Entry in supermarkets and retail

Paul Schrimpf

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1. Bronnenberg, Dhar, and Dubé (2009)
2. Ellickson (2007)
3. Jia (2008)

Section 1

Bronnenberg, Dhar, and Dubé (2009)

Bronnenberg, Dhar, and Dubé (2009)

- Style of paper: document interesting pattern in data that has not been highlighted before
- Looks at market shares of brands of consumer packaged goods (CPG) across markets and time
  - CPG = beer, coffee, ketchup, etc.
- Results
  - Market shares variable across geographic markets, but persistent over time within each market
  - Market shares spatially correlated
  - Spatial market shares strongly correlated with first mover advantage
    - e.g. Miller (founded in Milwaukee) most popular beer in Milwaukee, Budweiser (founded in St. Louis) most popular beer in St. Louis

Data

- Market shares from AC Nielsen scanner data
  - This type of data has been used very frequently in IO during the last decade
  - AC Nielsen distributes bar code scanners to a sample of consumers, consumers record every purchase by scanning bar codes
  - 4-week intervals, June 1992-May 1995
- $\text{Share}_{icmt} = \frac{\text{Sales}_{icmt}}{\sum_i \text{Sales}_{icmt}}$
- $\text{Share}_{icm} = \frac{\text{Sales}_{icmt}}{\sum_t \sum_i \text{Sales}_{icmt}}$

TABLE 1
STRUCTURE OF THE MAIN DATA SET

Industry groupings	Bread and bakery, candy and gum, dairy products, frozen entrees and side dishes, frozen and refrigerated desserts, nonalcoholic beverages, packaged dry groceries, processed canned and bottled foods, refrigerated meats*
Markets	Albany, Atlanta, Baltimore, Birmingham, Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Columbus, Dallas, Denver, Detroit, Des Moines, Grand Rapids, Harrisburg, Houston, Indianapolis, Jacksonville, Kansas City, Los Angeles, Louisville, Little Rock, Memphis, Miami, Milwaukee, Minneapolis, Nashville, New Orleans/Mobile, New York, Oklahoma City/Tulsa, Omaha, Orlando, Philadelphia, Phoenix, Pittsburgh, Portland, Raleigh/Durham, Richmond/Norfolk, Sacramento, San Antonio, San Diego, Seattle, San Francisco, St. Louis, Syracuse, Tampa, Washington
Retailers	A & P, ABCO, ACME, Albertsons, Almac's, AWG, Big Bear, BiLo, Bruno's, Del Champs, Demoulas Market Basket, Dominick's, Eagle Food Centers, Farm Fresh, Farmer Jack, Fiesta Mart Inc., Food4Less, Food Lion, Food Mart, Fred Meyer, Gerland's, Giant, Giant Eagle, Grand Union, Great American, H.E.B., Harris Teeter, Harvest Foods, Homeland Food Stores, Hughes Market, Hy Vee Foods, Jewel Food Stores, Kash N Karry, King Soopers, Kohl's, Kroger, Lucky, Lucky Stores, Minyard Food Stores, National, Omni, P&C, Pathmark, Publix, Purity Markets, Raley's, Ralphs, Randall's, Riser Foods Inc., Safeway, Save Mart, Schnuck's, Schwegmann, Sentry Markets, Shaw's, Shoprite, Smith's Food and Drug Centers, Smitty's, Star Market, Stop and Shop, Super Fresh, Tom Thumb, Tops Markets, Vons, Waldbaum's, Wegman's Food Markets, Winn Dixie

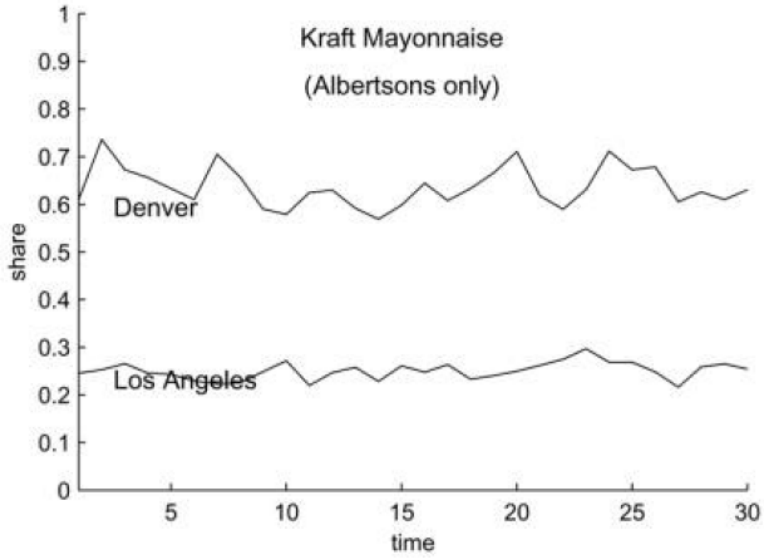
TABLE 2

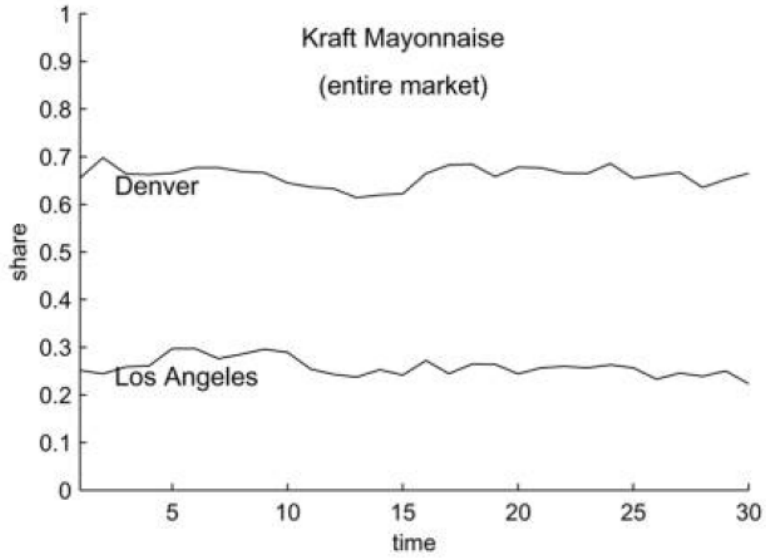
AVERAGE DESCRIPTIVE STATISTICS BY BRAND ACROSS GEOGRAPHIC MARKETS

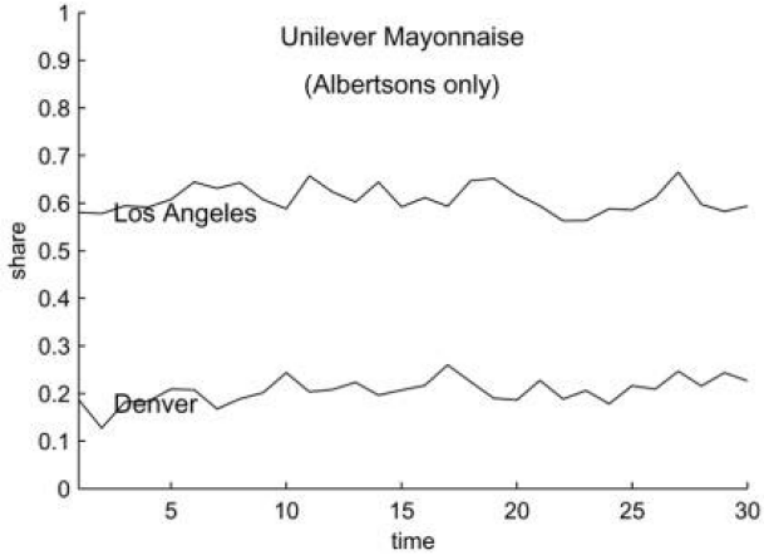
Industry	Brand	Share	Perceived Quality	Promotion*	Minimum Distance†
Beer	Budweiser	.267	21.037	.552	.219
Beer	Miller	.149	15.169	.501	.295
Coffee	Folgers	.310	26.170	.343	.704
Coffee	Maxwell House	.256	21.874	.407	.571
Coffee	Hills Bros.	.059	15.623	.510	.578
Ketchup	Heinz	.432	35.831	.464	.399
Mayonnaise	Kraft	.497	37.080	.328	.714
Mayonnaise	Unilever	.292	29.982	.264	.738
Soft drinks	Coca-Cola	.273	33.794	.630	.286
Soft drinks	Pepsi-Cola	.223	27.610	.633	2.115
Soft drinks	Dr Pepper	.062	21.722	.271	.499
Yogurt	Dannon	.307	23.484	.215	.427
Yogurt	Yoplait	.162	22.685	.209	.587

