 6 pp, 1993-2012, in ARTS

Local concentration accounts for 1/4–1/3 of markups in retail ▸ products

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 the retail sector
  - They rise for different reasons
  - 99% of national concentration is cross market
- Expansion of multi-market retailers links national+local trends
- Higher **local** concentration increased markups 1.6pp (1992-2012)
  - Explains about 1/4 of the rise in markups.

Appendix

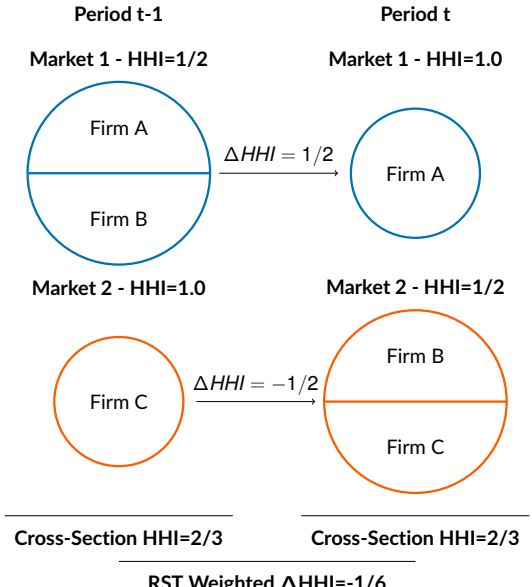
Comparison to RST

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

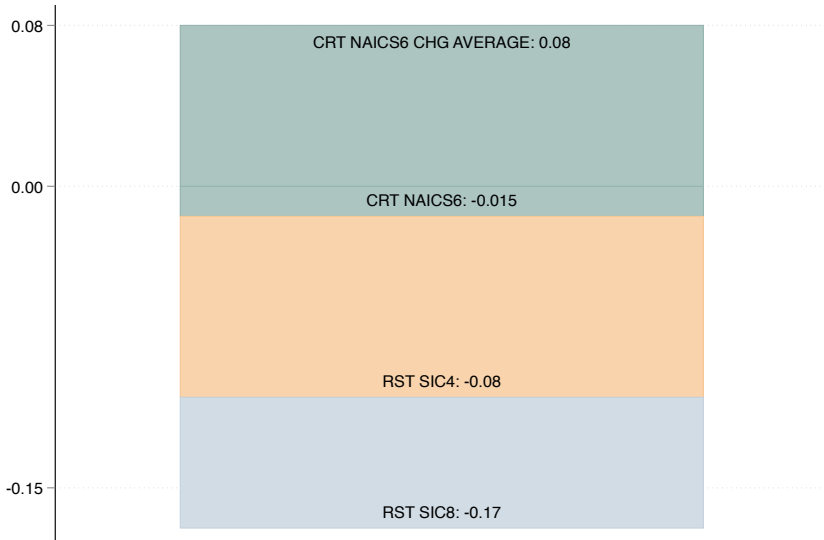
Each difference explains about $1/3$ of discrepancy

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

RST

Zip Code Concentration - End-of-Period Weights				
	Level	Change from 1992		
	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

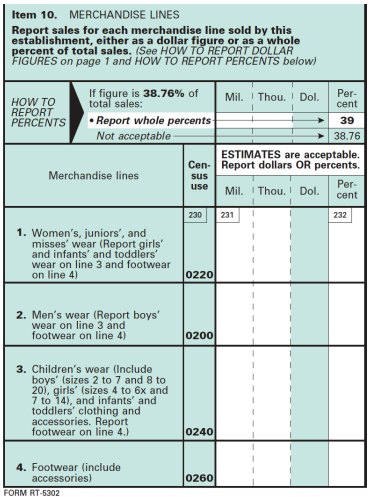
Zip Code Concentration - Current Period Weights				
	Level	Change from 1992		
NAICS-based	0.507	0.022	0.057	0.072
Select NAICS	0.552	0.026	0.067	0.083

