The Evolution of U.S. Retail Concentration

Dominic Smith — Bureau of Labor Statistics
Sergio Ocampo — Western University

March 4, 2020

Disclaimer: Any opinions and conclusions expressed herein are those of the author 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.

Motivation

Changes in the aggregate structure of retail

- Increasing national concentration
- Growth of Walmart, Target, etc.
- Exit of small firms
- Effect on consumers? (Markups, Market Power, Costs)

Motivation

Changes in the aggregate structure of retail

- Increasing national concentration
- Growth of Walmart, Target, etc.
- Exit of small firms
- Effect on consumers? (Markups, Market Power, Costs)

Retail markets are local

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

This paper

What does the increase in national concentration imply for local markets?

1. Decomposition of National HHI
   - Local HHI
   - Cross Market HHI
2. Measure National and **Local** Retail Concentration
   - Patterns of changes
   - Products, locations
3. What are the effects of increasing local concentration on consumers?
   - Model of prices, markups, costs
   - **Key:** $\uparrow$ Local concentration $\longrightarrow \uparrow$ Markups $\longrightarrow \downarrow$ Passthrough of cost savings

Results

1. National and local concentration measure different concepts
   - National - Consumers in different markets (cross market)
   - Local - Consumers in the same market

2. Both national and local concentration increasing
   - National increases accelerate in late 1990s
   - Local increases steady over 30 years
   - Local increases widespread (products and markets)

3. Effects on consumers
   - Markups increase by 5pp (6 percent)
   - Increased prices by 5 percent*

Literature review

- **National Concentration and Markups** - Autor, Dorn, Katz, Patterson, Van Reenan (2020); Hortascu and Syverson (2015); De Loecker, Eeckhout, Unger (2020); Burstein, Carvalho, Grassi (2019); Atkeson and Burstein (2008)
- **Local Concentration** - Rossi-Hansberg, Sarte, Trachter (2019); Rinz (2018); Lipsius (2018)
- **Importance of big firms** - Decker, Haltiwanger, Jarmin, Miranda (2014); Autor, Dorn, Katz, Patterson, Van Reenan (2020), Cao, Hyatt, Mukoyama, Saeger (2020); Rossi-Hansberg and Tsieh (2019)

What are retailers?

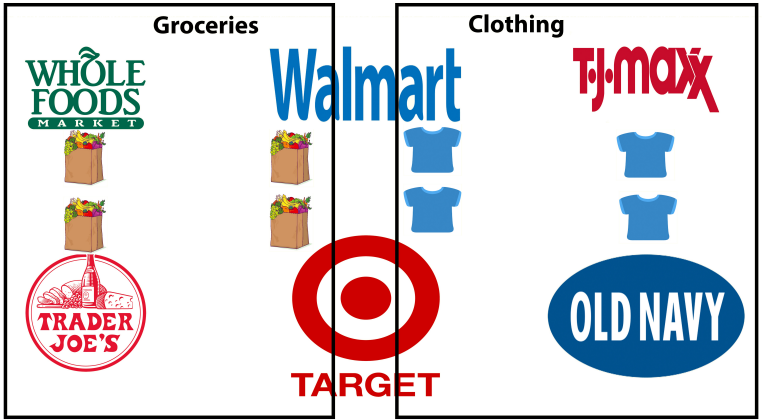
- Sell final goods to consumers
- Perform no transformation of materials
- Not Retailers:
  - Restaurants, Wholesalers (sell to businesses), Services (barber, gym, etc.)
- Excluded Retail Industries:
  - Auto dealers and gasoline stations (ownership issues)
  - Non-store retailers (measurement)

Store-level sales data

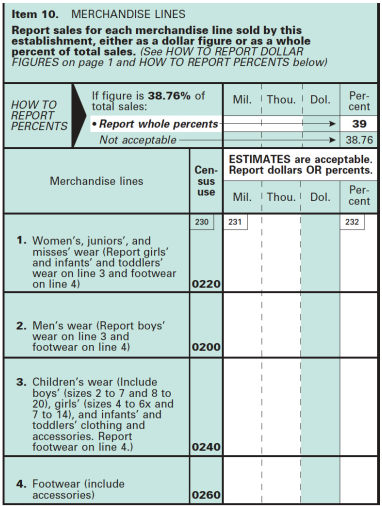
- Census of Retail Trade (CRT)
- 1982-2012 - Years ending in 2 and 7
- Location - Zip Code (aggregate to commuting zone)
- Sales by 20 product categories (clothing, groceries, etc.)