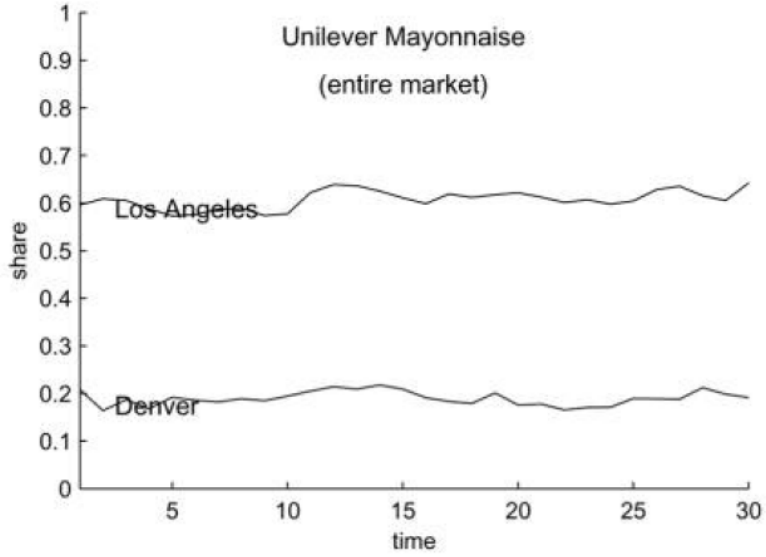
* Promotion is the percentage of sales volume sold on promotion.

† Minimum distance is the average distance to the closest manufacturing facility in 1,000 miles.


Kraft Mayonnaise
(Albertsons only)
Denver
Los Angeles
share
time


Kraft Mayonnaise
(entire market)
Denver
Los Angeles
share
time


Unilever Mayonnaise
(Albertsons only)
Los Angeles
Denver
share
time


Unilever Mayonnaise
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time

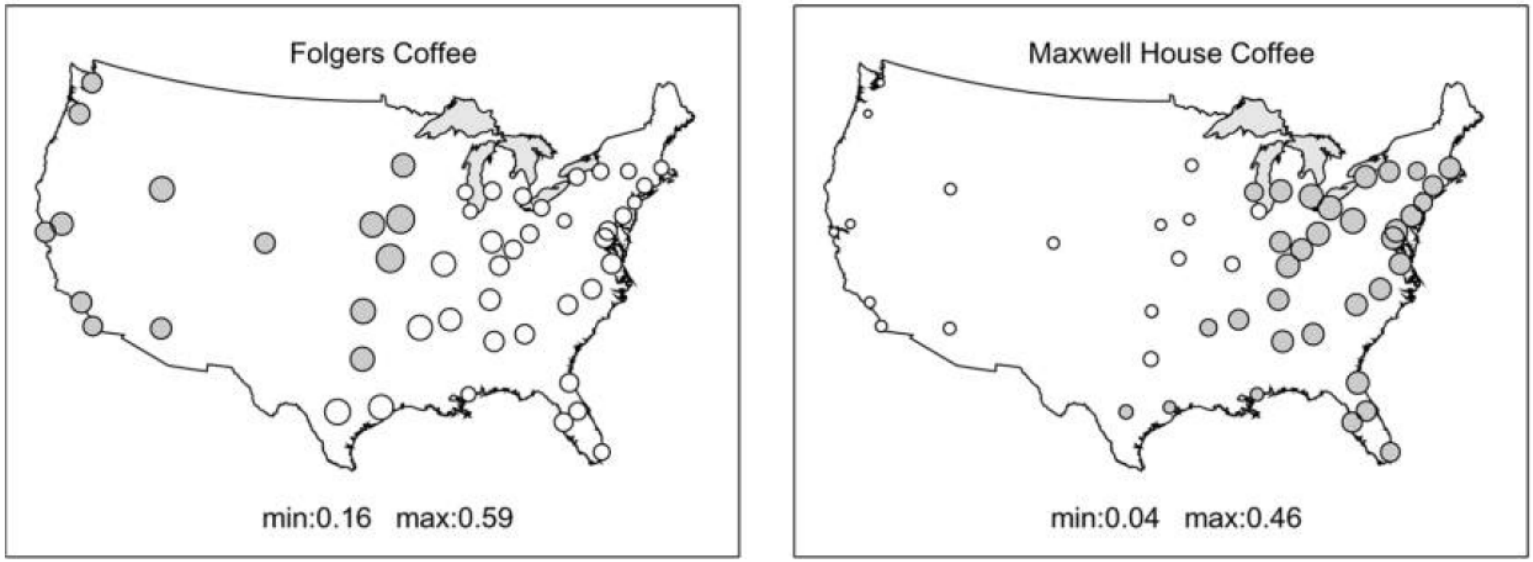


FIG. 2.—The joint geographic distribution of share levels and early entry across U.S. markets in ground coffee. The areas of the circles are proportional to share levels. Shaded circles indicate that a brand locally moved first.

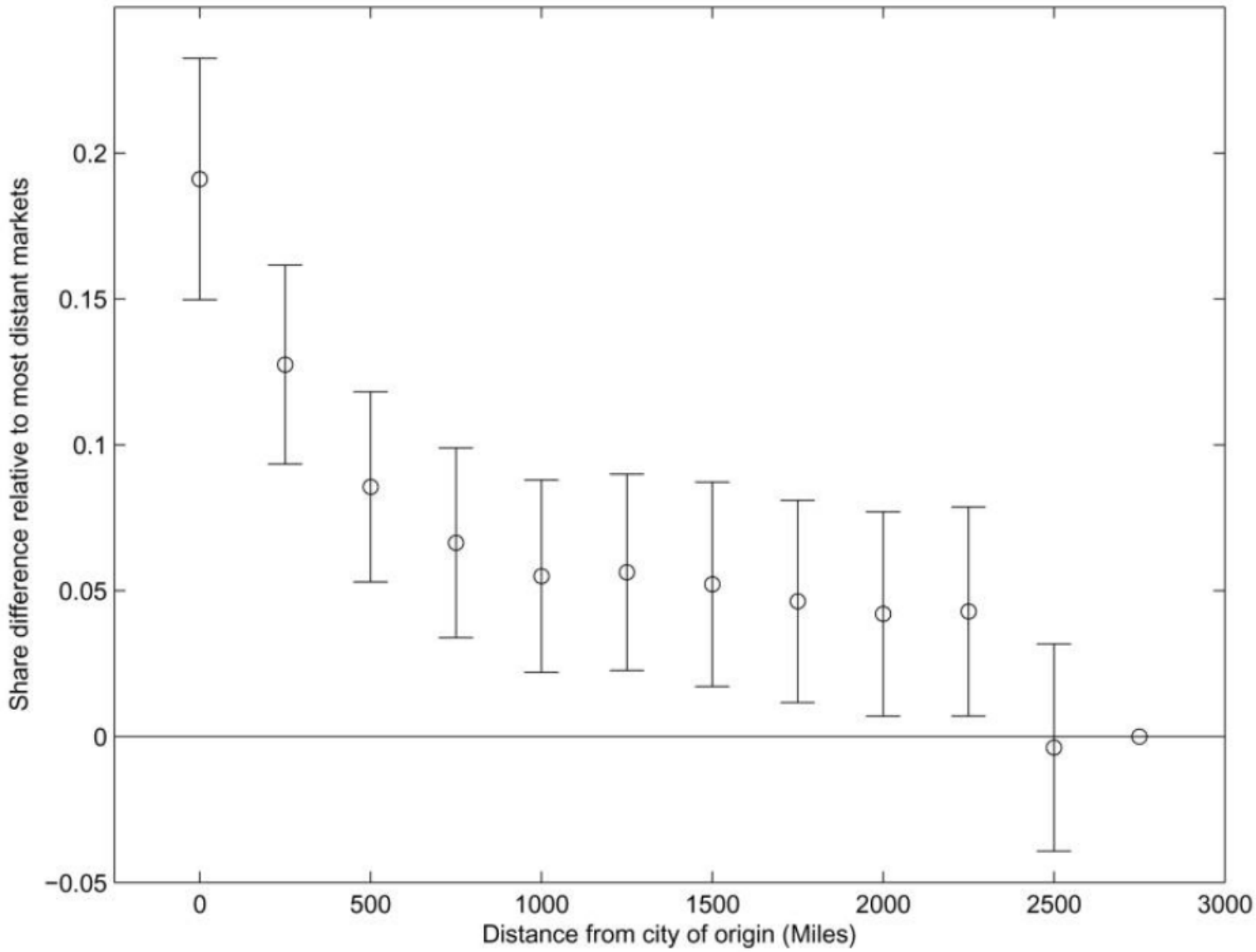


FIG. 3.—Effect of distance from city of origin on market share (net of brand-specific fixed effects). Whiskers indicate 95 percent confidence intervals.

