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: $\gamma = \{\overline{\gamma}, \underline{\gamma}\}$
  - *First Period*: Firm 1 is the monopolist
  - *Second Period*: possible entry of Firm 2 (Entry cost $K > 0$)
- Firm compete via quantity
- $p_t = g(q_t, \gamma) + \epsilon_t$
  - $\epsilon_t \sim U$; i.i.d.
- Incomplete and symmetric information:
  - Information cannot be manipulated (or only partially revealed)
  - Information is a *Public Good*

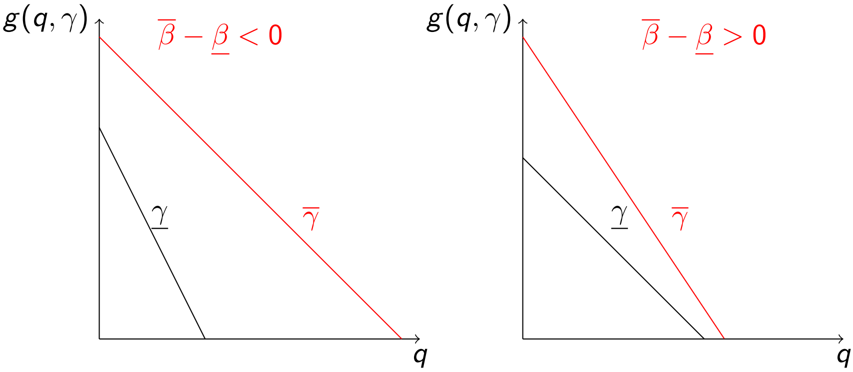
Linear Demand Model

- Simple mathematical framework:

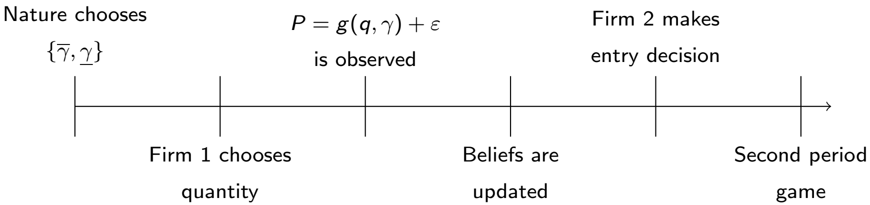
$$g(q,\gamma) = \begin{cases} \alpha - \beta q & \text{if } q \in [0, \frac{\alpha}{\beta}] \\ 0 & \text{otherwise} \end{cases}$$

- $\overline{\gamma} = \{\overline{\alpha}, \overline{\beta}\}$ and $\underline{\gamma} = \{\underline{\alpha}, \underline{\beta}\}$
- $\frac{\overline{\alpha}}{\overline{\beta}} > \frac{\underline{\alpha}}{\underline{\beta}}$

Information Revelation



How Does the Game Work?



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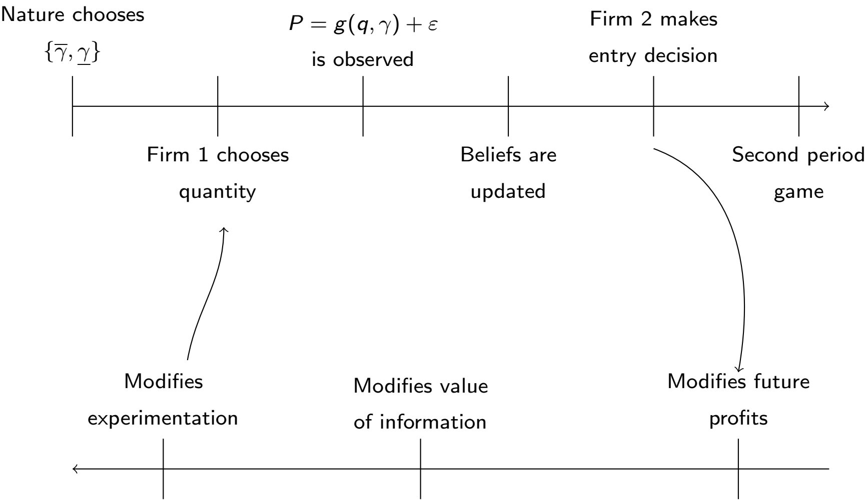