Definition of product markets

Definition of product markets



Constructing sales by product category



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	Mil.	Thou.	Dol.	Percent
If figure is **38.76%** of total sales:				
• *Report whole percents* →				39
Not acceptable →				38.76

Merchandise lines	Census use	ESTIMATES are acceptable. Report dollars OR percents. Mil.	Thou.	Dol.	Percent
		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

Measuring concentration

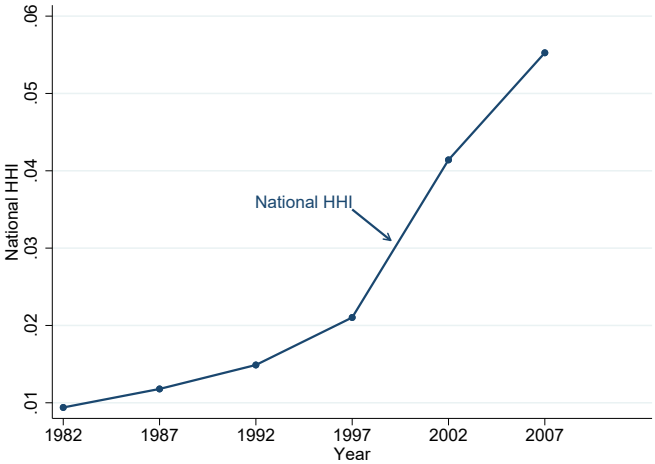
Herfindahl-Hirschman Index

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

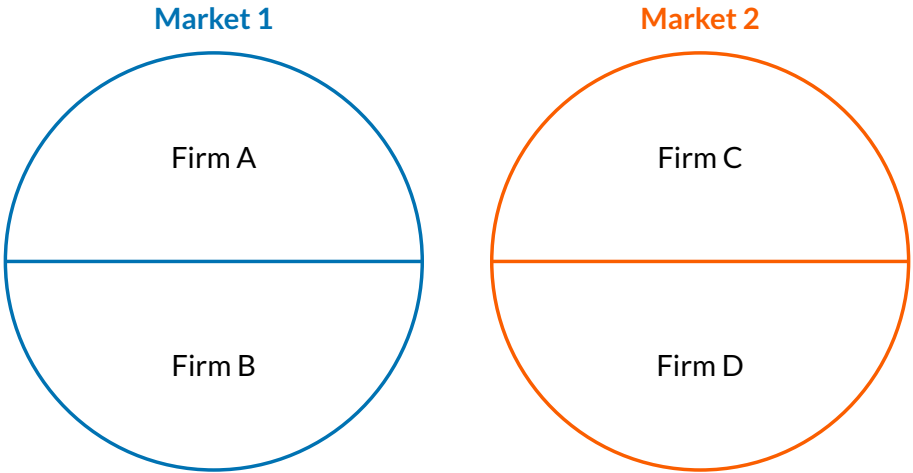
What does the HHI mean?

