Market entry

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Part I

Overview of market entry

References

- Reviews:
  - Aguirregabiria (2021) chapter 5
  - Sutton (1991) theory
  - Aradillas-López (2020), Kline, Pakes, and Tamer (2021) econometrics
  - Levin (2009)
- Key papers:
  - Bresnahan and Reiss (1991)

Section 1

Introduction

Introduction 1

- Models of entry:
  - Dependent variable = firm decision to operate or not in a market
    - Enter industry, open new store, introduce new product, release a new movie, bid in an auction
  - Sunk cost from being active in market
  - Payoff of being active depends on how many other firms are in the market (game)

$$a_{im} = 1\left\{\Pi_{im}(N_m, X_{im}, \epsilon_{im}) \geq 0\right\}$$

- Estimate Π using revealed preference
- Static models: entry $\approx$ being in active in market; not transition in/out

Why estimate models of entry?

- Why not just estimate payoff function using demand and production estimation techniques?
  - Answers new questions: source of market power
  - Efficiency: entry conditions provide additional information about payoffs, so using them can give us more precise estimates
  - Identification: some parameters (e.g. fixed costs) can only be identified from entry
  - Requires less data: price and quantity data not needed for some entry models
  - Controlling for selection

Starc (2014) 1

- What are the sources and consequences of insurer market power?
- Sutton (1991):
  - Model with price competition & fixed costs implies number of firms $\to\infty$ as market size $\to\infty$
  - Model with price competition & endogenous fixed costs implies number of firms $\to$ constant as market size $\to\infty$
  - Illustrative simplified model from Schmalensee (1992)
    - Exogenous, p, c, endogenous A_i (advertising)

$$\pi_i = (p-c)S\frac{A_i^e}{\sum_{j=1}^N A_j^e} - A_i - \sigma$$

    - Symmetric Nash equilibrium:

$$0 = (1/N^*)(1-e) + (1/N^*)^2 e - (\sigma/S)(1/(P-c))$$

if $e \in (1, 2]$, then $N^* \to e/(e-1)$ as $S \to \infty$

- Entry model:
    - Mutual of Omaha: fixed cost of entry (including advertising) in market m is Θ_{Mm}
    - Assume:
        1. Mutual of Omaha is profitable $\Pi_{Mm}(1,1) - \Theta_{Mm} \geq 0$
        2. It is not profitable for another firm to mimic Mutual of Omaha and enter $\Pi_{Mm}(1,2) - \Theta_{Mm} \leq 0$

      implies $\mathrm{E}[\Pi_{Mm}(2,1)] \leq \mathrm{E}[\theta_{Mm}] \leq \mathrm{E}[\Pi_{Mm}(1,1)]$
    - Similar for United Health, but they pay a single national suck cost Φ_U each year and

$$\mathrm{E}[\sum_m \Pi_{Um}(2,1)] \leq \mathrm{E}[\Phi_U] \leq \mathrm{E}[\sum_m \Pi_{Um}(1,1)]$$

Source of market power

TABLE A7 Fixed and Sunk Cost Estimates

	Lower Bound	Upper Bound
Sunk cost,	$99, 261, 645.01	$487, 935, 210.41
UnitedHealth	($1, 530, 902, 861, 706.31)	($23, 031, 614, 127.02)
Fixed cost,	$445, 010.32	$796, 342.56
Mutual of Omaha	($225, 593.04)	($3, 578, 033.82)

TABLE A8 Marketing Expenditure and Advertising Value

	United Health	Mutual of Omaha
L.B. of sunk (fixed) cost/consumer	$23.65	$8.37
U.B. of sunk (fixed) cost/consumer	$73.09	$14.81
Average marginal cost/consumer	$98.27	$238.67
L.B. of total marketing cost/consumer	$121.92	$247.05
U.B. of total marketing cost/consumer	$171.36	$253.48

Notes: Compensating variation is calculated as the average across consumers within a market using the standard log-sum formula; the number reported is the median across markets.