Map of Commuting Zones

back

Constructing sales by product category

back



Item 10. MERCHANDISE 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.	Dol.	Per-cent
	• *Report whole percents* →				**39**
	Not acceptable →				38.76

Merchandise lines	Cen-sus use	ESTIMATES are acceptable. Report dollars OR percents. Mil.	Thou.	Dol.	Per-cent
	230	231			232
1. Women's, juniors', and misses' wear (Report girls' and infants' and toddlers' wear on line 3 and footwear on line 4)	**0220**				
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

Back

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

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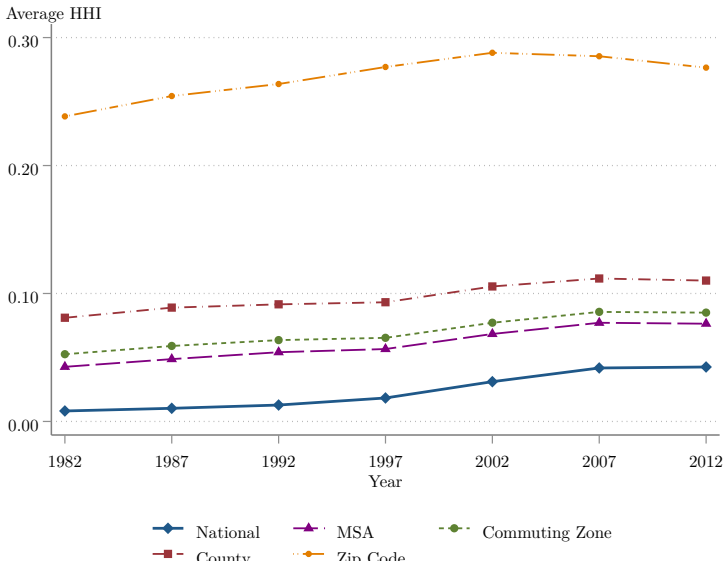

Local Concentration: Top 4 Shares

back

	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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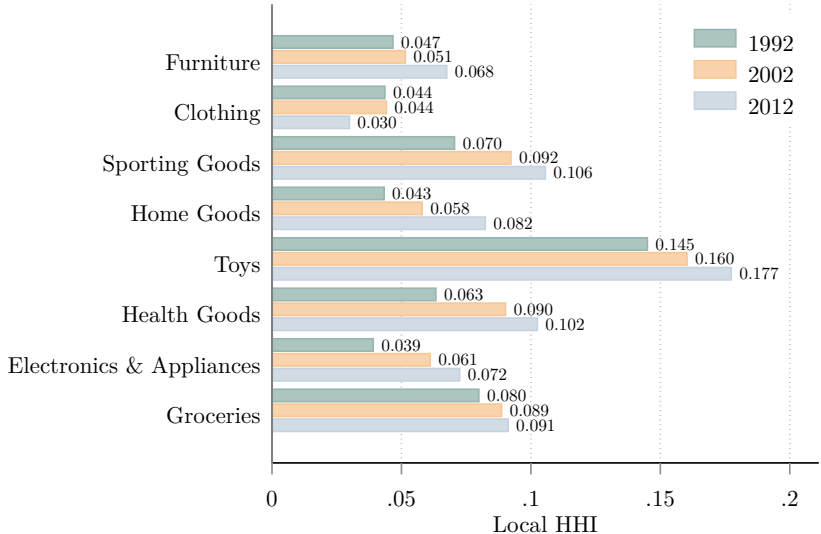