- Probability two random dollars are spent at the same store

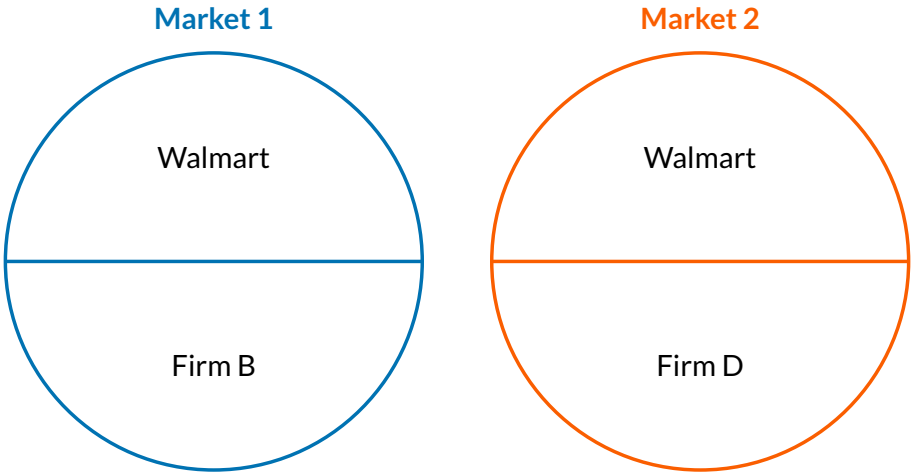
National retail concentration



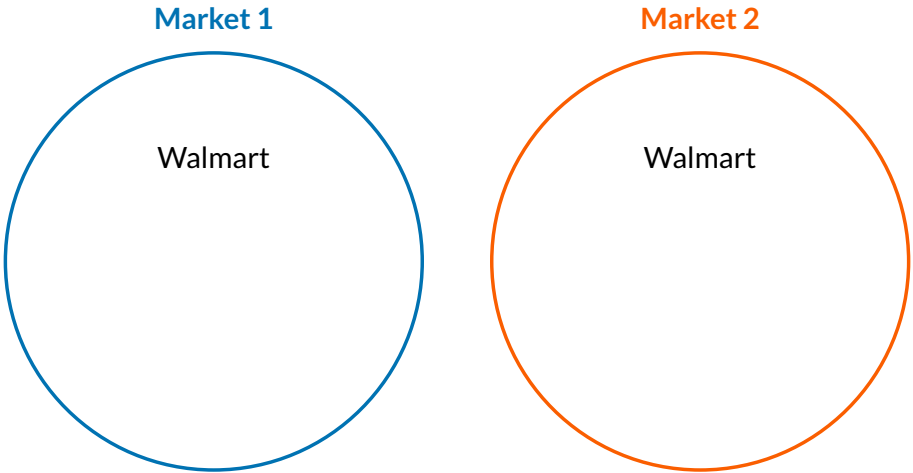
What does national concentration imply about local?



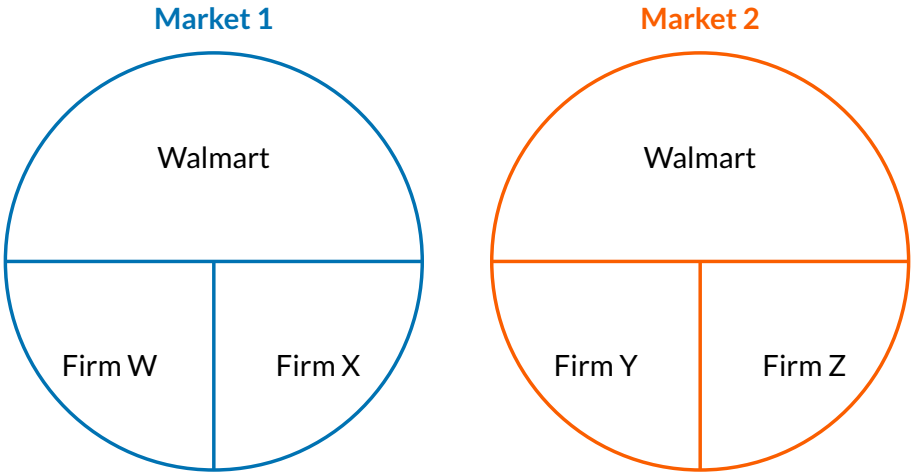
Scenario 1: Increasing national, local unchanged



Scenario 2: Increasing national and local



Scenario 3: Increasing national, decreasing local



National HHI driven by rise of national firms

Consider two random dollars x and y spent at retail firms i_x and i_y:

- What is the probability they are spent at the same firm?

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

- m_x - market of dollar x
- i_x - firm of dollar x

National HHI driven by rise of national firms

Consider two random dollars x and y spent at retail firms i_x and i_y:

- What is the probability they are spent at the same firm?

$$HHI^N = \underbrace{.02}_{\text{Collocation}} \underbrace{P(i_x = i_y | m_x = m_y)}_{\text{Local HHI}} + .98 \underbrace{P(i_x = i_y | m_x \neq m_y)}_{\text{Cross Market}}$$

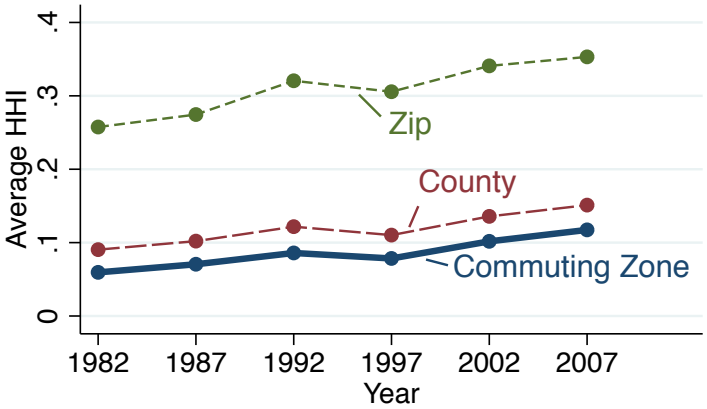
National index contains little information on local concentration

- Collocation term is less that 2 percent

Increase in national HHI reflect increasing cross market concentration

- Consumers in different markets shop at the same firms

Local concentration



- 5-10pp increases
- Steadily increasing
- Robust to geographies
- Comparison to National

Robustness

- E-commerce has small effect through 2012 Details
- Changes widespread: Product categories and geographic areas Details
- Local changes combination of entry and growth Details

What are the consequences of these changes?