Variable	Entry Effect (1)	Brand Effects (2)	Entry and Brand Effects (3)
Beer ($N = 94$):			
Intercept	.141 (.010)	.149 (.011)	.139 (.011)
Budweiser		.118 (.016)	.020 (.026)
Miller			
Early entry	.134 (.014)		.117 (.026)
R^2	.483	.372	.487
Coffee ($N = 150$):			
Intercept	.139 (.011)	.059 (.014)	.052 (.011)
Folgers		.251 (.020)	.206 (.015)
Maxwell House		.197 (.020)	.088 (.018)
Hills Bros.			
Early entry	.208 (.019)		.175 (.015)
R^2	.440	.533	.755
Ketchup ($N = 50$):			
Intercept			.388 (.019)
Heinz			
Early entry			.072 (.025)
R^2			.149

Conclusions

- Possible explanations:
  - Endogenous sunk costs (Sutton, 1991): early entrant invests in advertising (or something else that increases vertical quality), which creates high fixed cost of subsequent entry
  - Brand preference inertia
- Future research:
  - When can persistence be broken?

Section 2

Ellickson (2007)

Ellickson (2007) 1

- Style of paper: (1) theoretic model with stylized predictions (2) empirical evidence supporting stylized predictions
- Model: endogenous fixed costs (Sutton, 1991) adapted to supermarkets
  - Vertical quality = variety of products
  - Firms with low vertical quality cannot survive
  - As market grows, existing firms increase quality, which requires larger stores and more sophisticated distribution (fixed costs)
  - Non fragmentation: Higher fixed costs in larger markets means number of firms does not increase with market size
  - Fragmentation: if fixed costs were constant more firms would enter larger markets and market share of each firm would decline
- Empirical results:

Ellickson (2007) 2

- 4-6 supermarkets capture most market share regardless of market size
- Industry without fixed costs related to vertical quality (barber shops and beauty salons) have shares of each firm declining with market size

Model 1

- Consumer utility:

$$u(\underbrace{x_1}_{\text{other goods}}, \underbrace{x_2}_{\text{groceries}}, \underbrace{z}_{\text{quality}}) = (1-\alpha)\log(x_1) + \alpha\log(zx_2)$$

- Supermarket costs function:

$$C(p_L, w, p_g; q_j, z_j) = p_L\sigma + \frac{\lambda p_L}{\gamma}(z_j^\gamma - 1) + \underbrace{c}_{=\phi_1 w + \phi_2 p_g + \phi_3 p_L} q_j$$

quantity q_j, quality z_j, prices p_L (land), w (labor), p_g (inputs), and parameters σ, λ, γ

Model 2

- Shephard's lemma

$$h_L(p_L, w, p_g; q_j, z_j) = \frac{\partial C}{\partial p_L}$$
$$= \sigma + \frac{\lambda}{\gamma}(z_j^\gamma - 1) + \phi_3 q_j$$

- Equilibrium: simultaneous move, symmetric information
  1. Choose to enter at cost $p_L \sigma$
  2. Choose quality at cost $\frac{\lambda p_L}{\gamma}(z_j^\gamma - 1)$
  3. Choose q_j in Cournot competition
- Solving backward
  3. $q = \frac{N-1}{N^2}\frac{S}{c}$ and $p(z) = \frac{N}{N-1}c$
     - N = number of firms, S = market size
  2. $z = \left(\frac{2S(N-1)^2}{N^3 \lambda p_L}\right)^{1/\gamma}$

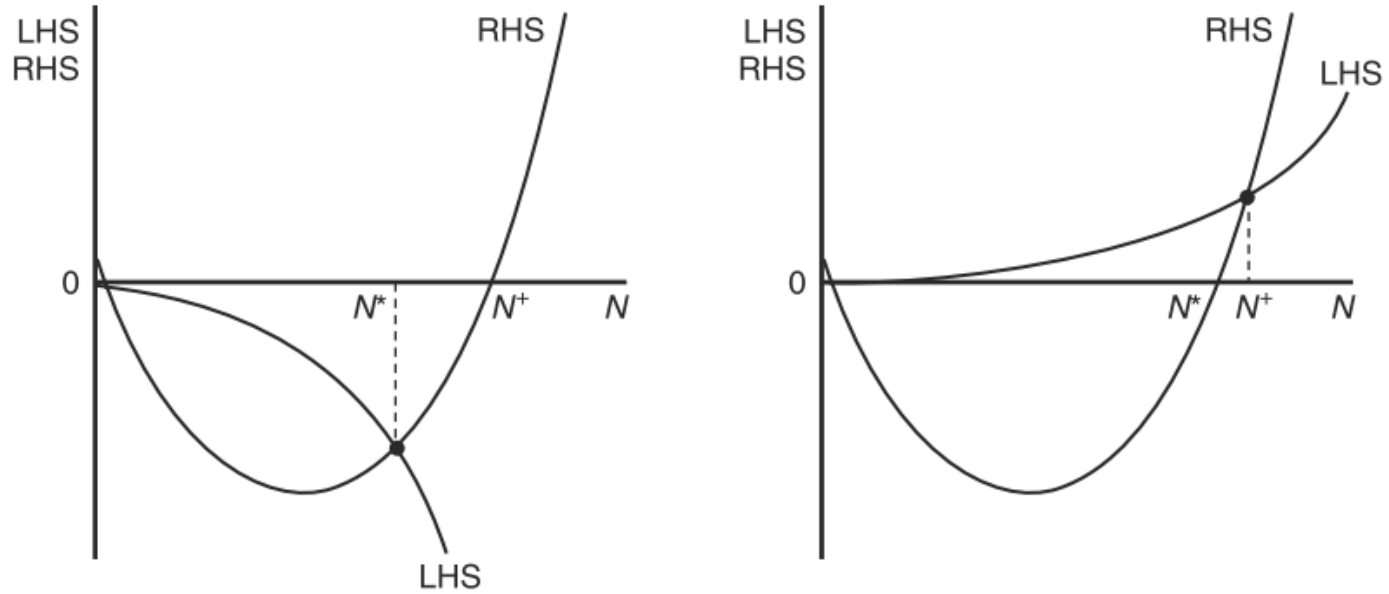
Model 3

1 $\left(\frac{p_L(\lambda-\gamma\sigma)}{S}\right) N^3 = 2N^2 - (4+\gamma)N + 2$

