Who Thinks About the Competition? Managerial ability and strategic entry in US local telephone markets by Avi Goldfarb and Mo Xiao (2010)

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Overview

- The competitive local telecom industry opened up with the *Telecommunications Act of 1996*. Competitive Local Exchange Carriers (CLECs) of different size, management and experience could now enter local markets.
- Key assumption: the entry decision is made by the CEO, and the strategic ability of management undermines the entry decision.
- A natural real-world experiment in estimating heterogeneity of strategic ability of managers through observable decision to enter a (competitive) market. The subsequent survival of the firm in a follow-up period indicates quality of manager's decision.

Behavioural IO

Motivation: Behavioural model underlying decisions of agents (firms and consumers) can provide either a better fit to observed behaviour, or better explanation for behaviour (e.g. measurable parameters).

- Consumer behaviour: Reference dependence (Thaler 1980), Probability weighing, Loss Aversion (Kahneman and Tversky 1979), Self-Control and Credit Card choices (Heidhues, Koszegi AER '10).
- Firm behaviour: Decisions made by managers who are susceptible to behavioural biases e.g. overconfidence, social preferences (Ho '05) [1].
- Behavioural explanations for entry decisions in laboratory experiments: Overconfidence (Camerer AER '99) and cognitive hierarchy (CHC04).

[1] TH Ho, N Lim and CF Camerer. Modeling the Psychology of Consumer and Firm Behavior with Behavioral Economics. Journal of Marketing Research 2005.

Cognitive Hierarchy model

The Cognitive Hierarchy model (Camerer, Ho, Chong 2004) posits a hierarchy of strategic rationality.

- Type 0 players do not think of their competitors. They either play randomly, or act as if competition is irrelevant to their decision.
- Type 1 players assume all other players are of type 0. Type 2 players assume others are a combination of types 0, and 1.
- Type k players assume all other players are distributed between types 0 and k-1.
- A Poisson distribution describes the distribution of types, and a type k player assumes all other players are distributed with a truncated (between 0 and k-1) version of the same Poisson distribution.

Elegant illustration of the CH model: p-Beauty game (CHC04).

Data

Firm Information:

- 1998 and 2002 CLEC annual reports from NPRG Inc. contains profile of every CLEC in USA.
- Potential Entry Decision: Was the CLEC licensed to operate in the state? *Firm variables:* Year founded, public or private, subsidiary.

Management Information:

- Education information for 90% of CEOs and experience information of 97% of CEOs collected from Who's Who directories, news archives, company websites etc.
- Years of Industry Experience. *Education Variables*: Degree in Economics or Business, Degree in Engineering or Science, Attended undergrad institute with average SAT score $\geq$ 1400, Graduate degree.

Data

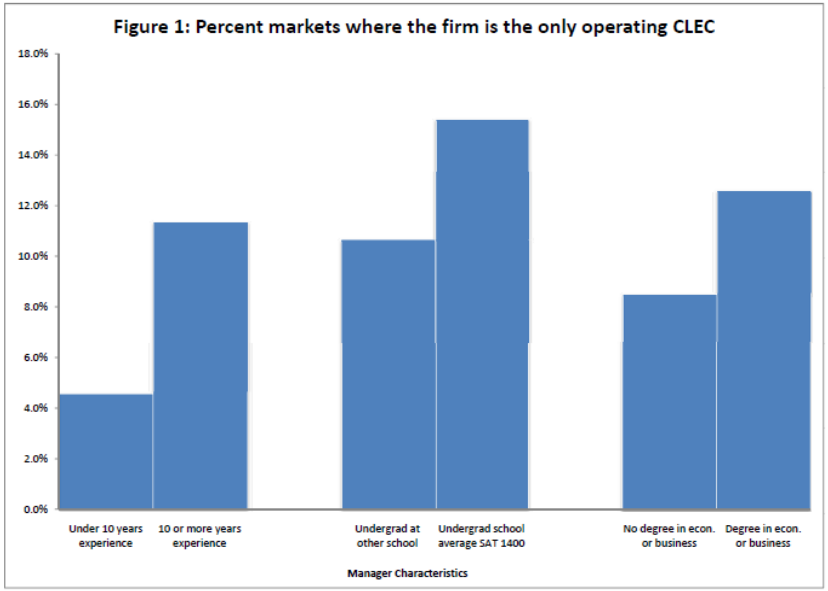
Population Information:

- Location information from 1997 US Economic Census, 2000 US Census and FCC.
- *Population Variables*: Population, household income, racial composition, median age, number foreign born, household size, poverty rate. *Economic variables*: number of establishments, number of employees per establishment, fraction of firms in manufacturing. *Local firm variables*: data on local exchange carrier.

Firm Survival:

- Survivors as set of firms from 1998 data also in 2002 NPRG data.
- Set of firms for which no public evidence of bankruptcy or firm-acknowledge failure was found.

Data Summary



- More experienced managers, managers with top undergrad degrees, and managers with econ / business degrees are more likely to enter markets with fewer competitors. (Table 2a)
- Interaction b/w experience and econ / business degree: potential substitutes.
- Interaction b/w manager characteristics and demographic controls. Not just an issue of entering markets with lower populations.