Changes in Concentration Across Locations - I

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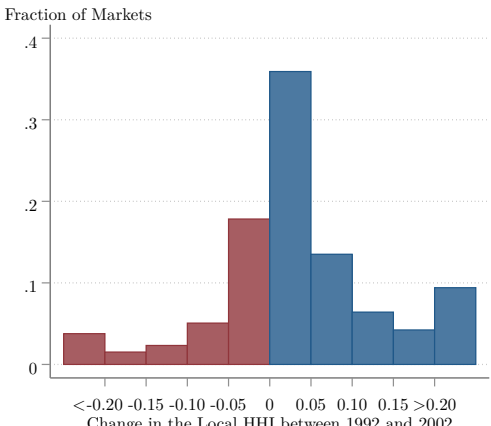

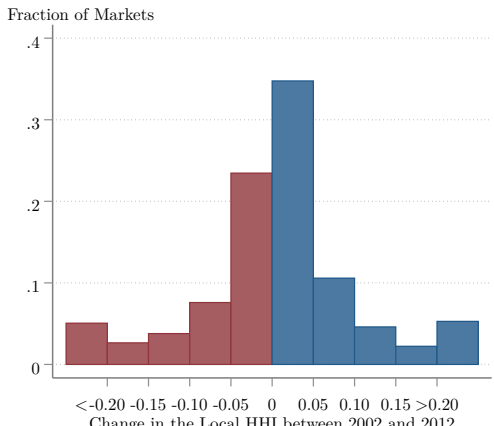

Changes in Concentration Across Locations - II

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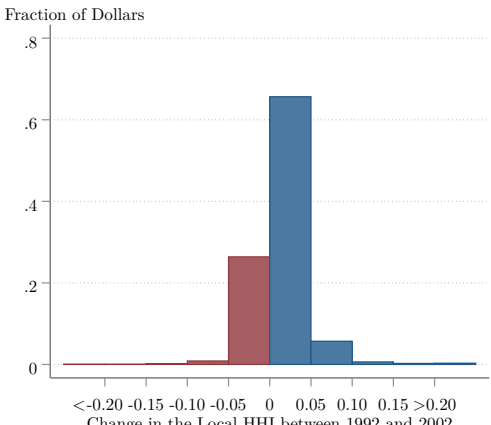

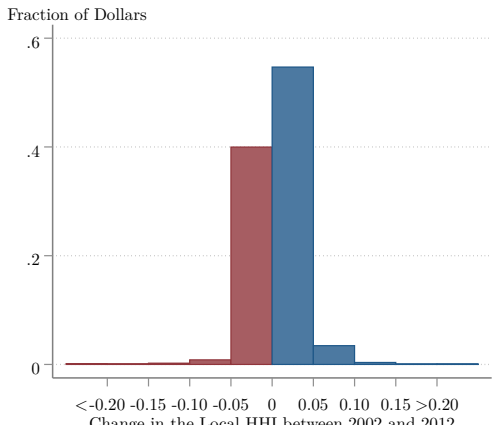

Accounting for Non-Store Retailers

back

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

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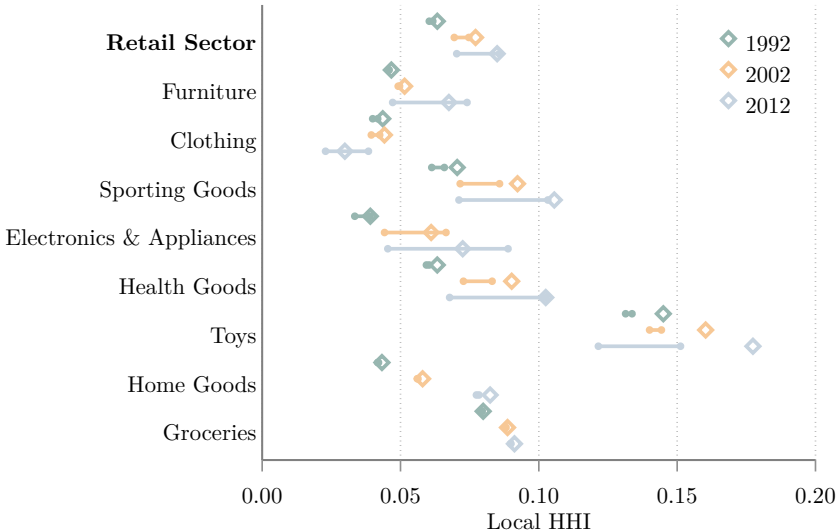
  - Low share in most products (Groceries 1.3%$\rightarrow$0.7%)
  - High share in some products (Electronics and Appliances 7.5%$\rightarrow$20.9%)
- Use national numbers for e-commerce shares to **obtain bounds**
  - Assumption: Online sales proportionally distributed across markets