Equilibrium N

FIGURE 1

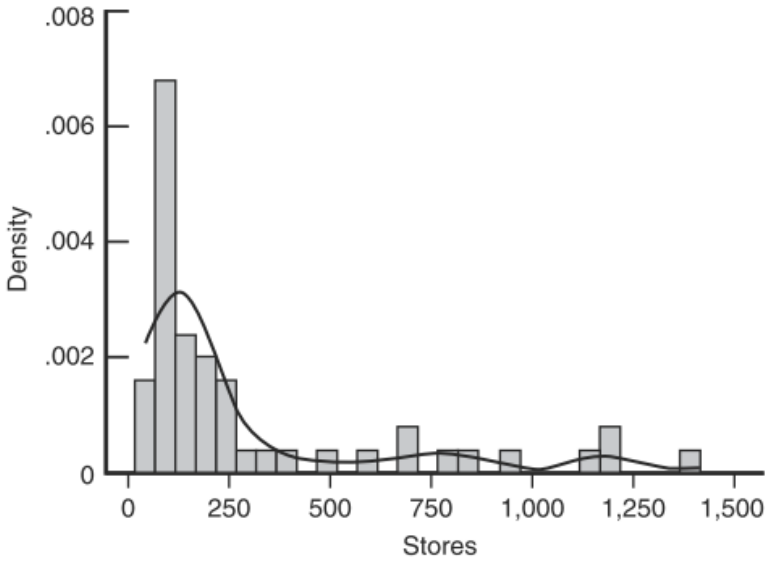
EQUILIBRIUM NUMBER OF ENTRANTS



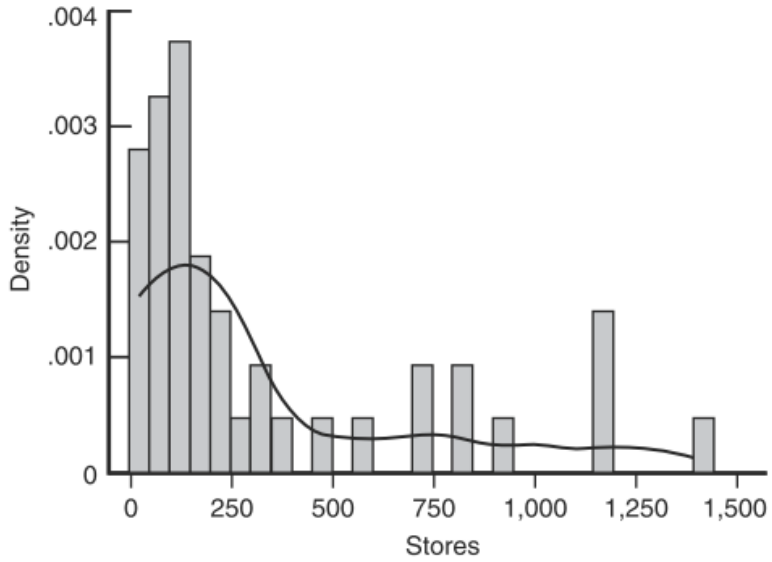
Equilibrium N comparative statics

1. "If $\lambda - \gamma\sigma < 0$, then the left-hand side has a concave graph and lies below the horizontal axis. As shown on the left side of Figure 1, the equilibrium number of firms N^* lies in the interval $(0, N^+)$. Because the slope of the left-hand side decreases (in absolute value) as S increases, the equilibrium number of firms increases as market size increases. This effect can be offset to a greater or lesser extent by an increase in the price of land as market size expands."
2. "If $\lambda - \gamma\sigma > 0$, then the left-hand side has a convex graph and lies above the horizontal axis. Because the slope of the left-hand side decreases as S increases, this case has the somewhat counterintuitive implication that the equilibrium number of firms will decrease as market sizes expand, an effect that will be reinforced if land prices also increase."

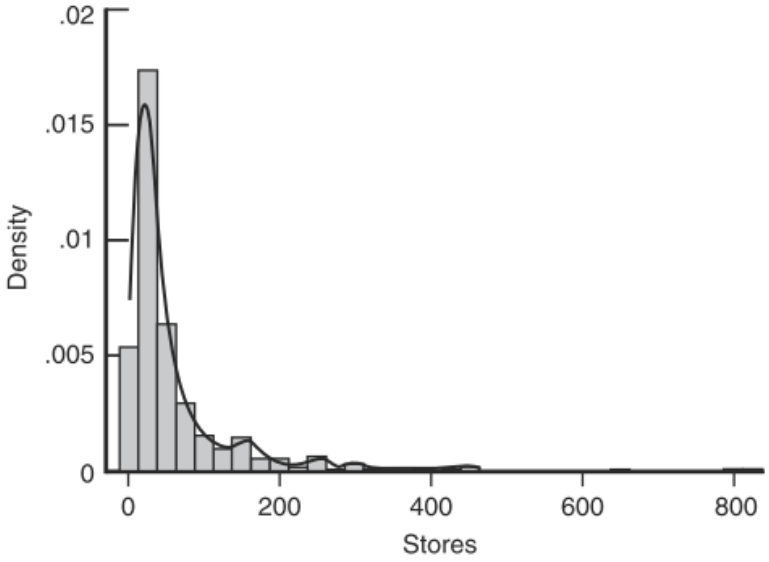
Market definition



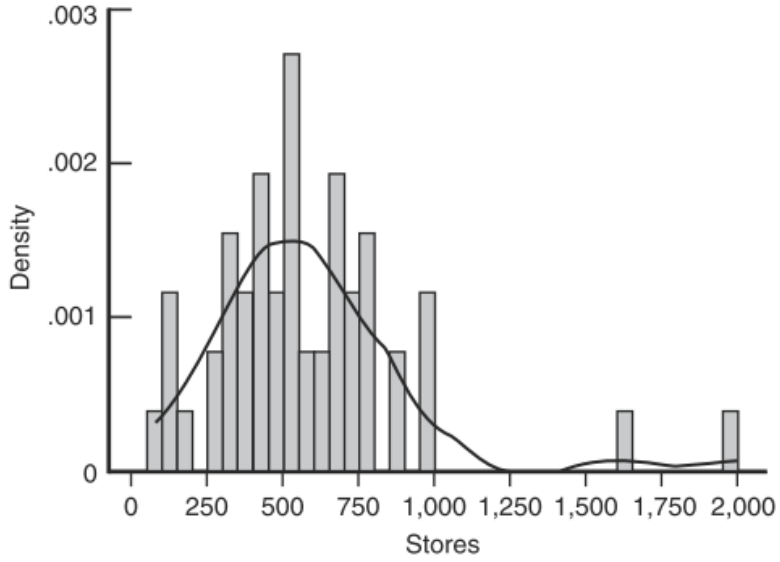
A: Total chain size = top 50 firms.



B: Total chain size = top two in one or more markets

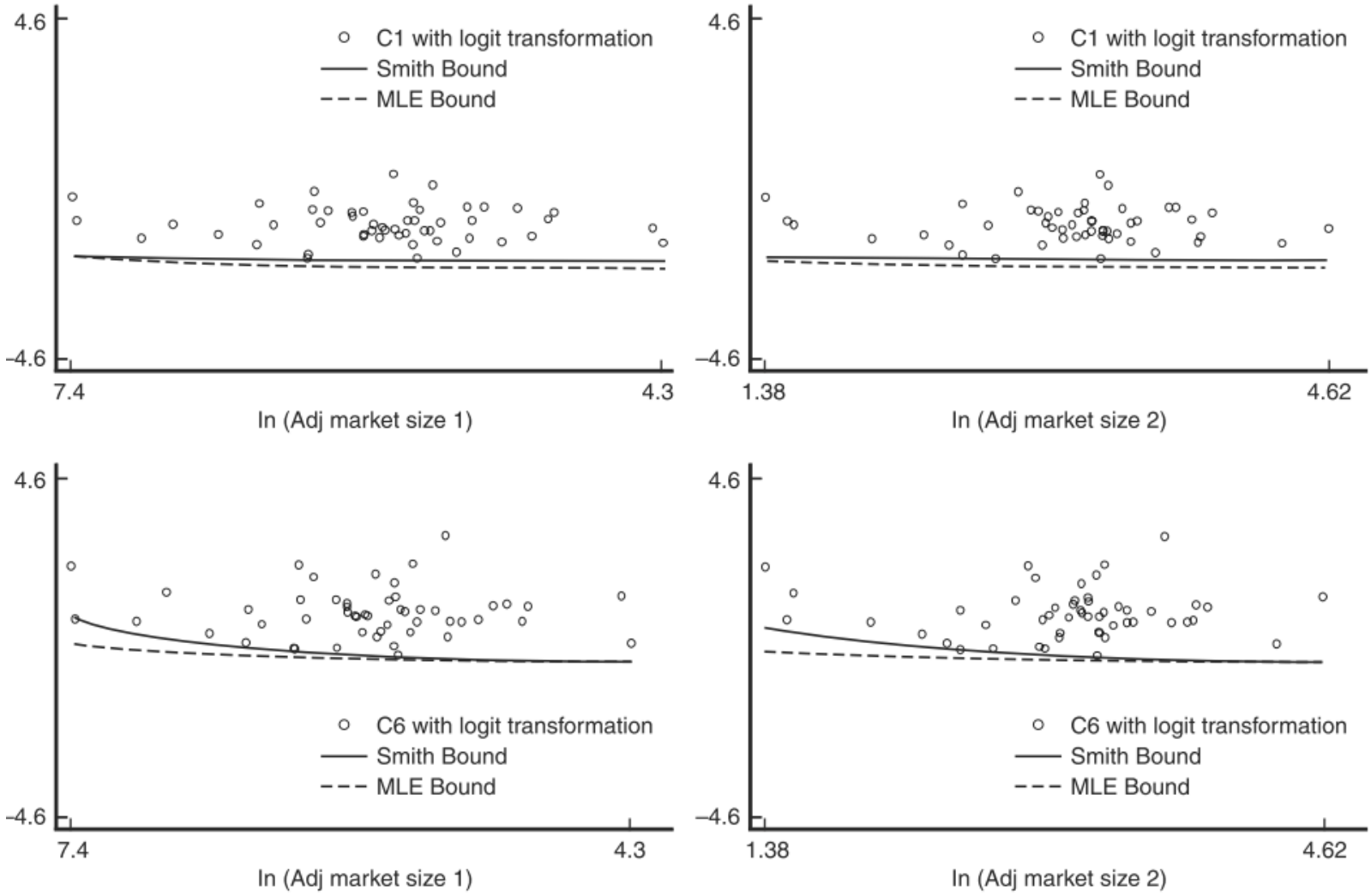


C: Total stores = 331 MSAs.