- Are the numbers big? (5pp increase in local HHI)
- Market power and markups?
- Consumer welfare
- Key Question:

  Effect of increase in concentration on passthrough of lower costs
- Off-the-shelf model of firm markups

Model of firms' markups

Objective: Model with costs, markups, and prices

- Build on Atkeson & Burstein (2008) model of oligopolistic competition
- Model of retail sector across locations and products
- Parametric demand allows us to infer markups from data on market shares
  - Also gives relative costs and prices

Model of firms' markups

Objective: Model with costs, markups, and prices

- Build on Atkeson & Burstein (2008) model of oligopolistic competition
- Model of retail sector across locations and products
- Parametric demand allows us to infer markups from data on market shares
  - Also gives relative costs and prices
- A market is a location-product pair
  - Labor is immobile across locations
  - Demand implies expenditure share on a market is fixed
  - Market-level markup is function of local HHI

Model structure

- Sales of retail goods across **J** products in **M** locations
  - A product is labeled $\mathbf{j} \in \{\mathbf{1}, \ldots, \mathbf{J}\}$
  - Locations are $\mathbf{m} \in \{\mathbf{1}, \ldots, \mathbf{M}\}$
- Good **j** in location **m** produced by $\mathbf{N_m}$ firms
  - Firms compete in oligopolistic fashion (Bertrand or Cournot pricing)
  - Firm *i* has marginal cost: λ_i^{jm}
  - Marginal cost varies by firms, product, and market

Demand

- Representative consumer has demand in each market
  - Cobb-Douglas across markets $\longrightarrow$ constant expenditure share

Focus: Within market competition

- Product j in location m $\left(y_j^m\right)$:
  - CES aggregate over output y_i^{jm} of firms $i \in \{1, \ldots, N_m\}$
  - Elasticity $\epsilon_j > 1$
  - Finite number of firms implies more productive firms have more market power

Details

Pricing to market: Cournot competition

$$p_i^{jm} = \mu_i^{jm} \lambda_i^{jm} \qquad \mu_i^{jm} = \frac{\epsilon_j}{(\epsilon_j - 1)(1 - s_i^{jm})}$$

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

- Higher share $\longrightarrow$ Higher markup
- Strong implication for prices and productivity
  - Higher share $\longrightarrow$ Lower prices, Higher productivity
- **Key:** inversion from shares to markups and (relative) prices and quantities

Details

Market and product markups

Average markup in a market (m) depends on local HHI

$$\mu_j^m = \frac{\epsilon_j}{\epsilon_j - 1}\left[1 - HHI_j^m\right]^{-1}$$

Market and product markups

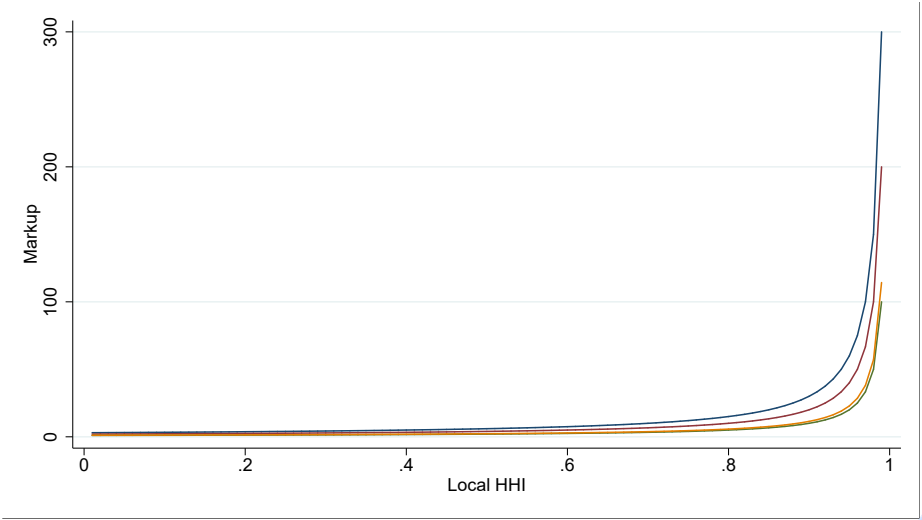
Average markup in a market (m) depends on local HHI

