Industrial Organization - II

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Oligopolistic Competition: Introduction

In an oligopolistic market structure, a firm no longer encounters a passive environment: strategic interactions b/w players modeled via noncooperative game theory.

Each firm takes into account the influence of its behavior on the market.

Firms use different "instruments" to compete in a market: price, capacities, product characteristics, R&D, etc.

Some instruments can changed more quickly than others: difference b/w short-run and long-run.

Short-run competition: The Bertrand Paradox

Framework:

- Two firms produce the same good (perfectly homogenous) at the same constant marginal cost c.
- For a given market price p, the demand is $D(p)$.
- Timing: Firms simultaneously set their price; then buyers choose.

Demand faced by firm i for a given price p_j set by its rival:

$$D_i(p_i, p_j) = \begin{cases} D(p_i) & \text{if } p_i < p_j, \\ \frac{1}{2}D(p_i) & \text{if } p_i = p_j, \\ 0 & \text{if } p_i > p_j. \end{cases}$$

Profit of firm i:

$$\pi_i(p_i, p_j) = (p_i - c)D_i(p_i, p_j).$$

Short-run Competition: The Bertrand Paradox

Example

Show that $p_1^* = p_2^* = c$ is a Nash equilibrium. Show that it is unique.

The Bertrand paradox: Even a duopoly would suffice to restore perfect competition: marginal cost pricing and no profit!

The Bertrand Paradox: Critical Assumptions

Discussion:

- Search and switching costs.
- Symmetry of cost and constant returns-to-scale.
- Capacity constraints limit the possibility for a firm to undercut its rivals.
- Product differentiation.
- Other “forms” of competition.
- Static analysis implies that a firm does not react when its rival undercuts it.

Bertrand Competition and Asymmetric Firms

Example

- In the Bertrand framework, suppose that $c_1 < c_2$. Determine the equilibrium of the price competition game (Consider that firms do not play weakly dominated strategies).
- Suppose that firms have identical costs given by $C(q)$ with $C'(q) > 0$ $\forall q$. Show that marginal cost pricing is not an equilibrium.

Costless Info Acquisition from the Buyers' Side

Suppose buyers are not informed initially on the firms' prices, choose randomly one firm and discovers that firm's price. If the buyer wants to choose another firm, he has to pay a search cost to discover that firm's price.

There exists an equilibrium in which both firms set the monopoly price:

- Given these prices and the search cost, a buyer has no incentives to visit another firm than the one he has selected randomly.
- Given this behavior from the buyers, a firm has no incentives to decrease its price.

$\rightarrow$ Differentiation b/w firms wrt to search costs (restaurants for tourists vs for locals).

Switching Costs

Framework:

- Two symmetric firms, two periods ($t = 1, 2$). Marginal cost c_t at period t. No discounting ($\delta = 1$).
- One buyer w/ utility $u_t > c_t + s$ at date t.
- Cost $s > 0$ for the buyer to switch from firms b/w dates 1 and 2.
- Firms cannot commit to a sequence of prices.

Switching Costs

At date 2, the firm that sold in period 1 exercises its ex post market power by pricing $c_2 + s$.

Foreseeing this, firms are willing to price at $c_1 - s$ at date 1 to acquire the buyer who will become a valuable follow-on purchaser at date 2

"Bargains-then-ripoffs": introductory offers or penetration pricing [but no predation despite pricing below marginal cost], w/ increasing pattern of prices.

Note that switching costs do not affect the life-cycle price $c_1 + c_2$ (in this simple model); competition is "displaced over time".

Decreasing Returns-to-Scale and Capacity Constraints

Suppose that the demand is:

$$D(p) = 1 - p \Leftrightarrow p = P(q_1 + q_2) = 1 - (q_1 + q_2).$$

Suppose firms are capacity-constrained: $q_i \leq \overline{q}_i \leq \frac{1}{3}$ and that the marginal cost of production is 0 if $q_i \leq \overline{q}_i$ and $+\infty$ otherwise.

An equilibrium of the game is:

$$p_1^* = p_2^* = p^* = 1 - (\overline{q}_1 + \overline{q}_2).$$

We need to show that firm i has no incentive to propose a price $p \geq p^*$. Profit associated with such a deviation:

$$p(\overbrace{D(p) - \bar{q}_j}^{\text{Residual demand of firm } i}) = p\left(1 - p - \bar{q}_j\right), \\ = \left(1 - q - \bar{q}_j\right) q,$$

where q $(\leq \bar{q}_i)$ is the quantity sold by firm i at price p.

But:

$$\frac{\partial}{\partial q}\left[(1 - q - \bar{q}_j)q\right]\Big|_{q=\bar{q}_i} > 0 \qquad (\text{since } \bar{q}_i, \bar{q}_j \leq \frac{1}{3})$$

so that the deviation ($\nearrow$ price or $\searrow$ quantity) is not optimal.