Section 2

Bresnahan and Reiss (1991)

Bresnahan and Reiss (1991)

- Can learn a lot from market entry with very limited data
- Cross-section of isolated markets where we observe
  - Number of firms
  - Some market characteristics (prices and quantities not needed)
- Identify:
  - Fixed costs
  - Degree of competition: payoffs $= f$(number of firms)

Motivating theory

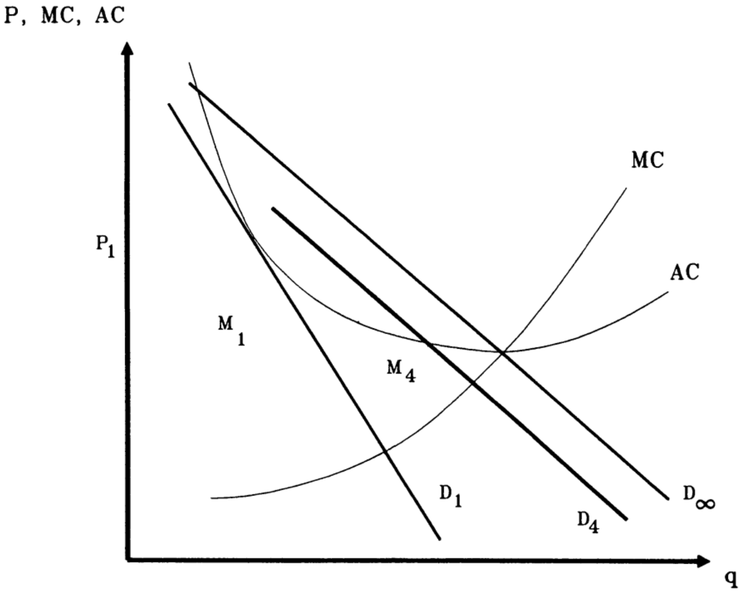


FIG. 1.—Breakeven firm demand and margins

Motivating theory

- Demand $= d(P) \underbrace{S}_{\text{market size}}$
- Monopolist entry:

$$0 = (P_1 - AVC(q_1))d(P_1)S_1 - F$$
$$S_1 = \frac{F}{(P_1 - AVC(q_1))d(P_1)}$$

- Symmetric market with n firms, demand per firm = $d(P)S/n$, entry threshold for nth firm

$$S_n = \frac{F}{(P_n - AVC(q_n))d(P_n)}$$

- P_n, q_n, depend on "competitive conduct" (form of competition, residual demand for firm who deviates from equilibrium P_n)
- As $n \to \infty$, $S_n/n \to s_\infty =$ minimal market size per firm to support entry when P, q competitive
- S_{n+1}/S_n measures how competitive conduct changes

Setting

- Questions:
  - Degree of competition: how fast profits decline with n_m
  - How many entrants needed to achieve competitive equilibrium (contestable markets)
- Data:
  - Retail and professional industries (doctors, dentists, pharmacies, car dealers, etc.), treat each industry separately
  - M markets
  - n_m firms per market
  - S_m market size
  - x_m market characteristics

Model 1

- N potential entrants
- Profit of each firm when n active $= \Pi_m(n)$
  - Π_m decreasing in n
- Equilibrium:

$$\Pi_m(n_m) \geq 0 \text{ and } P_m(n_m + 1) < 0$$

- Profit function:

$$\begin{aligned}\Pi_m(n) = & \underbrace{V_m(n)}_{\text{variable}} - \underbrace{F_m(n)}_{\text{fixed}} \\ = & S_m v_m(n) - F_m(n) \\ = & S_m \left(x_m^D \beta - \alpha(n)\right) - \left(x_m^c \gamma + \delta(n) + \epsilon_m\right)\end{aligned}$$

where

- $\alpha(1) \leq \alpha(2) \leq \cdots \leq \alpha(N)$

Model 2

- $\delta(1) \leq \delta(2) \leq \cdots \leq \delta(N)$
  - Entry deterrence, firm heterogeneity, real estate prices
- Key difference between variable and fixed profits is that variable depend on S_m, fixed do not

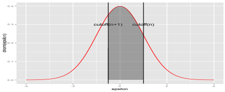
Estimation 1

- Parameters $\theta = (\beta, \gamma, \alpha, \delta)$
- MLE

$$\hat{\theta} = \arg\max_{\theta} \sum_{m=1}^{M} \log \mathrm{P}(n_m | x_m, S_m; \theta)$$