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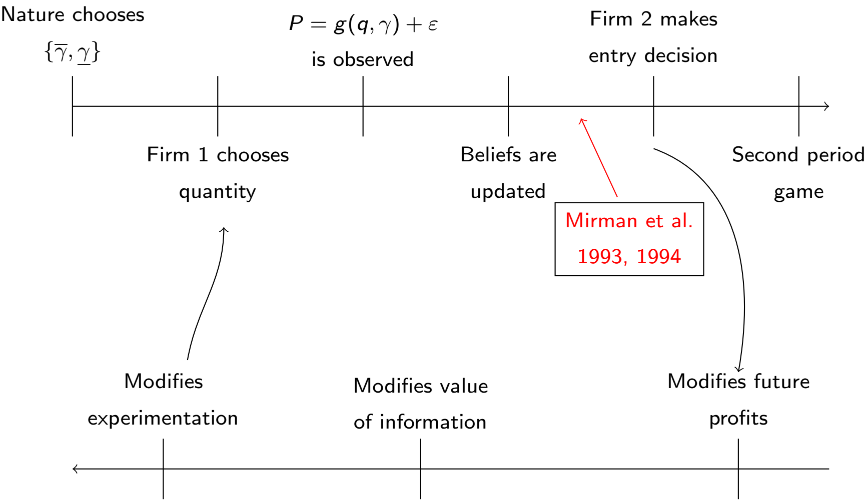

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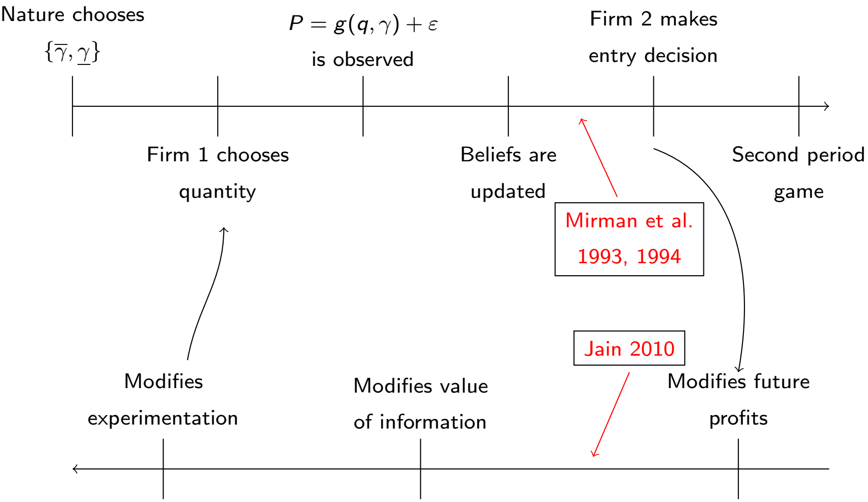
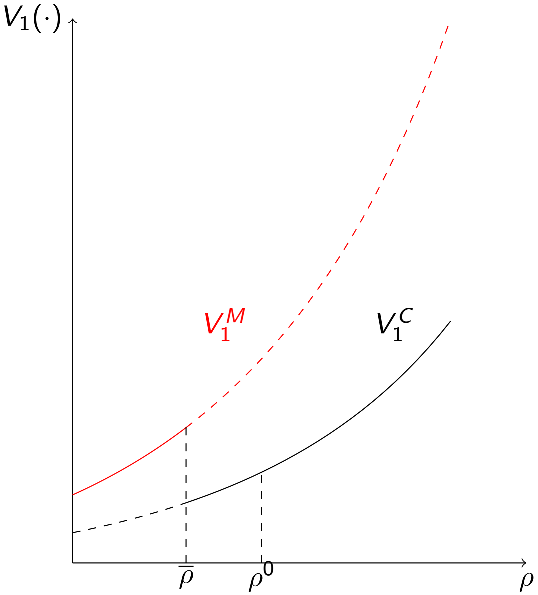
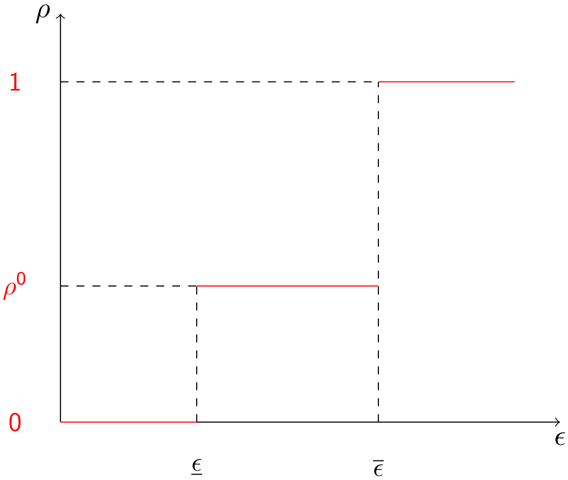


