Experimentation and Entry Threat in Oligopolies

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Idea

• A firm just launched a new product

• Uncertainty over *market demand*
  • Is the product appreciated?

• How can the firm learn about demand function?
  • Pay for experts (e.g. market studies): *Private information*
  • **Experimentation:** *Public information*

• Double edge sword:
  • Help to uncover market demand
  • Information is available to potential competitors

• **Research question:** How does the entry threat change the experimentation level of a monopolist?
  • Can experimentation deter entry?
Framework

- **Two-period model**
  - Nature chooses demand function parameter: $\gamma = \{\gamma, \overline{\gamma}\}$
  - *First Period*: Firm 1 is the monopolist
  - *Second Period*: possible entry of Firm 2 (Entry cost $K > 0$)

- Firm compete via quantity

- $p_t = g(q_t, \gamma) + \epsilon_t$
  - $\epsilon_t \sim U; \text{ i.i.d.}$

- Incomplete and symmetric information:
  - Information cannot be manipulated (or only partially revealed)
  - Information is a *Public Good*
Linear Demand Model

• Simple mathematical framework:

\[ g(q, \gamma) = \begin{cases} \alpha - \beta q & \text{if } q \in [0, \frac{\alpha}{\beta}] \\ 0 & \text{otherwise} \end{cases} \]

• \( \overline{\gamma} = \{\overline{\alpha}, \overline{\beta}\} \) and \( \underline{\gamma} = \{\underline{\alpha}, \underline{\beta}\} \)

• \( \frac{\overline{\alpha}}{\overline{\beta}} > \frac{\underline{\alpha}}{\underline{\beta}} \)
Information Revelation

\[ g(q, \gamma) \]

\[ \bar{\beta} - \beta < 0 \]

\[ g(q, \gamma) \]

\[ \bar{\beta} - \beta > 0 \]
How Does the Game Work?

Nature chooses \( \{\gamma, \gamma\} \)

\[ P = g(q, \gamma) + \epsilon \]

is observed

Firm 1 chooses quantity

Firm 2 makes entry decision

Beliefs are updated

Second period game

Mirman et al. 1993, 1994

Jain 2010
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Second period game

Modifies future profits

Modifies value of information

Modifies experimentation

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Second Period Profits

\[ V_1(\cdot) = V_1^M + V_1^C \]

\[ V_1^M \]

\[ V_1^C \]
First Period Problem

\[ \max_{Q_1} \Pi(\rho^0, Q_1) = \pi_1(Q_1) + \delta \left[ V_1(\rho^0) + \left( \frac{g(Q_1, \gamma) - g(Q_1, \gamma)}{2t} \right) \right] \]

- Net Value of Information
  - If \( V(\cdot) \) were always convex; information would always be valuable
    - Monopolist
  - Value of information is hard to determine \textit{ex-ante} in case of entry threat

Back
High Entry Threat

\[ V_1(\cdot) \]

\[ V_1^M \]

\[ V_1^C \]

\[ \rho \]

\[ \rho^0 \]

\[ \rho \]
Low Entry Threat

\[ V_1(\cdot) \]

\[ V_1^M \]

\[ V_1^C \]

\[ \rho^0 \]

\[ \tilde{\rho} \]

\[ \rho \]
Experimentation and Entry Threat

• **Question**: Does entry threat increase or decrease experimentation?
  - If the value of information is *negative*: decreases experimentation (Remember)
  - If the value of information is *positive*: hard to say ex-ante (Remember)

• Entry threat increase experimentation only if $V_2(0) < K < V_2(\rho^0)$ and $\rho^0 < \hat{\rho}$ (Graphical Intuition)
  - Only bad news can avoid entry
  - Bad news is likely enough

• **Driving Forces**:
  - *Entry Deterrence Effect*
  - *Public Good Effect*
Bayesian Persuasion

- We concentrated on a specific technology: quantity experimentation; uniform distribution

- What happens if we relax the assumption on information technology?

- Opposite case: Firm can design any information disclosure policy

- Pharmaceutical company needs to design pre-test for its new drug:
  - Can choose sample size, technology used etc.

- 'Bayesian Persuasion': Company commits to a distribution over posterior:
  - Probability $\tau$ the posterior is $\rho_s$
  - $1 - \tau$ posterior is $\rho_s'$
  - Bayesian Plausibility: $\rho_0 = \tau \rho_s + (1 - \tau)\rho_s'$
Monopolist

\[ V_1(\cdot) \]

\[ V_1^M \]

\[ 0 \leq \rho \leq 1 \]
Entry Deterrence

\[ V_1(\cdot) \]

\[ V_1^M \]

\[ V_1^C \]

\[ \rho \]

\[ \rho_0 \]

\[ \bar{\rho} \]
Entry Deterrence

\[ V_1(\cdot) \]

\[ V_1^M \]

\[ V_1^C \]

\[ \rho^0 \]

\[ \bar{\rho} \]

\[ \rho \]
Is Full Disclosure Possible?

\[ V_{1}(\cdot) \]

\[ V_{1}^{M} \]

\[ V_{1}^{C} \]

\[ \rho \]
Why is this mechanism important?

- Literature on entry deterrence: does not consider experimentation level
- Literature on experimentation: does not consider entry deterrence effect (exception: Jain (2010))
- Two different settings analysed:
  - Quantity experimentation and *Uniform Technology*
  - No Technological Constraints: *Bayesian Persuasion*
- **Robust Finding**: Entry deterrence and public good effect are robust
- **Non-Robust Finding**: the results depend on the information structure
- **Policy Implication**: Should we incorporate these results in the debate over markets’ liberalization and patents’ protection?