$$\underbrace{\underline{HHI} = (1 - s_{NS})^2 \, HHI_{BM}}_{\text{Lower Bound: Diluted Sales}} \quad \text{and} \quad \underbrace{\overline{HHI} = (1 - s_{HS})^2 \, HHI_{BM} + s_{NS}^2}_{\text{Upper Bound: Concentrated Sales}}$$

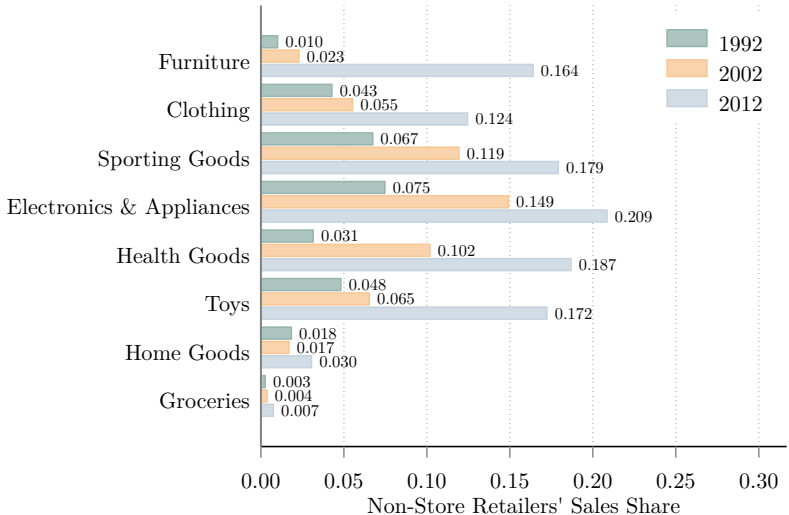
Bounds on Local Concentration

back



Non-Store Retailers Share by Product

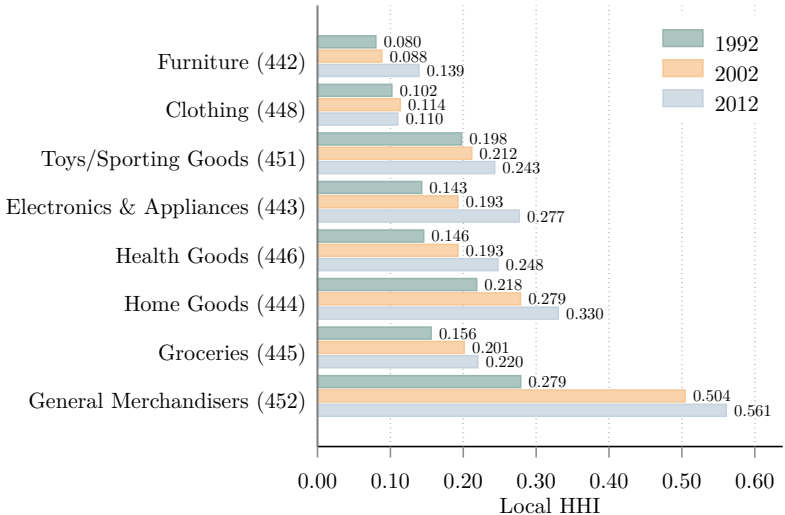
back



Average Industry Concentration

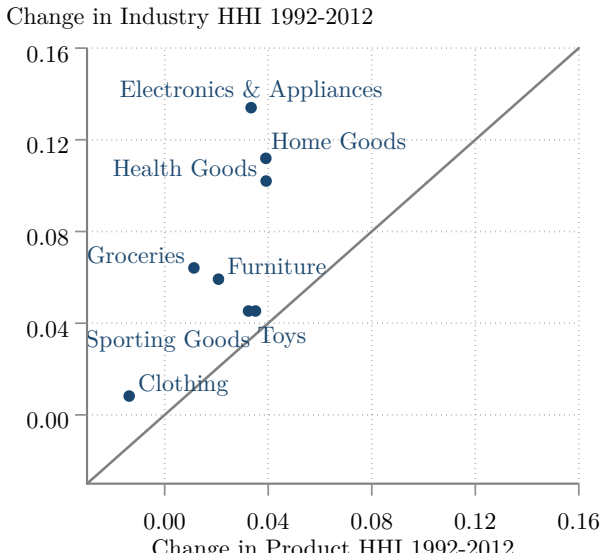
	1992	1997	2002	2007	2012