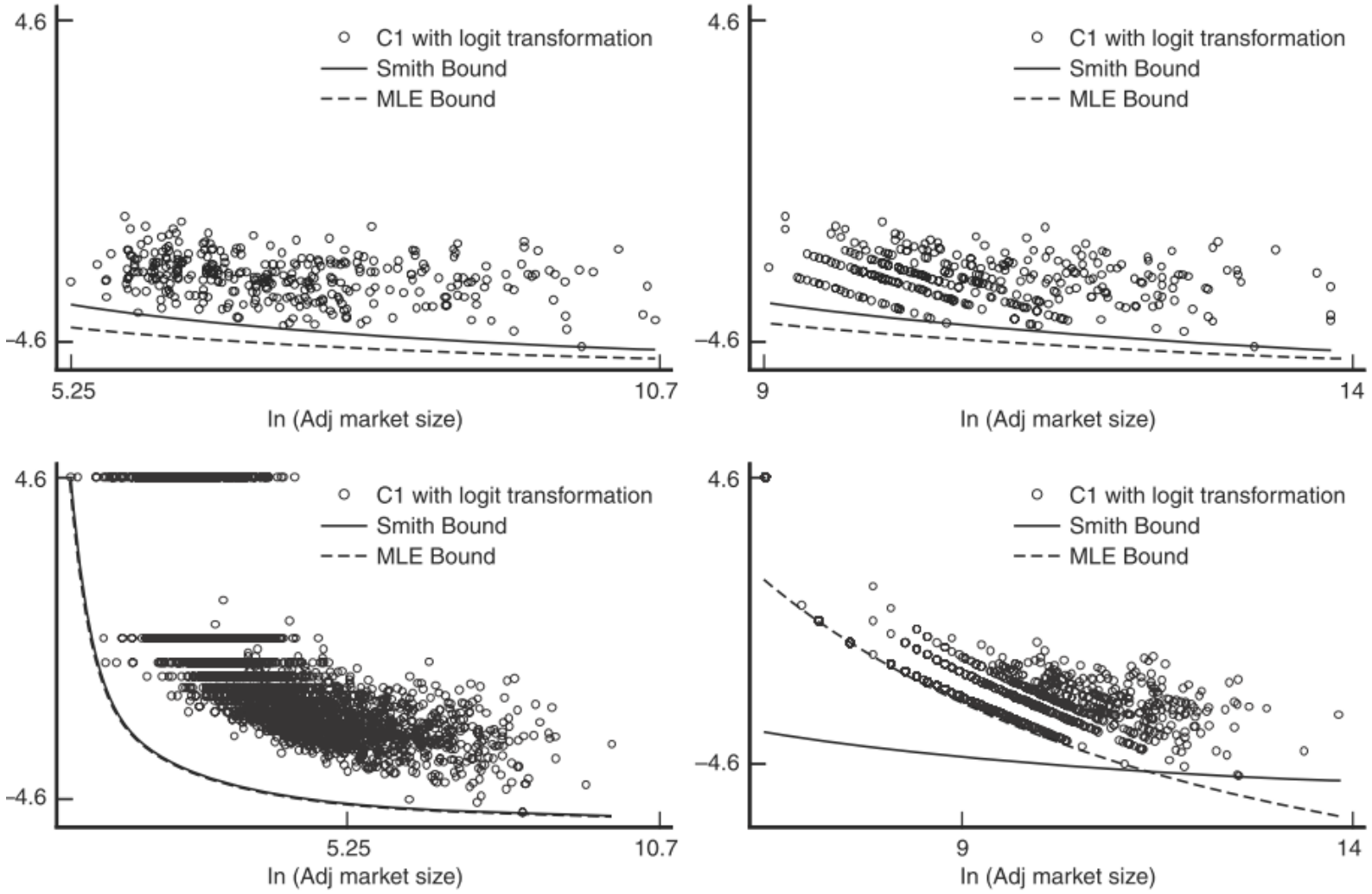


D: Total stores = 51 distribution areas.

Concentration and market size



Fragmentation in barber shops and beauty salons



Conclusions

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Section 3

Jia (2008)

Jia (2008)

"What happens when wal-mart comes to town: an empirical analysis of the discount retailing industry"

- Style of paper: structural empirical IO (like most of the papers we have covered)
- Question: impact of Wal-Mart (and Kmart) on local discount retailers
  - Importance of economies of scale for Wal-Mart's success?
- Model:
  - Flexible competition among all players and markets (important for question, but makes model difficult to solve)
  - Scale economies within chain and across regions
- Results:
  - Kmart declined in importance
  - Entry of chain store makes 50% of other discount stores unprofitable
  - Entry of Wal-Mart explains 30-50% of decline in other discount stores

Growth in discount retailers

TABLE I

THE DISCOUNT INDUSTRY FROM 1960 TO 1997[a]

Year	Number of Discount Stores	Total Sales (2004 $, billions)	Average Store Size (thousand ft^2)	Number of Firms
1960	1329	12.8	38.4	1016
1980	8311	119.4	66.8	584
1989	9406	123.4	66.5	427
1997	9741	198.7	79.2	230

[a]Source: Various issues of *Discount Merchandiser*. The numbers include only traditional discount stores. Wholesale clubs, supercenters, and special retailing stores are excluded.

Data

- Like Bresnahan and Reiss (1991) no firm specific price or quantity data
- Market (county) characteristics (population, total retail sales)
- Presence of Wal-Mart and Kmart in each market
- Number of other discount stores in each market

Data

SUMMARY STATISTICS FOR THE DATA SET[a]

Variable	1978 Mean	1978 Std.	1988 Mean	1988 Std.	1997 Mean	1997 Std.
Population (thousand)	21.47	13.38	22.47	14.12	24.27	15.67
Per capita retail sales (1984 $, thousands)	4.07	1.42	3.69	1.44	4.05	2.02
Percentage of urban population	0.30	0.23	0.30	0.23	0.33	0.24
Midwest (1 if in the Great Lakes, Plains, or Rocky Mountain region)	0.41	0.49	0.41	0.49	0.41	0.49
South (1 if Southwest or Southeast)	0.50	0.50	0.50	0.50	0.50	0.50
Distance to Benton, AR (100 miles)	6.14	3.88	6.14	3.88	6.14	3.88
% of counties with Kmart stores			0.21	0.41	0.19	0.39
% of counties with Wal-Mart stores			0.32	0.47	0.48	0.50
Number of discount stores with 1–19 employees	4.75	2.86	3.79	2.61	3.46	2.47
Number of all discount stores (excluding Kmart and Wal-Mart)	4.89	3.24	4.54	3.10	4.04	2.85
Number of counties	2065					

[a]Source: The population is from the website of the Missouri State Census Data Center. Retail sales are from the 1977, 1987, and 1997 Economic Census. The percentage of urban population is from the 1980, 1990, and 2000 decennial census. Region dummies are defined according to the 1990 census. The numbers of Kmart and Wal-Mart stores are from the annual reference *Directory of Discount Department Stores* (Chain Store Guide (1988–1997)). The numbers of small discount stores and all other discount stores are from various years of the county business patterns.

Model

1. Pre-chain: small firms compete; do not expect chain entry
2. Chain entry: Kmart & Wal-Mart simultaneously choose store locations
3. Small firms exit (or enter) in response

- Complete information except for unanticipated chain entry

Profit function

- Pre-chain: small firm profits

$$\Pi^0_{s,m} = X^0_{s,m}\beta_s + \delta_{ss}\log N^0_{s,m} + \sqrt{1-\rho^2}\epsilon^0_m + \rho\eta^0_{s,m} - SC$$

- Chain entry:
  - Entry indicators: $D_{i,m} \in \{0,1\}$, $D_i = (D_{i,1}, \ldots, D_{i,M})$
  - Distance between markets Z_{ml}, $Z_m = (Z_{m1}, \ldots, Z_{mM})$
  - Chain profits:

$$\Pi_i = \sum_{m=1}^{M} D_{i,m} \begin{pmatrix} X_m\beta_i + \delta_{ij}D_{j,m} + \delta_{is}\log(N_{s,m}+1) + \\ +\delta_{ii}\sum_{l\neq m}\frac{D_{i,l}}{Z_{ml}} + \sqrt{1-\rho^2}\epsilon_m + \rho\eta_{i,m} \end{pmatrix}$$

- Post chain entry small firm profits:

$$\Pi_{s,m} = X_m\beta_i + \sum_{i=k,w}\delta_{is}D_{i,m} + \delta_{ss}\log(N_{s,m}) + \sqrt{1-\rho^2}\epsilon_m + \rho\eta_{s,m} -$$

Solving for equilibrium 1

- Profit maximization for chain:

$$\max_{D_1,\ldots,D_m \in \{0,1\}^M} \sum_{m=1}^{M} D_m \left(X_m + \delta \sum_{l \neq m} \frac{D_l}{Z_{ml}} \right)$$

- Discrete strategy space, so usual optimization techniques do not apply
- In general discrete optimization is NP-hard, which in practice means that there is no general purpose algorithm that can solve large problems
- $2^M = 2^{2062}$ possible D, so cannot brute force maximize

Solving for equilibrium 1

- Solution approach:
  - Observe: we are maximizing profits over an ordered discrete set, we know a lot about this sort of problem (monotone comparitive statics, supermodularity, lattice theory etc)
  - Use results from lattice[1] theory to devise a solution algorithm

[1] Lattice = partially ordered set where every pair of elements has least upper bound (denoted $a \vee b$) and greatest lower bound (denoted $a \wedge b$).