- Assume $\epsilon_m \sim N(0, 1)$, independent of x_m, S_m

$$\begin{aligned}
\mathrm{P}(n|x_m, S_m; \theta) =& \mathrm{P}\left(\Pi_m(n) \geq 0 > \Pi_m(n+1)\right) \\
=& \mathrm{P}\begin{pmatrix} S_m x_m^D \beta - x_m^C \gamma - S_m \alpha(n) - \delta(n) \geq \epsilon \\ \epsilon > S_m x_m^D \beta - x_m^C \gamma - S_m \alpha(n+1) - \delta(n+1) \end{pmatrix} \\
=&
\end{aligned}$$



$$\begin{aligned}
=& \Phi\left(S_m x_m^D \beta - x_m^C \gamma - S_m \alpha(n) - \delta(n)\right) - \\
& - \Phi\left(S_m x_m^D \beta - x_m^C \gamma - S_m \alpha(n+1) - \delta(n+1)\right)
\end{aligned}$$

Data

- 202 isolated local markets
  - Population 500-75,000
  - $\geq$ 20 miles from nearest town of 1,000+
  - $\geq$ 100 miles from city of 100,000+
- 16 industries: retail and professions, each estimated separately

TABLE 3

SAMPLE MARKET DESCRIPTIVE STATISTICS

Variable	Name	Mean	Standard Deviation	Min	Max
Firm counts:					
Doctors	DOCS	3.4	5.4	.0	45.0
Dentists	DENTS	2.6	3.1	.0	17.0
Druggists	DRUG	1.9	1.5	.0	11.0
Plumbers	PLUM	2.2	3.3	.0	25.0
Tire dealers	TIRE	2.6	2.6	.0	13.0
Population variables (in thousands):					
Town population	TPOP	3.74	5.35	.12	45.09
Negative TPOP growth	NGRW	−.06	.14	−1.34	.00
Positive TPOP growth	PGRW	.49	1.05	.00	7.23
Commuters out of the county	OCTY	.32	.69	.00	8.39
Nearby population	OPOP	.41	.74	.01	5.84
Demographic variables:					
Birth ÷ county population	BIRTHS	.02	.01	.01	.04
65 years and older ÷ county population	ELD	.13	.05	.03	.30
Per capita income ($1,000's)	PINC	5.91	1.13	3.16	10.50
Log of heating degree days	LNHDD	8.59	.47	6.83	9.20
Housing units ÷ county population	HUNIT	.46	.11	.29	1.40
Fraction of land in farms	FFRAC	.67	.35	.00	1.27
Value per acre of farm-land and buildings ($1,000's)	LANDV	.30	.23	.07	1.64
Median value of owner-occupied houses ($1,000's)	HVAL	32.91	14.29	9.90	106.0

SOURCE.—Firm counts: American Business Lists, Inc.; population variables: U.S. Bureau of the Census (1983) and *Rand McNally Commercial Atlas and Marketing Guide* (annual); demographic variables: U.S. Bureau of the Census (1983).