Second Period Profits



Posterior



First Period Problem

$$\max_{Q_1} \Pi(\rho^0, Q_1) = \pi_1(Q_1) + \delta\Bigg[V_1(\rho^0) + \left(\overbrace{\frac{g(Q_1,\overline{\gamma}) - g(Q_1,\underline{\gamma})}{2t}}^{\text{Experimentation Level}}\right)$$

$$\Bigg(\underbrace{\rho^0 V_1(1) + (1-\rho^0)V_1(0) - V_1(\rho^0)}_{\text{Net Value of Information}}\Bigg)\Bigg]$$

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

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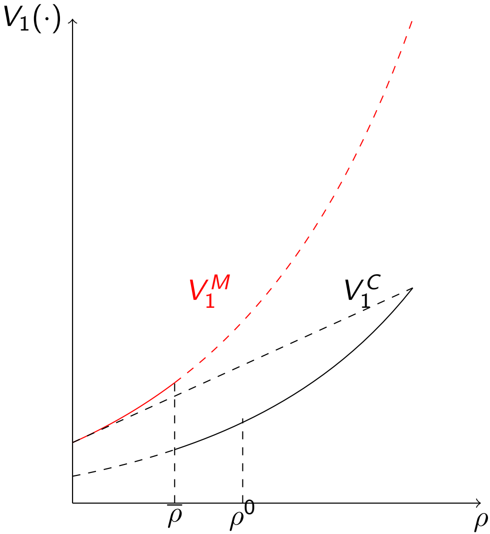
High Entry Threat



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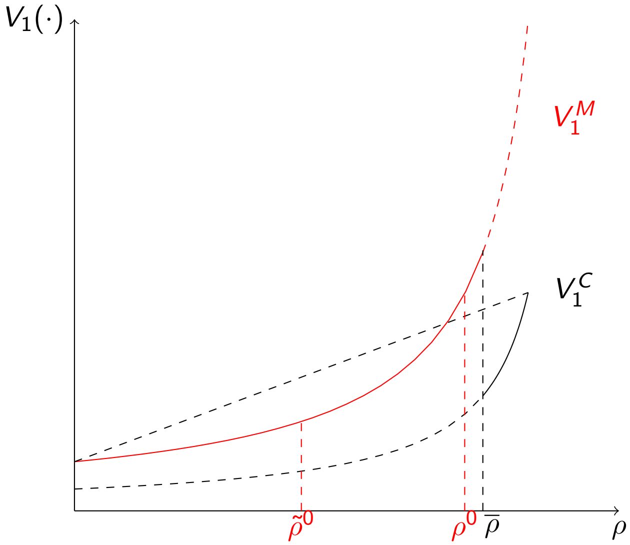
Low Entry Threat