$$\mu_j^m = \frac{\epsilon_j}{\epsilon_j - 1}\left[1 - HHI_j^m\right]^{-1}$$

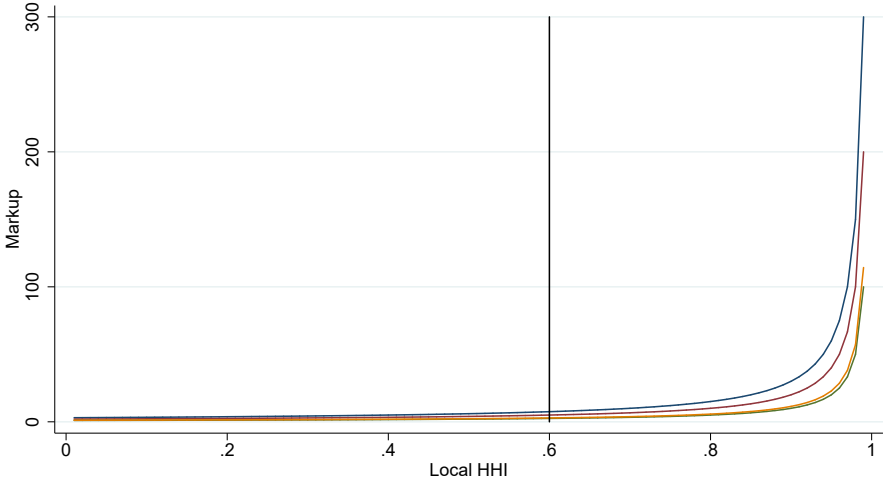
Product j markup depends on product HHI

$$\mu_j = \frac{\epsilon_j}{\epsilon_j - 1}\left[1 - HHI_j\right]^{-1} \qquad \text{where:} \quad HHI_j = \sum_{m=1}^{M} HHI_j^m s_m^j$$

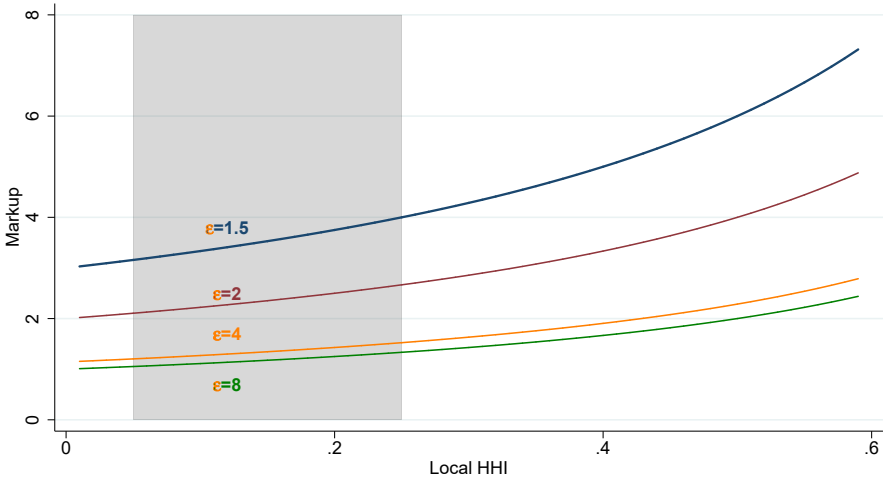
HHI and markups



HHI and markups



HHI and markups



Closing the model: Aggregate demand and labor supply

- Representative household
  - Consumes the aggregate retail basket (Y)
  - Supplies labor in each market (ℓ_m)
    - Labor endowment: Market share of U.S. population

$$u(c, \{\ell_m\}) = c \qquad \text{s.t.} \qquad P \cdot Y = \sum_{m=1}^{M} w_m \cdot \ell_m + \Pi$$

- **Equilibrium:** aggregate demand equal aggregate retail output $\mathbf{c = Y}$

Elastic Labor Supply

Model parameters

Production function:

$$y_i^{jm} = z_i^{jm} \ell_i^{jm}$$

Demand:

- β_m, γ_j^m: Cobb-Douglas aggregator weights
  - Match sales shares in Census of Retail Trade

- ϵ_j: Elasticity of substitution across varieties of product j
  - Match gross margins by industry from ARTS

Markup data

Annual Retail Trade Survey (1993-2018)

- Firm level survey ($\sim$ 80% of retail sales)
- Gross Margin (Sales / COGS)

Issues

- No distribution across markets, firms, product categories
- "Industry" level (General Merchandise example)

Goal: Model results that are consistent with these data

- Product markup equation $\mu_j(\epsilon_j, HHI_j)$
- HHI_j: Average (weighted) HHI for product *j* from CRT
- Data for 2007

Elasticities of demand estimates

Product	ϵ_j
Furniture	2.3
Clothing	2.3
Sporting Goods	2.9
Toys	3.8
Home Goods	4.1
Health	4.5
Electronics & Appliances	4.6
Groceries	4.7

Solving the model

- Sales shares from Census of Retail Trade (firm share in market)
  - Directly imply markups and relative prices and output for each firm
- Level of prices and output implied by normalization
  - Set aggregate price and output to 1: $\mathbf{P = 1}$ $\mathbf{Y = 1}$
- GE step: clear labor market with wages
  - Equilibrium labor and output imply productivity

Key steps:

- Markups: Elasticity of substitution ϵ_j
- Productivity: Normalization of output and labor

What do we learn from the model?