Solving for equilibrium

- Solving single firm problem
  - Necessary condition for optimizer:

$$\Pi(D_1^*, \ldots, D_m^*, \ldots, D_M^*) \geq \Pi(D_1^*, \ldots, D_m, \ldots, D_M^*)$$

implies

$$D_m^* = 1\left\{ X_m + 2\delta \sum_{l \neq m} \frac{D_l^*}{Z_{ml}} \geq 0 \right\} \equiv V_m(D)$$

  - Tarski's fixed point theorem: $\mathcal{D}$ =set of D s.t. $D = V(D)$ is nonempty and bounded above and below
  - Iterating V starting from $(0, \ldots, 0)$ and $(1, \ldots, 1)$ converges in at most M steps to lower and upper bound of $\mathcal{D}$
  - Can exhaustively search between bounds to find all of $\mathcal{D}$

Solving for equilibrium

- Solving for equibria (there will generally be many):
  - X_m above depends on what other chain does
  - Topkis's theorem: best response of Wal-Mart is decreasing as function of actions of Kmart
  - Solve for equilibrium by:
    0. Set $D_w^0 = (0, \ldots, 0)$
    1. Given D_w^T, using method above solve for maximal best response of Kmart to D_w^T, call this D_k^T
    2. Given D_k^{T-1} solve for minimal best response of Wal-Mart, call this D_w^T
    3. Goto 1

    Converges to most profitable equilibrium for Kmart. Switching roles gives most profitable equilibrium for Wal-Mart.

Estimation

- Method of simulated moments
- Moments = observed market structures − market structure predicted by model (computed by simulation)
- Variance of estimates is complicated by spatial correlation
  - Asymptotic normality requires spatial correlation to die out as distance increases (mixing condition)
  - Spatial correlation in model is endogenous (depends on δ_{ii})

Results

- Tables below
- Parameter estimates: expected signs? magnitude for Wal-Mart vs Kmart?
- Fit: Table VI, VII
- Table VIII: appears to usually be a unique equilibrium
- Table IX-XI: comparative statics of market size and number of stores
- Table XII: competition and chain effects
- Table XIII-XV: other stores with and without Wal-Mart
- Table XVI: subsidies and employment

TABLE IV

PARAMETER ESTIMATES FROM DIFFERENT SPECIFICATIONS—1988[a]

	Baseline	Favors Wal-Mart	Regional Advantage	Personal Income	Rival Stores in Neighborhood	All Other Discount Stores
Kmart's profit						
Log population	1.40*	1.43*	1.44*	2.09*	1.38*	1.55*
	(0.11)	(0.09)	(0.09)	(0.11)	(0.10)	(0.08)
Log retail sales/log personal income	2.20*	2.27*	2.18*	1.78*	2.20*	2.25*
	(0.08)	(0.07)	(0.07)	(0.10)	(0.08)	(0.07)
Urban ratio	2.29*	2.37*	2.31*	2.98*	2.20*	2.24*
	(0.35)	(0.32)	(0.25)	(0.45)	(0.37)	(0.22)
Midwest	0.52*	0.54*	0.52*	0.27*	0.55*	0.47*
	(0.14)	(0.11)	(0.12)	(0.12)	(0.20)	(0.14)
Constant	−24.59*	−25.28*	−24.49*	−25.47*	−24.54*	−25.17*
	(0.73)	(0.51)	(0.50)	(0.67)	(0.69)	(0.58)
delta_kw	−0.33*	−0.28*	−0.31	−0.31*	−0.31	−0.25†
	(0.15)	(0.12)	(0.20)	(0.15)	(0.25)	(0.15)
delta_kk	0.59	0.64*	0.63	0.53*	0.57*	0.56*
	(0.68)	(0.16)	(0.50)	(0.27)	(0.28)	(0.22)
delta_ks	−0.01	−0.02	−0.01	−0.04	−0.001	−0.11
	(0.07)	(0.09)	(0.08)	(0.09)	(0.13)	(0.10)
delta_kw2					0.19	
					(4.76)	
Wal-Mart's profit						
Log population	1.39*	1.43*	1.40*	2.05*	1.37*	1.86*
	(0.08)	(0.09)	(0.09)	(0.16)	(0.15)	(0.12)
Log retail sales/log personal income	1.68*	1.73*	1.62*	1.22*	1.68*	1.62*
	(0.07)	(0.06)	(0.05)	(0.08)	(0.08)	(0.07)
Urban ratio	2.40*	2.43*	2.43*	3.37*	2.24*	2.15*
	(0.38)	(0.27)	(0.33)	(0.38)	(0.39)	(0.26)
Log distance	−1.49*	−1.54*	−1.42*	−1.49*	−1.48*	−1.57*
	(0.12)	(0.10)	(0.10)	(0.11)	(0.16)	(0.12)
South	1.06*	1.11*	1.05*	1.62*	1.08*	1.24*
	(0.16)	(0.13)	(0.15)	(0.19)	(0.14)	(0.14)
Constant	−10.70*	−11.04*	−10.66*	−11.14*	−10.73*	−10.72*
	(1.03)	(0.87)	(0.75)	(0.80)	(1.08)	(0.66)
delta_wk	−1.10*	−1.18*	−1.13*	−1.10*	−0.93*	−0.85*
	(0.28)	(0.29)	(0.18)	(0.24)	(0.28)	(0.28)
delta_ww	1.31*	1.36*	1.36*	1.34*	1.36*	1.30*
	(0.64)	(0.53)	(0.33)	(0.37)	(0.56)	(0.51)
delta_ws	−0.02	−0.02	−0.02	−0.01	−0.02	−0.37*
	(0.07)	(0.05)	(0.11)	(0.09)	(0.07)	(0.10)
rho	0.68*	0.71*	0.69*	0.90*	0.71*	0.87*
	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)
delta_wk2					0.18	
					(2.75)	

(Continues)

TABLE IV—*Continued*

	Baseline	Favors Wal-Mart	Regional Advantage	Personal Income	Rival Stores in Neighborhood	All Other Discount Stores
Small stores' profit/all other discount stores' profit						
Log population	1.53*	1.57*	1.50*	1.45*	1.52*	1.75*
	(0.06)	(0.07)	(0.06)	(0.07)	(0.06)	(0.06)
Log retail sales	1.15*	1.19*	1.14*	1.12*	1.17*	1.34*
	(0.06)	(0.07)	(0.05)	(0.05)	(0.05)	(0.04)
Urban ratio	−1.42*	−1.46*	−1.38*	−1.55*	−1.44*	−0.73*
	(0.13)	(0.14)	(0.14)	(0.12)	(0.14)	(0.10)
South	0.92*	0.96*	0.91*	0.87*	0.92*	0.77*
	(0.06)	(0.07)	(0.07)	(0.06)	(0.07)	(0.06)
Constant_88	−9.71*	−10.01*	−9.57*	−9.32*	−9.75*	−11.73*
	(0.46)	(0.63)	(0.48)	(0.42)	(0.37)	(0.36)
delta_sk	−0.99*	−0.98*	−0.97*	−0.63*	−0.98*	−0.76*
	(0.15)	(0.13)	(0.16)	(0.12)	(0.13)	(0.12)
delta_sw	−0.93*	−0.94*	−0.93*	−0.63*	−0.96*	−0.95*
	(0.13)	(0.14)	(0.15)	(0.13)	(0.18)	(0.12)
delta_ss	−2.31*	−2.39*	−2.26*	−2.26*	−2.32*	−2.24*
	(0.09)	(0.10)	(0.09)	(0.11)	(0.09)	(0.10)
tao	0.58*	0.68*	0.54*	0.67*	0.61*	0.26*
	(0.12)	(0.11)	(0.10)	(0.15)	(0.10)	(0.10)
Constant_78	−8.62*	−8.86*	−8.50*	−7.80*	−8.60*	−10.14*
	(0.50)	(0.60)	(0.63)	(0.60)	(0.47)	(0.42)
Sunk cost	−1.80*	−1.86*	−1.80*	−2.07*	−1.90*	−2.32*
	(0.33)	(0.25)	(0.34)	(0.35)	(0.42)	(0.26)
Function value	120.26	120.77	136.74	155.65	119.62	96.05
Observations	2065	2065	2065	2065	2065	2065