Model

- $j(j = 1, 2, \cdots, J)$ indexes the firms, and $m(m = 1, 2, \cdots, M)$ indexes markets.
- At a given time period, J_m potential entrants *simultaneously* decide to enter (or stay out of) market m.
- All firms make decisions based on market-level factors (common knowledge) and expected competition from other firms. Firms have heterogeneous ability to infer potential level of competition.
- In each market, each firm draws its type, $k(k = 0, 1, 2, \cdots, K)$ from a Poisson distribution with firm specific parameter τ_i, such that k $Poisson(\tau_j)$.
- τ_j is a deterministic function of firm and manager characteristics, $\tau_j = \exp(\gamma_0 + Z_j\gamma)$. Z_j is vector of covariates affecting strategic ability of firm j. τ_j is public information.

Model

- Type k firm believes a potential competitor has type drawn from a Poisson distribution with parameter τ_i, truncated at $k-1$. [2]
- Upon actual entry, payoff for firm j in market m is given by: $\Pi_{jm} = \beta_0 + X_m\beta + \Psi(\#competitors)_m + \xi_m + \epsilon_{jm}$.
- Payoff depends on: market attributes X_m, number of competitors upon entry, market-specific random term ξ_m, and idiosyncratic error term ϵ_{jm} with a standard normal distribution.
- Based on type of manager of the firm, payoff equation becomes: $E(\Pi_{jm}|k) = \beta_0 + X_m\beta + \Psi E[(\#competitors)_m|X_m, \xi_m, \tau, k] + \xi_m + \epsilon_{jm}$
- Firm j will enter local market if expected discounted value of future payoffs is positive, i.e. $D_{jm} = 1$ if $E(\Pi_{jm}|k) \geq 0$ and $D_{jm} = 0$ otherwise.

[2] Notation: $Poisson(\tau_i, k-1)$

Model Estimation

- Type 0 firm, which does not take competitor entry into consideration, has expected payoff: $E(\Pi_{jm}|0) = \beta_0 + X_m\beta + \xi_m + \epsilon_{jm}$
- Type 1 firm, which perceives all potential competitors as type 0, has expected payoff: $E(\Pi_{jm}|1) =$
  $\beta_0 + X_m\beta + \Psi E[\sum_{i=1,\cdots,J_m}^{i\neq j} D_{im}|X_m, \xi_m, Poisson(\tau_i, 0), 1] + \xi_m + \epsilon_{jm}$
- As k increases, the player is able to make decisions based on nearly correct beliefs of rivals' expected behaviour. Higher types are less likely to make decisions that generate ex-post regret.
- Estimated parameters are $\theta = [\beta_0, \beta, \Psi, \gamma_0, \gamma, \sigma_\xi]$.
- Econometricians can estimate latent ability distribution parameter τ_j, using firm and manager-specific characteristics.
- To estimate θ, evaluate each firm's entry probability by conditioning on all possible types in each market and integrate probabilities over distribution of types. Entry probabilities are matched using *maximum simulated likelihood* procedure (20 draws).

Results

- Overall, strong negative correlation b/w expected number of competitors and level of entry.
- *Experience*: More experienced managers have higher values of τ. Going from 1 to 5 years associated with 26% increase in τ. Older firms have higher values of τ.
- *Education*: Managers with top-level undergrad degree (avg. SAT $\geq$ 1400) have 6.9% higher τ. Managers with Econ / Business degree (and little experience) have 39.6% higher value of τ.
- Having a degree in Econ / Business is strong substitute for industry experience in ability to conjecture competitor behaviour.
- *Ownership*: Subsidiaries of larger companies had lower τ. Possibly the managers had less incentive to be careful in entry decisions, whose loss would be covered by mother company.

Results

- In 1998, average estimated level of τ is 2.59. Corresponds to: 7.5% type 0, 19.4% of type 1, 25.2% of type 2, 21.7% of type 3, 14.1% of type 4, and 12.1% of type 5 and higher.
- in 2002, estimated τ is 4.35. Potential increase due to (i) learning from previous period (1998), and (ii) only firms with high τ survived.
- Predicted τ (using firm characteristics) positively correlated with 1) Survival - as appearing in 2002 reports 2) Survival - as absence of public record of exit through failure 3) Revenue 4) Local phone service revenue.

Identification

Identification of parameters $[\beta, \Psi, \gamma_0, \gamma]$

- Association b/w market characteristics and entry probability variation across markets allows identification of coeff. for demographics (β).
- Confound b/w Ψ and τ: same entry probability attributed to small competition effect and high strategic ability, or large competition effect and low strategic ability.
- Higher τ types behave similarly, thus there is less variation in entry decisions. Whereas large number of 0 and 1 types implies large variation in entry probability. Use first and second moments for given β to identify τ and Ψ.
- Expected number of competitors is endogeneous. Used exogeneous variables - characteristics of other potential entrants in the same market - to predict expected number of competitors.

Issues / Other Explanations

- Strategic ability, defined as cognitive hierarchy level, provides structural framework for capturing firm's estimate of level of competition. Interesting correlations with measurable manager characteristics.
- Big assumption: Manager's ability only affects expected profitability of entry through ability to conjecture number of competitors. Other reasons: better information about other firms, pricing etc.
- No equilibrium predictions. Comparisons with Nash equilibrium models not feasible. Have to limit k to finite levels.
- Estimates of τ are higher than estimates from lab experiments with CEOs (Camerer 2003). Feasible to conduct simple experiments on these company CEOs for calibration?