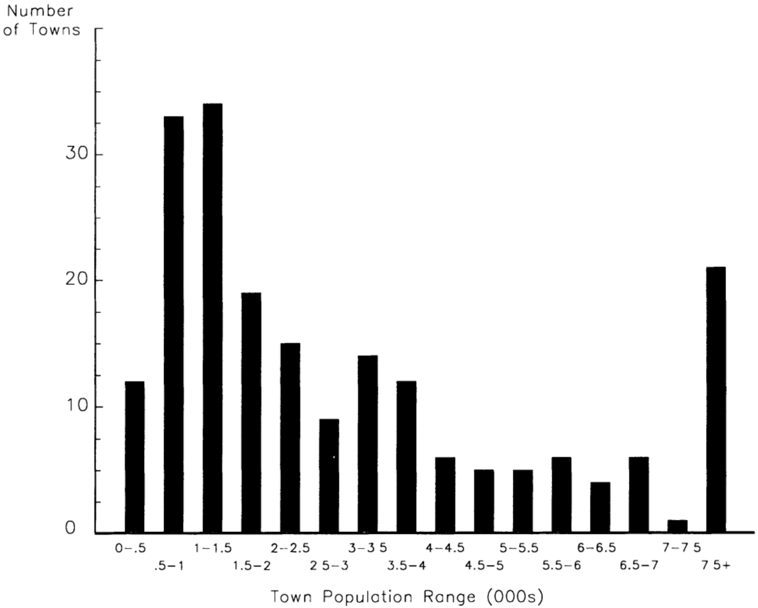


FIG. 2.—Number of towns by town population

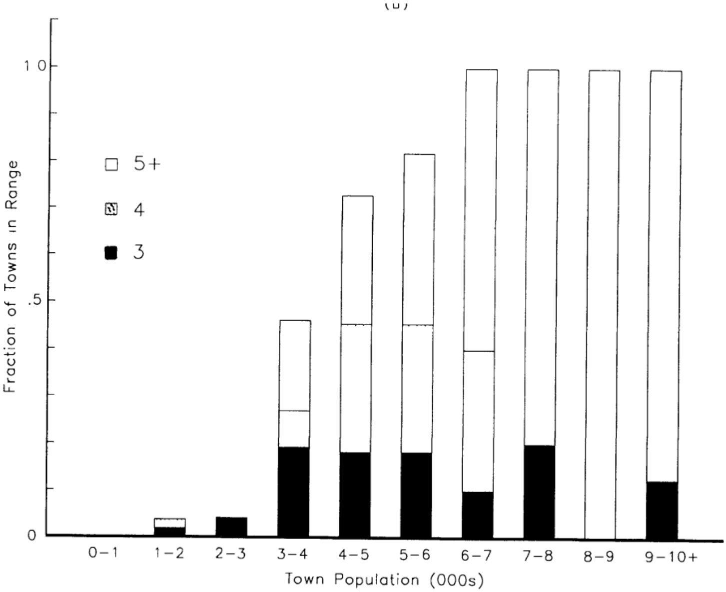


FIG. 3.—Dentists by town population

Results

- For most industries, $\alpha(n)$ and $\delta(n)$ increase with n
- Define $S(n)$ = minimal S such that n firms enter

$$S(n) = \frac{x_m^C \gamma + \delta(n)}{x_m^D \beta - \alpha(n)}$$

  - Varies across industries
- $\frac{S(n)}{n} \approx$ constant for $n \geq 5$
  - Contestable markets (Baumol, Panzar, and Willig, 1982) : an industry can be competitive even with few firms if there is easy entry

TABLE 5

A. Entry Threshold Estimates

Profession	Entry Thresholds (000's) S_1	S_2	S_3	S_4	S_5	Per Firm Entry Threshold Ratios s_2/s_1	s_3/s_2	s_4/s_3	s_5/s_4
Doctors	.88	3.49	5.78	7.72	9.14	1.98	1.10	1.00	.95
Dentists	.71	2.54	4.18	5.43	6.41	1.78	.79	.97	.94
Druggists	.53	2.12	5.04	7.67	9.39	1.99	1.58	1.14	.98
Plumbers	1.43	3.02	4.53	6.20	7.47	1.06	1.00	1.02	.96
Tire dealers	.49	1.78	3.41	4.74	6.10	1.81	1.28	1.04	1.03

B. Likelihood Ratio Tests for Threshold Proportionality

Profession	Test for $s_4 = s_5$	Test for $s_3 = s_4 = s_5$	Test for $s_2 = s_3 = s_4 = s_5$	Test for $s_1 = s_2 = s_3 = s_4 = s_5$
Doctors	1.12 (1)	6.20 (3)	8.33 (4)	45.06* (6)
Dentists	1.59 (1)	12.30* (2)	19.13* (4)	36.67* (5)
Druggists	.43 (2)	7.13 (4)	65.28* (6)	113.92* (8)
Plumbers	1.99 (2)	4.01 (4)	12.07 (6)	15.62* (7)
Tire dealers	3.59 (2)	4.24 (3)	14.52* (5)	20.89* (7)

Note.—Estimates are based on the coefficient estimates in table 4. Numbers in parentheses in pt. B are degrees of freedom.
* Significant at the 5 percent level.