National Concentration					
Product Based	0.013	0.019	0.031	0.042	0.043
Industry Based	0.029	0.046	0.085	0.105	0.116
Commuting Zone Concentration					
Product Based	0.064	0.066	0.078	0.086	0.086
Industry Based	0.177	0.199	0.263	0.287	0.303
Zip Code Concentration					
Product 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

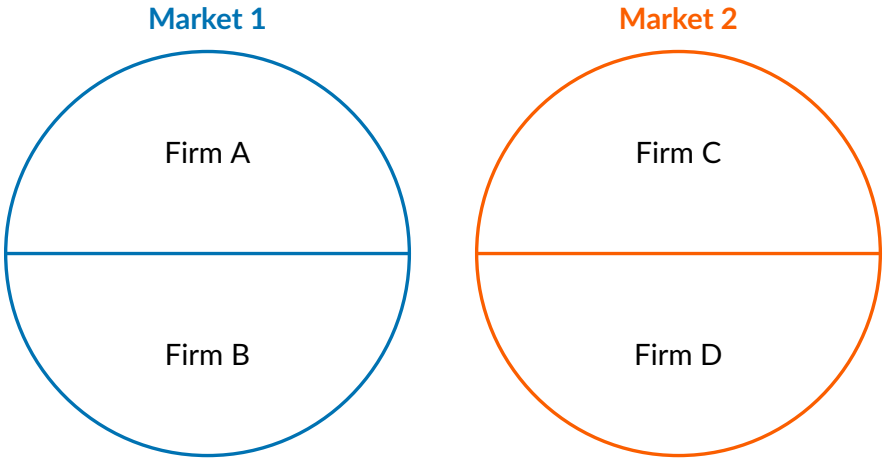


Local Concentration Products vs Industries

back



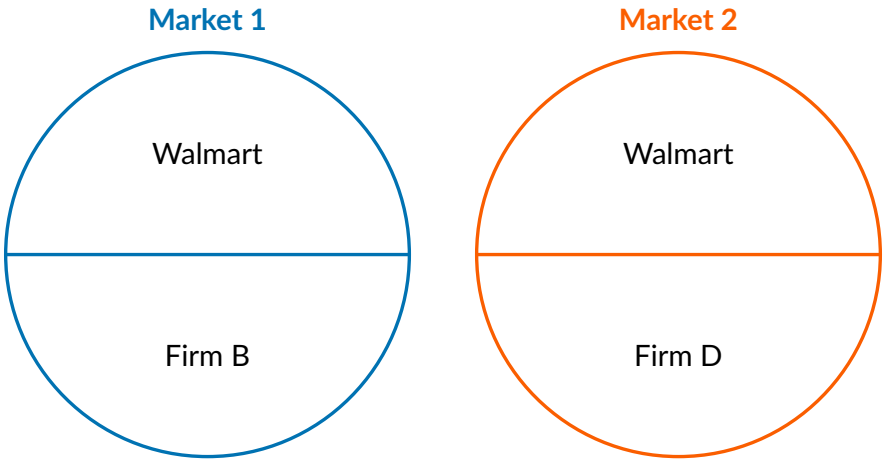
What does national concentration imply about local?