[a]Asterisks (*) denote significance at the 5% confidence level daggers and (†) denote significance at the 10% confidence level. Standard errors are in parentheses. Midwest and South are regional dummies, with the Great Lakes region, the Plains region, and the Rocky Mountain region grouped as the Midwest, and the Southwest region and the Southeast region grouped as the South. delta_kw, delta_ks, delta_wk, delta_ws, delta_sk, delta_sw, and delta_ss denote the competition effect, while delta_kk and delta_ww denote the chain effect. "k" stands for Kmart, "w" stands for Wal-Mart, and "s" stands for small stores in the first five columns, and all discount stores (except Kmart and Wal-Mart stores) in the last column. $\sqrt{1-\rho^2}$ measures the importance of the market-level profit shocks. In the first three columns, the parameters are estimated using the equilibrium most profitable for Kmart, the equilibrium most profitable for Wal-Mart, and the equilibrium that grants Kmart advantage in the Midwest region and Wal-Mart advantage in the South, respectively. In the last three columns, the parameters are estimated using the equilibrium that is most favorable for Kmart. In the fourth column, log of personal income per capita is used in Kmart's and Wal-Mart's profit function. In the fifth column, the existence of rival stores in neighboring markets matters. The sixth column estimates the model using Kmart, Wal-Mart, and all other discount stores, not just small stores.

TABLE V

PARAMETER ESTIMATES FROM DIFFERENT SPECIFICATIONS–1997

	Baseline	Favors Wal-Mart	Regional Advantage	Personal Income	Rival Stores in Neighborhood	All Other Discount Stores
Kmart's profit						
Log population	1.50*	1.45*	1.42*	1.34*	1.50*	1.65*
	(0.11)	(0.21)	(0.14)	(0.10)	(0.10)	(0.09)
Log retail sales/log personal income	2.16*	2.08*	2.17*	2.06*	2.16*	2.14*
	(0.16)	(0.13)	(0.13)	(0.09)	(0.09)	(0.08)
Urban ratio	1.36*	1.43*	1.41*	1.79*	1.25*	1.47*
	(0.23)	(0.41)	(0.24)	(0.28)	(0.20)	(0.42)
Midwest	0.38*	0.42*	0.33†	0.37*	0.35†	0.36*
	(0.13)	(0.20)	(0.18)	(0.15)	(0.18)	(0.12)
Constant	−24.26*	−23.47*	−24.20*	−25.04*	−24.26*	−24.70*
	(1.59)	(0.69)	(0.87)	(0.73)	(0.59)	(0.61)
delta_kw	−0.74*	−0.77*	−0.59*	−0.96*	−0.67*	−0.64*
	(0.19)	(0.25)	(0.14)	(0.18)	(0.31)	(0.23)
delta_kk	0.63	0.69	0.85*	0.56*	0.64	0.51
	(0.54)	(0.53)	(0.32)	(0.27)	(0.55)	(0.33)
delta_ks	−0.03	−0.002	−0.003	−0.02	−0.01	−0.07
	(0.20)	(0.18)	(0.08)	(0.09)	(0.12)	(0.08)
delta_kw2					0.27	
					(1.99)	
Wal-Mart's profit						
Log population	2.02*	1.97*	2.00*	2.31*	2.01*	2.01*
	(0.08)	(0.11)	(0.14)	(0.16)	(0.15)	(0.12)
Log retail sales/log personal income	1.99*	1.93*	1.99*	1.82*	2.00*	1.94*
	(0.06)	(0.08)	(0.12)	(0.08)	(0.12)	(0.08)
Urban ratio	1.63*	1.71*	1.57*	1.74*	1.48*	1.64*
	(0.29)	(0.20)	(0.63)	(0.34)	(0.36)	(0.24)
Log distance	−1.06*	−1.03*	−1.07*	−1.10*	−1.05*	−1.00*
	(0.10)	(0.15)	(0.16)	(0.09)	(0.11)	(0.04)
South	0.88*	0.94*	0.81*	0.99*	0.88*	0.93*
	(0.20)	(0.21)	(0.21)	(0.11)	(0.13)	(0.13)
Constant	−16.95*	−16.53*	−16.68*	−18.38*	−16.95*	−16.58*
	(0.76)	(0.87)	(1.08)	(0.95)	(1.20)	(0.51)
delta_wk	−0.68*	−0.74*	−0.59*	−0.68*	−0.53†	−0.87*
	(0.26)	(0.34)	(0.16)	(0.21)	(0.27)	(0.18)
delta_ww	0.79*	0.76	0.86*	0.77*	0.73†	0.76*
	(0.36)	(0.50)	(0.33)	(0.29)	(0.41)	(0.23)
delta_ws	−0.10	−0.10	−0.12†	−0.06	−0.10	−0.28*
	(0.13)	(0.07)	(0.07)	(0.08)	(0.17)	(0.08)
rho	0.86*	0.86*	0.90*	0.85*	0.88*	0.90*
	(0.06)	(0.08)	(0.05)	(0.04)	(0.06)	(0.05)
delta_wk2					0.10	
					(3.46)	

(Continues)

TABLE V—*Continued*

	Baseline	Favors Wal-Mart	Regional Advantage	Personal Income	Rival Stores in Neighborhood	All Other Discount Stores
Small stores' profit/all other discount stores' profit						
Log population	1.64*	1.62*	1.67*	1.66*	1.65*	1.92*
	(0.10)	(0.08)	(0.10)	(0.09)	(0.11)	(0.07)
Log retail sales	1.37*	1.33*	1.38*	1.37*	1.37*	1.37*
	(0.07)	(0.07)	(0.06)	(0.06)	(0.08)	(0.06)
Urban ratio	−1.87*	−1.76*	−1.91*	−1.95*	−1.88*	−0.80*
	(0.18)	(0.17)	(0.19)	(0.13)	(0.17)	(0.11)
South	1.14*	1.11*	1.13*	1.19*	1.13*	0.89*
	(0.09)	(0.08)	(0.08)	(0.08)	(0.07)	(0.06)
Constant_97	−11.75*	−11.46*	−11.84*	−11.75*	−11.76*	−12.35*
	(0.61)	(0.52)	(0.43)	(0.77)	(0.68)	(0.42)
delta_sk	−0.45*	−0.44*	−0.41†	−0.43*	−0.39†	−0.38*
	(0.15)	(0.15)	(0.22)	(0.15)	(0.21)	(0.12)
delta_sw	−0.79*	−0.71*	−0.64*	−0.78*	−0.72*	−0.96*
	(0.17)	(0.14)	(0.15)	(0.15)	(0.16)	(0.12)
delta_ss	−2.68*	−2.64*	−2.75*	−2.73*	−2.69*	−2.69*
	(0.19)	(0.11)	(0.14)	(0.21)	(0.21)	(0.10)
tao	0.57*	0.53*	0.63*	0.61*	0.60*	0.11
	(0.21)	(0.19)	(0.24)	(0.17)	(0.16)	(0.13)
Constant_78	−9.62*	−9.33*	−9.48*	−9.98*	−9.56*	−9.77*
	(0.65)	(0.63)	(0.73)	(1.25)	(0.93)	(0.54)
Sunk cost	−2.36*	−2.31*	−2.50*	−1.90*	−2.40*	−2.69*
	(0.40)	(0.44)	(0.62)	(0.78)	(0.60)	(0.30)
Function value	108.68	105.02	103.90	216.24	104.64	91.24
Observations	2065	2065	2065	2065	2065	2065

[a]Asterisks (*) denote significance at the 5% confidence level and daggers (†) denote significance at the 10% confidence level. Standard errors are in parentheses. See Table IV for the explanation of the variables and the different specifications for each column.

Model fit

TABLE VI

MODEL'S GOODNESS OF FIT FOR THE BASELINE SPECIFICATION

	1988		1997	
Number of	Sample Mean	Model Mean	Sample Mean	Model Mean
Kmart	0.21	0.21	0.19	0.19
Wal-Mart	0.32	0.32	0.48	0.48
Small stores in 1978	4.75	4.80	4.75	4.74
Small stores	3.79	3.78	3.46	3.39

Model fit

TABLE VII

CORRELATION BETWEEN MODEL PREDICTION AND SAMPLE OBSERVATION

Number of	1988	1997
Kmart	0.66	0.63
Wal-Mart	0.72	0.75
Small stores in 1978	0.61	0.61
Small stores	0.65	0.67

Unique equilibrium?