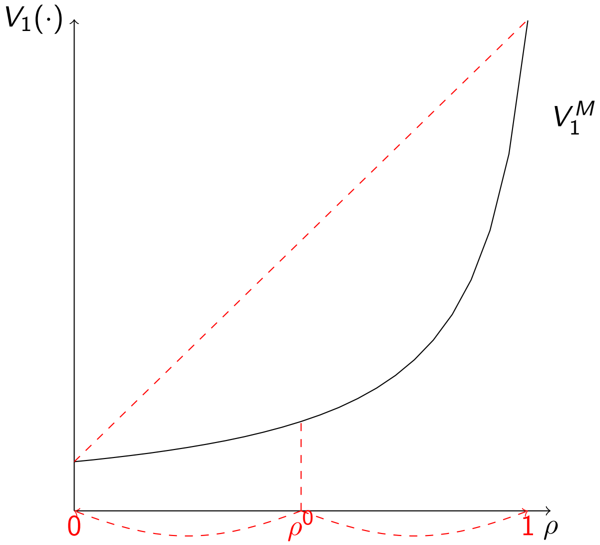
Experimentation and Entry Threat

- **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*

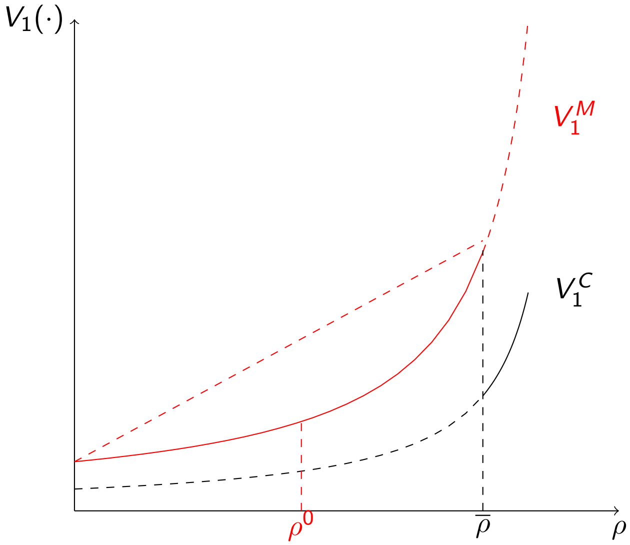
Bayesian Persuasion

- We concentrated on a specific technology: quantity experimentation; uniform distribution
- What happens if we relax the assumption on information tehcnology?
- *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 τ the posterior is ρ_s
  - $1-\tau$ posterior is $\rho_{s'}$
  - Bayesian Plausibility: $\rho_0 = \tau\rho_s + (1-\tau)\rho_{s'}$

Monopolist



Entry Deterrence



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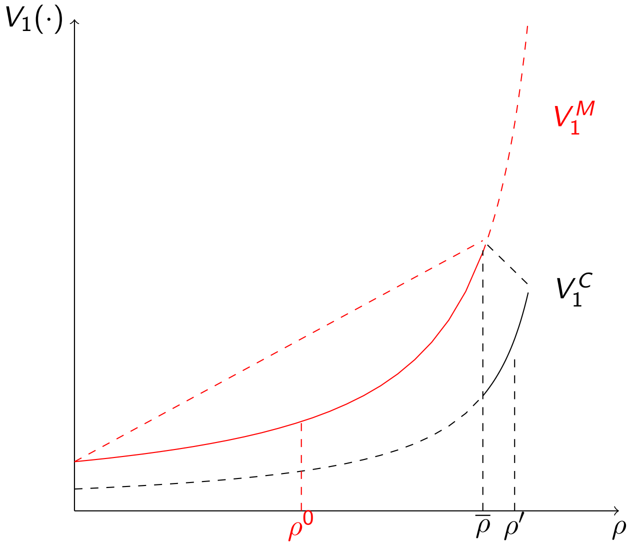
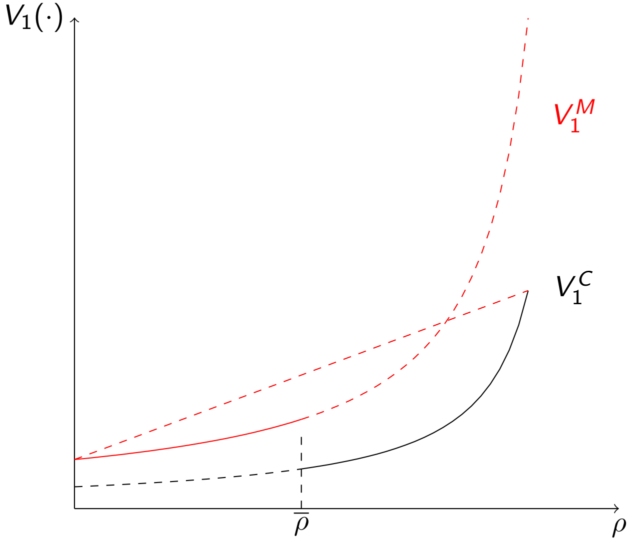


Is Full Dislosure Possible?



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?