- Distribution of markups and productivity in the U.S.
  - Model fit?
- Main story:
  More concentrated markets $\longrightarrow$ Higher markups
  High markup firms $\longrightarrow$ Higher productivity (all else equal)
- What are the welfare effects of increase in concentration?
  - Entry of productive firm increases concentration/markups, but lowers prices

Comparing model results across years

- In cross section aggregate price normalized to 1
- Comparison across time requires more care
- Solution: Calibrate aggregate price to match CPI
  - CPI-U for each product category between 1992 and 2007
  - Change relative to overall inflation
  - Price of retails goods fell 20 percent relative to CPI-U
- Other changes
  - Labor endowment to match population growth (21%)
  - Output using real GDP for retail (44%)
  - Expenditure shares vary over time

Results: Effect of increasing concentration

Between 1987 and 2007

- Local HHI increased 5 percentage points
- Relative Retail Prices actually fell 20 percent
- Without increase in concentration prices would have fallen 24 percent Details

Model Fit: Markups Over Time

Use calibrated ϵ_j and change in HHI

	ΔMarkup (07-97)		Markups
Product	Data	Model	2007
Furniture			1.85
Clothing			1.81
Sporting Goods			1.67
Toys			1.67
Home Goods			1.51
Health			1.43
Electronics & Appliances			1.39
Groceries			1.41

Model Fit: Markups Over Time

Use calibrated ϵ_j and change in HHI

	ΔMarkup (07-97)		Markups
Product	Data	Model	2007
Furniture	0.04	0.11	1.85
Clothing	0.00	0.10	1.81
Sporting Goods	0.13	0.09	1.67
Toys	0.07	0.09	1.67
Home Goods	0.09	0.12	1.51
Health	0.05	0.03	1.43
Electronics & Appliances	0.13	0.03	1.39
Groceries	0.05	0.06	1.41

Model Fit: Markups Over Time

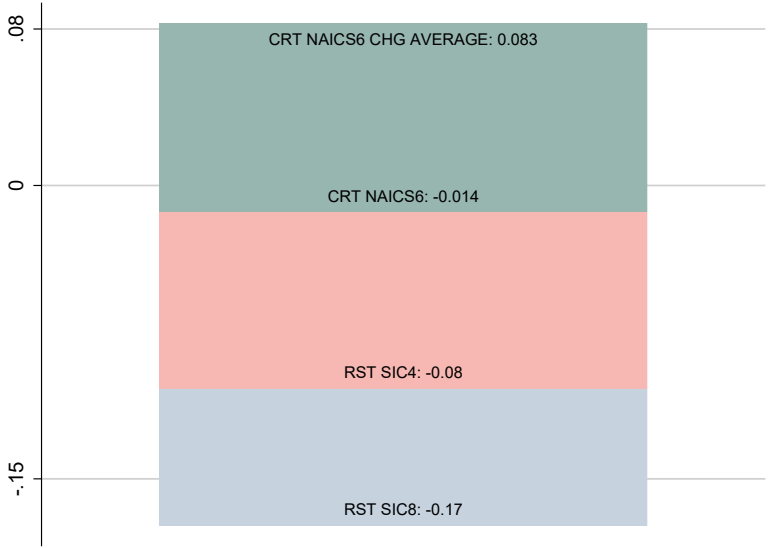
Use calibrated ϵ_j and change in HHI

	ΔMarkup (07-97)		Markups
Product	Data	Model	2007
Furniture	0.04	0.11	1.85
Clothing	0.00	0.10	1.81
Sporting Goods	0.13	0.09	1.67
Toys	0.07	0.09	1.67
Home Goods	0.09	0.12	1.51
Health	0.05	0.03	1.43
Electronics & Appliances	0.13	0.03	1.39
Groceries	0.05	0.06	1.41

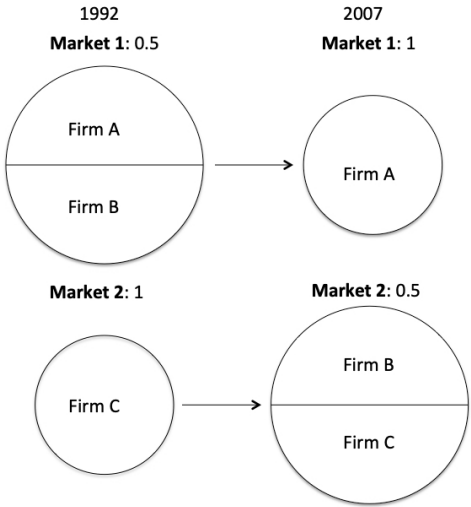
Conclusion

- Both local and national concentration rising the retail sector
- Local concentration has increased markups by 5pp
- Increased prices by 5 percent*
- Future Work
  - Why are costs falling?
  - Discipline with data on gross margins
  - Distributional impacts