TABLE VIII

PERCENTAGE OF MARKETS WHERE THE TWO EXTREME EQUILIBRIA DIFFER[a]

	1988	1997
Using parameters associated with the equilibrium most profitable for Kmart	1.41%	1.58%
Using parameters associated with the equilibrium most profitable for Wal-Mart	1.20%	2.03%
Using parameters associated with the equilibrium that favors Wal-Mart in the South	1.45%	1.11%

[a]For each of these exercises, I solve the two extreme equilibria (the one most profitable for Kmart and the one most profitable for Wal-Mart) evaluated at the same set of parameter values, compute their difference, and average over 300 simulations.

TABLE IX

NUMBER OF KMART STORES WHEN THE MARKET SIZE CHANGES[a]

	1988				1997			
	Favors Kmart		Favors Wal-Mart		Favors Kmart		Favors Wal-Mart	
	Percent	Total	Percent	Total	Percent	Total	Percent	Total
Base case	100.0	437	100.0	413	100.0	393	100.0	362
Population increases 10%	110.5	482	110.9	458	113.1	445	113.5	411
Retail sales increases 10%	116.8	510	117.4	485	118.8	467	119.4	432
Urban ratio increases 10%	107.2	468	107.6	445	105.4	415	105.6	382
Midwest = 0 for all counties	82.7	361	81.8	338	84.6	333	84.5	306
Midwest = 1 for all counties	123.7	540	124.0	512	118.7	467	119.2	432

[a] For each of the simulation exercises in all Tables IX–XI, I fix other firms' profits and change only the profit of the target firm in accordance with the change in the market size. I resolve the entire game to obtain the new equilibrium numbers of firms. Columns labeled Favors Kmart use the equilibrium most profitable for Kmart, and columns labeled Favors Wal-Mart use the equilibrium most profitable for Wal-Mart. For example, in the second row of Table IX, I increase Kmart's profit according to a 10% increase in population while holding Wal-Mart's and small firms' profit the same as before. Using this new set of profits and the equilibrium that favors Kmart most, the number of Kmart stores is 10.5% higher than in the base case in 1988.

TABLE X

NUMBER OF WAL-MART STORES WHEN THE MARKET SIZE CHANGES[a]

	1988				1997			
	Favors Kmart		Favors Wal-Mart		Favors Kmart		Favors Wal-Mart	
	Percent	Total	Percent	Total	Percent	Total	Percent	Total
Base case	100.0	651	100.0	680	100.0	985	100.0	1016
Population increases 10%	108.6	707	108.2	736	107.4	1058	106.9	1086
Retail sales increases 10%	110.3	718	109.9	747	107.3	1057	106.8	1085
Urban ratio increases 10%	105.4	686	105.2	715	102.2	1007	102.1	1037
Distance increases 10%	91.2	594	91.5	622	96.0	946	96.3	978
South = 0 for all counties	63.6	414	65.5	445	83.8	825	85.0	863
South = 1 for all counties	135.7	884	134.9	917	117.8	1160	116.3	1182

[a]See the footnote to Table IX for comments.

TABLE XI

NUMBER OF SMALL FIRMS WHEN THE MARKET SIZE CHANGES[a]

	1988				1997			
	Favors Kmart		Favors Wal-Mart		Favors Kmart		Favors Wal-Mart	
	Percent	Total	Percent	Total	Percent	Total	Percent	Total
Base case	100.0	7808	100.0	7803	100.0	6995	100.0	6986
Population increases 10%	106.6	8319	106.6	8314	106.3	7437	106.3	7427
Retail sales increases 10%	104.9	8191	104.9	8186	105.3	7365	105.3	7355
Urban ratio increases 10%	98.2	7665	98.2	7660	97.6	6827	97.6	6817
South = 0 for all counties	80.6	6290	80.6	6285	78.3	5476	78.3	5467
South = 1 for all counties	120.8	9431	120.8	9425	123.3	8625	123.3	8612
Sunk cost increases 10%	95.9	7485	95.9	7481	95.6	6689	95.6	6680

[a]See the footnote to Table IX for comments.

TABLE XII

COMPETITION EFFECT AND CHAIN EFFECT FOR KMART (KM) AND WAL-MART (WM)[a]

	1988		1997	
Number of	Percent	Total	Percent	Total
Kmart stores				
Base case	100.0	437	100.0	393
Wm in each market	85.1	371	82.2	323
Wm exits each market	108.6	474	141.9	558
Not compete with small stores	101.3	442	104.3	410
No chain effect	94.7	414	93.5	368
Wal-Mart stores				
Base case	100.0	651	100.0	985
Km in each market	61.4	400	82.2	809
Km exits each market	119.5	778	105.7	1042
Not compete with small stores	101.7	662	105.1	1035
No chain effect	84.4	550	92.9	915

[a] Base case is the number of stores observed in the data. For each exercise, I resolve the full model under the specified assumptions. For the last two rows of both panels where the counterfactual exercise involves multiple equilibria, I solve the model using the equilibrium that is most profitable for Kmart.

TABLE XIII

NUMBER OF SMALL STORES WITH DIFFERENT MARKET STRUCTURE[a]

	Profit Positive		Profit Recovers Sunk Cost	
	Percent	Total	Percent	Total
		1988		
No Kmart or Wal-Mart	100.0	9261		
Only Kmart in each Market	76.2	7057	47.9	4440
Only Wal-Mart in each Market	77.5	7173	49.1	4542
Both Kmart and Wal-Mart	56.1	5195	31.6	2925
		1997		
No Kmart or Wal-Mart	100.0	8053		
Only Kmart in each Market	89.8	7228	54.1	4357
Only Wal-Mart in each Market	82.4	6634	47.9	3854
Both Kmart and Wal-Mart	72.9	5868	40.3	3244

[a]I fix the number of Kmart and Wal-Mart stores as specified and solve for the equilibrium number of small stores. If stores have perfect foresight, the columns labeled Profit Recovers Sunk Cost would have been the number of stores that we observe, as they would not have entered in the pre-chain period if their profit after entry could not recover the sunk cost.

NUMBER OF ALL DISCOUNT STORES (EXCEPT FOR KMART AND WAL-MART STORES) WITH DIFFERENT MARKET STRUCTURE[a]

	Profit Positive		Profit Recovers Sunk Cost	
	Percent	Total	Percent	Total
		1988		
No Kmart or Wal-Mart	100.0	10,752		
Only Kmart in each Market	82.7	8890	47.1	5064
Only Wal-Mart in each Market	78.5	8443	43.6	4692
Both Kmart and Wal-Mart	62.7	6741	31.5	3383
		1997		
No Kmart or Wal-Mart	100.0	9623		
Only Kmart in each Market	91.9	8842	51.7	4976
Only Wal-Mart in each Market	79.8	7683	42.0	4043
Both Kmart and Wal-Mart	72.4	6964	36.5	3508

[a]I fix the number of Kmart and Wal-Mart stores as specified and solve for the number of all other discount stores. See the additional comments in the footnote to Table XIII.

TABLE XV

THE IMPACT OF WAL-MART'S EXPANSION[a]

	1988	1997
Observed decrease in the number of small stores between 1988 and 1997	693	693
Predicted decrease from the full model	380	259
Percentage explained	55%	37%
Observed decrease in the number of all discount stores (except for Kmart and Wal-Mart stores) between 1988 and 1997	1021	1021
Predicted decrease from the full model	416	351
Percentage explained	41%	34%

[a] In the top panel, the predicted 380 store exits in 1988 are obtained by simulating the change in the number of small stores using Kmart's and the small stores' profit in 1988, but Wal-Mart's profit in 1997. The column of 1997 uses Kmart's and small stores' profit in 1997, but Wal-Mart's profit in 1988. Similarly for the second panel.

TABLE XVI

THE IMPACT OF GOVERNMENT SUBSIDIES: CHANGES IN THE NUMBER OF JOBS IN THE DISCOUNT SECTOR[a]

	1988	1997
Subsidize Kmart's profit by 10%		
Increase in Kmart's employees	4	4
Decrease in other stores' employees	−1	−1
Subsidize Wal-Mart's profit by 10%		
Increase in Wal-Mart's employees	7	8
Decrease in other stores' employees	−1	−1
Subsidize small stores' profit by 100%		
Increase in small stores' employees	13	12
Decrease in other stores' employees	0	−2
Subsidize all other discount stores' profit by 100%		
Increase in other discount stores' employees	40	34
Decrease in Kmart and Wal-Mart stores' employees	−6	−4

[a]For each of these counterfactual exercises, I incorporate the change in the subsidized firm's profit as specified, solve for the equilibrium numbers of stores, and obtain the estimated change in employment assuming that (a) a Kmart or a Wal-Mart store employs 300 employees, (b) a small discount store employs 10 employees, and (c) an average discount store employs 25 employees.

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