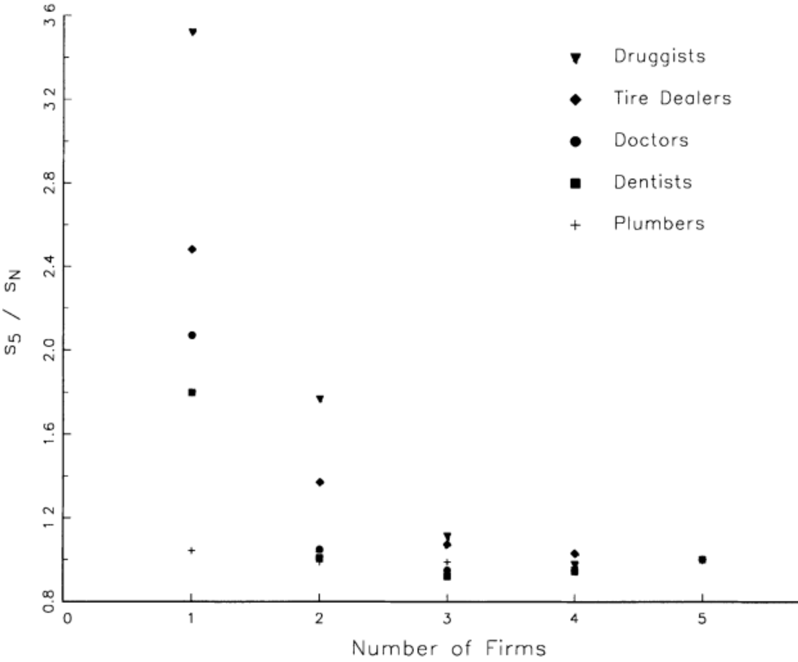


FIG. 4.—Industry ratios of s_5 to s_N by N

Further evidence - prices

TABLE 10

TIRE PRICE SAMPLE DESCRIPTIVE STATISTICS

	Number of Tire Dealers in the Market						
	1	2	3	4	5	1.5	Urban
Candidate phone listings	39	66	48	64	75	*	200+
Surveyed by us	36	22	19	28	21	20	19
At listed number	32	19	19	24	21	17	18
Would respond	28	19	19	23	20	14	17
Total prices quoted	76	52	50	64	49	36	62
Usable price quotations	42	31	40	57	45	17	59
	Sample Means						
Price	54.9	55.7	54.4	51.6	52.0	53.8	45.6
Tire mileage rating (000)	44.5	47.0	47.7	45.4	43.8	43.0	45.3
	Sample Medians						
Price	53.9	55.0	52.9	50.9	49.8	51.7	43.2
Tire mileage rating (000)	45	45	50	40	40	40	45

* Unknown.

Further evidence - prices

TIRE PRICE REGRESSIONS (N = 282)

VARIABLE NAME	ORDINARY LEAST SQUARES (1)	(2)	LEAST ABSOLUTE DEVIATIONS (3)
Constant term	26.4	29.9	29.5
	(4.69)	(4.87)	(4.43)
Monopoly market dummy	1.88	.26	.54
	(2.12)	(2.33)	(2.12)
Duopoly market dummy	1.88	−.62	.96
		(2.42)	(2.30)
Triopoly market dummy	−1.80	−2.60	−2.12
	(2.05)	(2.34)	(2.11)
Quadropoly market dummy	−1.80	−3.36	−2.53
		(2.21)	(2.01)
Quintopoly market dummy	−1.80	−1.99	−2.00
		(2.22)	(2.01)
Urban market dummy	−12.1	−11.0	−11.4
	(2.62)	(2.62)	(2.38)
Mileage rating	.43	.38	.39
	(.05)	(.05)	(.05)
County retail wage	1.00	.62	.74
	(.53)	(.53)	(.49)
Other dummy variables	Michelin brand	11 brands	11 brands
Regression R^2	.43	.51	
F or χ^2 hypothesis tests:			
$\alpha_1 = \alpha_2$	.01	.01	1.1
$\alpha_3 = \alpha_4 = \alpha_5$	.68	.70	2.3
$\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5$	2.82*	2.86*	448*

NOTE.—The omitted category is all towns not satisfying our monopoly market definition. The numbers in parentheses are asymptotic standard errors.

* Significant at the 5 percent level.

Section 3

Other applications

Other applications

- Supermarkets:
  - Bronnenberg, Dhar, and Dubé (2009)
  - Jia (2008)
  - Ellickson (2007)
- Airlines:
  - Berry (1992)
  - Ciliberto and Tamer (2009)
- Radio: Sweeting (2009)

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