Comparison to RST



Weighting Comparison



Me: 1*1/3 + 0.5 * 2/3 − (0.5*2/3 + 1*1/3) = 0
RST: (1-0.5)*1/3 + (0.5-1)*2/3 = -0.169

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

Takeaways

- Half of the difference is data
  - Census data gold standard
- Other half weighting
  - RST methodology weights markets with decreasing concentration more
- Local retail markets different than other sectors

Back

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
Product-based	0.015	0.006	0.027	0.040

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
Product-based	0.321	-0.015	0.020	0.033

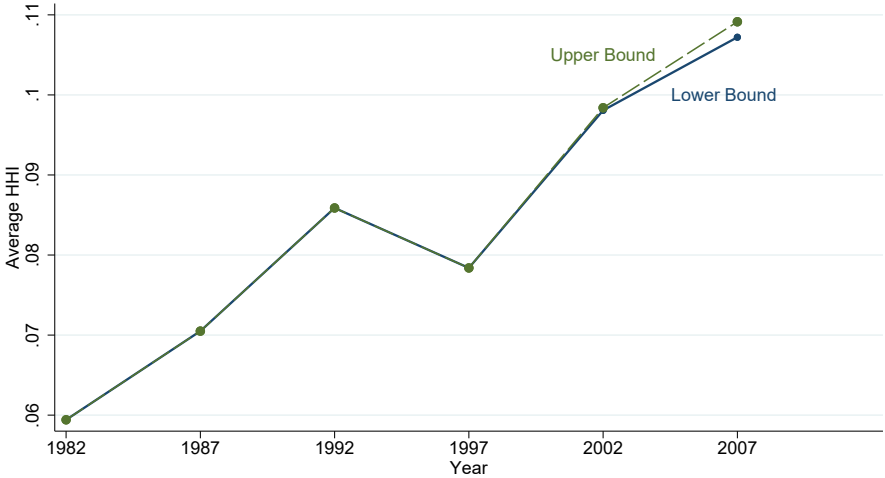
Top 4 share

	1982	1987	1992	1997	2002	2007
Czone	2.7	4.4	5.8	7.9	11.5	15.1
Zip	5.2	8.3	10.3	14.2	18.7	23.2

Online sales

- Historically online sales are low for most product categories
  - Moderately important by 2012, very important by 2017
- Use numbers from Hortascu and Syverson (2015) for bounds
  - Assumption: Online sales proportionally distributed across markets
- E-commerce: 1% of retail sales in 1998, 5% in 2013
  - 80% of music, 23% of Electronics, 1% of Groceries (2013)