National HHI 0.25
Local HHI 0.50

Scenario 1: Increasing national, local unchanged

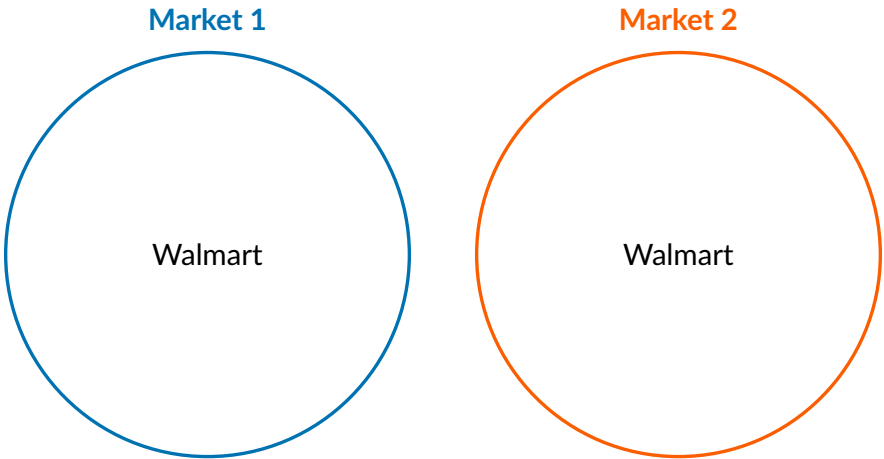
back



National HHI 0.375
Local HHI 0.50

Scenario 2: Increasing national and local

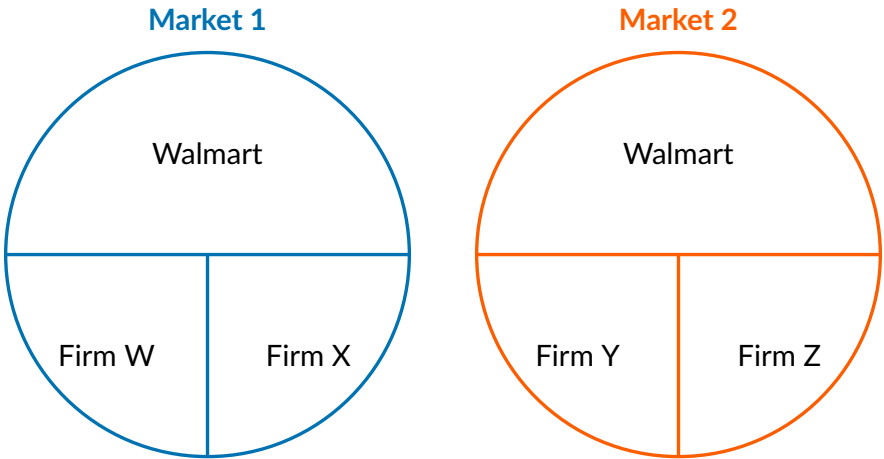
back



National HHI 1.00
Local HHI 1.00

Scenario 3: Increasing national, decreasing local

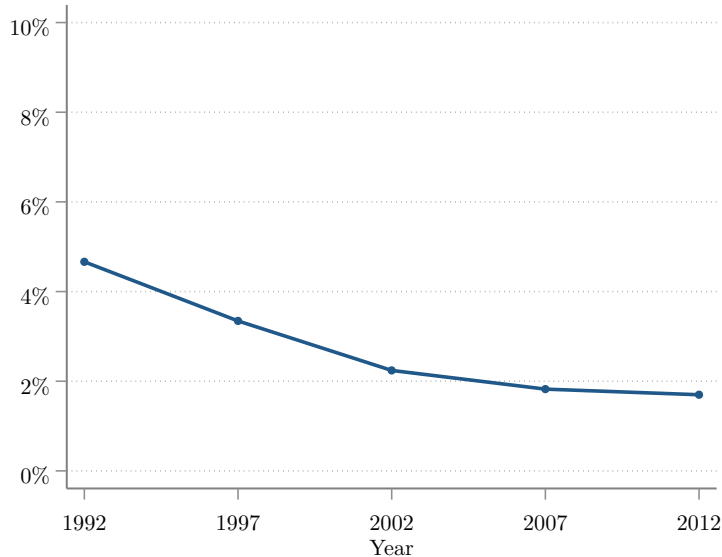
back



National HHI 0.3125
Local HHI 0.375

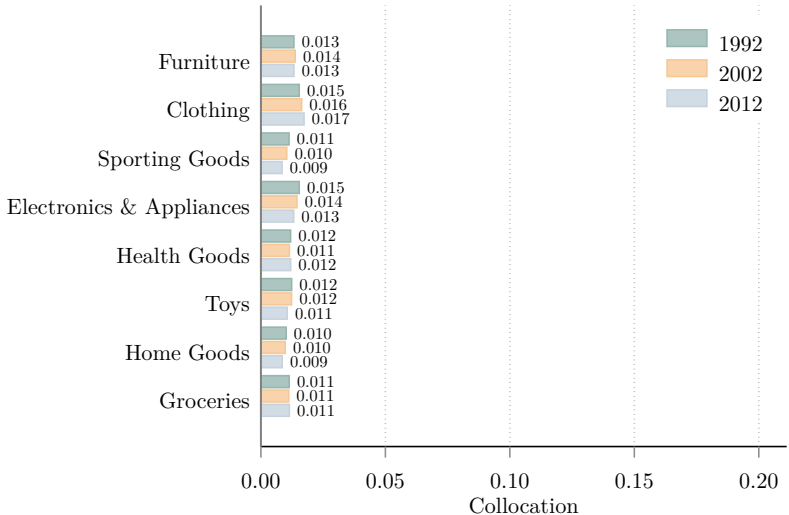
Contribution of Local HHI to National HHI

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

$$\text{Cross HHI} = \sum_m \sum_{n \neq m} s_m s_n \sum_{i=1}^{N} s_i^m s_i^n$$

$$= \sum_m \sum_{n \neq m} s_m s_n \left(\underbrace{\sum_{i \in N_{mn}^{new}} s_i^m s_i^n}_{Entry} + \overbrace{\sum_{i \in N_{mn}^{old}} s_i^m s_i^n}^{Continuers} \right)$$

- 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

Back

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

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

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

- Higher share $\longrightarrow$ Higher markup
- Higher share $\longrightarrow$ Lower prices, Higher productivity

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

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

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 details
  - 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:

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

- Market retail output:

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

- Product output (market m):

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

Functional forms: Demand and prices

back

- Demand for market m and aggregate price p:

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

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

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

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

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

Aggregating markups - I

back

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

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Relationship to **local HHI**:

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

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

Relationship to product's **gross margins**:

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

Matching markups from ARTS

back

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:

$$\mu^j_{GM} = \lambda \cdot \mu^{ARTS}_j$$

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

$$\mu^{ARTS}_{GM} = \sum_j \omega^j_{GM} \mu^j_{GM} = \lambda \sum_j \omega^j_{GM} \cdot \mu^{ARTS}_j$$

4. Compute product markups - Geometric average of markups

$$\mu_j = \left(\frac{1 - \omega^j_{GM}}{\mu^{ARTS}_j} + \frac{\omega^j_{GM}}{\mu^j_{GM}} \right)^{-1}$$

Estimated parameters by product

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Product Category	ε_j 1992	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

Model vs Data: change in markups

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