Bounds on local concentration

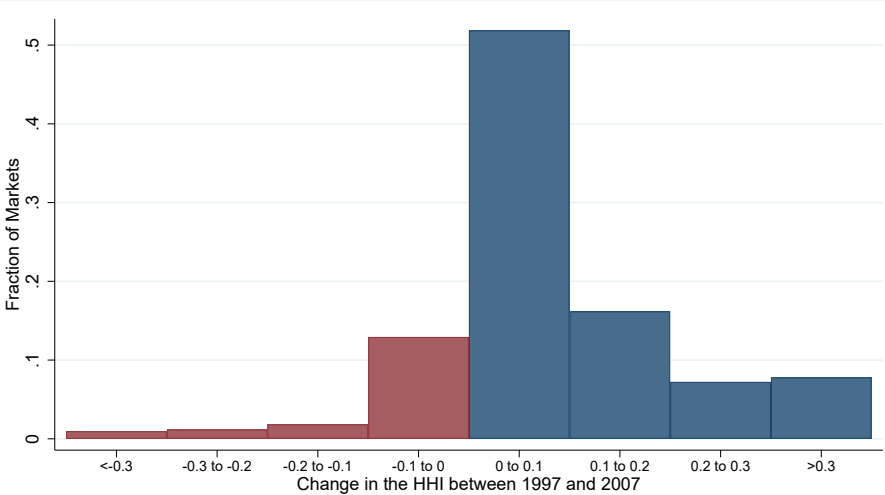


Back

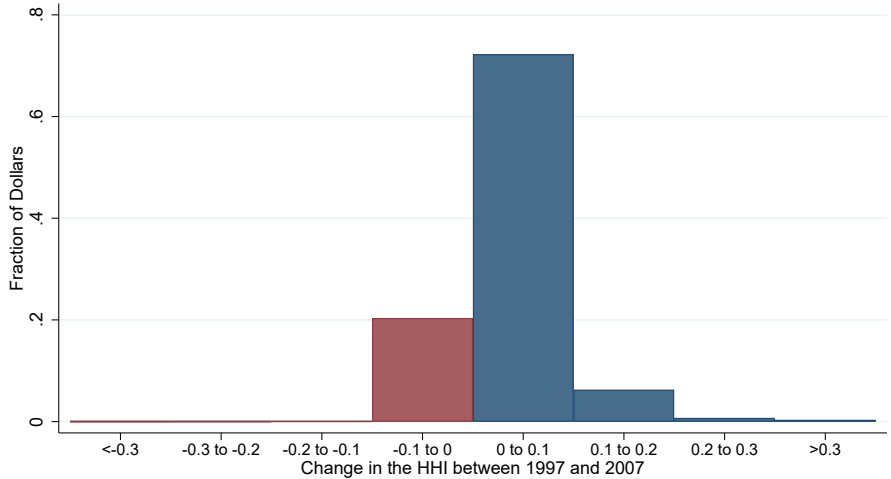
Digging Deeper

- What does the distribution of changes look like?
- What is driving changes in concentration?

Distribution of Changes in Concentration - Unweighted



Distribution of Changes in Concentration - Weighted



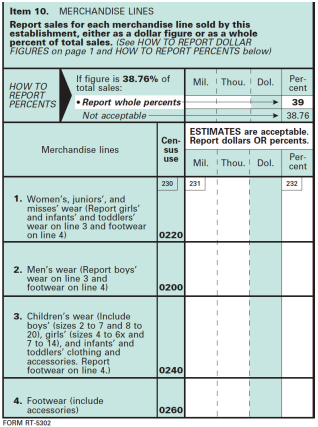
Back

Map of Commuting Zones

Back

Imputing Data

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



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

Stores accounting for 20% of sales do not receive the form

Imputing Data

1. Collection with Census of Retail Trade (every 5 years)
2. Aggregation to departments
   - Goal: Aggregate so industries primarily sell one department

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

Imputing Data

1. Collection with Census of Retail Trade (every 5 years)
2. Aggregation to departments
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

Back

Decomposition Equation - Local HHI

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

- 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

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

- 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:

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

Shares inversion details

Markups

- Inversion is immediate from optimal markup rule given type of competition
- Solve with either Cournot or Bertrand competition

Prices and quantities:

- Recall the demand for firm *i*'s output of product *j* in market *m*:

$$y_i^{jm} = \left(\frac{p_i^{jm}}{p_j^m}\right)^{-\epsilon} y_j^m$$

- Manipulating gives shares as:

$$s_i^{jm} \equiv \frac{p_i^{jm} y_i^{jm}}{p_j^m y_j^m} = \left(\frac{p_i^{jm}}{p_j^m}\right)^{1-\epsilon} = \left(\frac{y_i^{jm}}{y_j^m}\right)^{\frac{\epsilon-1}{\epsilon}}$$

Elastic Labor Supply

$$u\left(c,\{\ell_m\}\right)=\frac{c^{1-\sigma}}{1-\sigma}-\sum_{m=1}^{M}\chi_m\frac{\left(\ell_m\right)^{1+\frac{1}{\phi}}}{1+\frac{1}{\phi}} \qquad \text{s.t.} \quad P\cdot Y=\sum_{m=1}^{M}w_m\cdot\ell_m$$

back

Markup Change Details

Product	ϵ_j	HHI_{1987}	HHI_{2007}	μ_{1987}	μ_{2007}
Furniture	2.3	0.05	0.07	1.82	1.85
Clothing	2.3	0.05	0.05	1.81	1.81
Sporting Goods	2.9	0.11	0.15	1.61	1.67
Toys	3.8	0.07	0.20	1.44	1.67
Home Goods	4.1	0.07	0.11	1.44	1.51
Health	4.5	0.07	0.12	1.35	1.43
Electronics & Appliances	4.6	0.05	0.13	1.27	1.39
Groceries	4.7	0.09	0.15	1.33	1.41

Back

Price Change Details

- Back out costs from price and markup data in 2007:
  - $p_{07} = \mu_{07} \cdot \lambda_{07} \longrightarrow 0.80 = 1.52 \cdot \hat{\lambda}_{07}$
  - $\hat{\lambda}_{07} = 0.53$
- Prices with 1987 level of concentration:
  - $\hat{p}_{07} = \mu_{97} \cdot \hat{\lambda}_{07} = 1.43 \cdot 0.53 = 0.76$
- Price 5 percent lower with lower level of concentration

Back