Decreasing Returns-to-Scale and Capacity Constraints

Conclusion: Everything happens as if the firms put outputs equal to their capacities on the market and an auctioneer adjusts the price so that total supply equals total demand.

Reduced-form profit functions:

$$\pi_i(\overline{q}_i, \overline{q}_j) = \left(1 - \overline{q}_i - \overline{q}_j\right)\overline{q}_i,$$

which coincides with the Cournot reduced form.

With large capacities, mixed strategy equilibrium...

... but Kreps-Scheinkman (1983): In a two-stage game in which firms choose first capacities and then compete in prices, the Cournot outcome emerges...

... but Davidson-Deneckere (1984): for rationing rules other than the efficient one, the outcome tends to be more competitive than the Cournot one.

Product Differentiation: Introduction

The Bertrand paradox relies on the fact buyers choose the cheapest firm, even for very small price differences.

In practice, some buyers may continue to buy from the most expensive firms because they have an intrinsic preference for the product sold by that firm: Notion of differentiation.

Two types of product differentiation:

- Horizontal differentiation: for identical prices, buyers choose different products.
- Vertical differentiation: for identical prices, buyers choose the same product.

Common feature: Buyers have different tastes.

Horizontal Differentiation

Spatial competition à la Hotelling (an example of discrete choice model)

Model:

- Buyers are uniformly distributed on a “linear city” of length 1: segment $[0, 1]$.
- Two firms, 1 and 2, are located at the extremities of the city and produce the same good. The unit production cost is c.
- Buyers incur a transportation cost t per unit of length: for a buyer located in x, the transportation cost is tx^2 if he goes to firm 1 and $t(1-x)^2$ if he goes to firm 2.
- Buyers have unit demand and obtain gross utility v if they buy the product.

Horizontal Differentiation

Interpretations:

- For equal prices, a buyer prefers the firm which is closer to his location.
- "Product space" interpretation: Each buyer has specific tastes (characterized by his location) but the number of available products in the economy is limited.

Horizontal Differentiation

Marginal or indifferent buyer $\tilde{x}$:

$$v - p_1 - t\tilde{x}^2 = v - p_2 - t(1 - \tilde{x})^2.$$

Demand faced by the firms:

$$D_1(p_1, p_2) = \tilde{x} = \frac{1}{2} - \frac{p_1 - p_2}{2t},$$
$$D_2(p_1, p_2) = 1 - \tilde{x} = \frac{1}{2} - \frac{p_2 - p_1}{2t}.$$

Profit functions:

$$\pi_i(p_i, p_j) = (p_i - c)D_i(p_i, p_j).$$

Horizontal Differentiation

Example

Suppose that firms set simultaneously their prices. Determine the equilibrium.

Remarks:

- The total demand is constant: $D_1(p_1, p_2) + D_2(p_1, p_2) = 1 \ \forall (p_1, p_2)$.
- For the entire market to be covered at equilibrium, v must be sufficiently large; otherwise, local monopolies.

Horizontal Differentiation: Choice of Product Characteristic

Assume that firm 1 is located at point a, and firm 2 at point $1 - b$ with wlog $a + b \leq 1$:

- $a = b = 0$: maximal differentiation.
- $a + b = 1$: minimal differentiation.

Demands are given by:

$$D_1(p_1, p_2) = a + \frac{1 - a - b}{2} - \frac{p_1 - p_2}{2t(1 - a - b)} = 1 - D_2(p_1, p_2),$$

Profit of firm 1:

$$\pi_1(a, b, p_1, p_2) = (p_1 - c)\, D_1\left(a, b, p_1, p_2\right).$$

The game we consider:

- Firms choose the characteristic of their products/locations;
- Firms choose their prices.

Horizontal Differentiation: Choice of Product Characteristic

Example

Determine the subgame-perfect symmetric equilibrium of this two-stage game.

Horizontal Differentiation: Choice of Product Characteristic

At the second stage, problem of firm 1:

$$\max_{p_1} \pi_1(a, b, p_1, p_2),$$

which leads to:

$$p_1^*(a,b) = c + t(1-a-b)\left(1 + \frac{a-b}{3}\right) \quad p_2^*(a,b) = c + t(1-a-b)\left(1 + \frac{b-a}{3}\right)$$

From the viewpoint of stage 1, problem of firm 1:

$$\max_{a} \Pi_1(a,b) \equiv \pi_1(a,b,p_1^*(a,b),p_2^*(a,b)) = \left(p_1^*(a,b) - c\right) D_1\left(a,b,p_1^*(a,b),p_2^*(a,b)\right).$$

Horizontal Differentiation: Choice of Product Characteristic

Considering an interior equilibrium (in locations), we must have for firm 1:

$$\frac{d\Pi}{da}(a,b) = \underbrace{\frac{\partial \pi}{\partial a}}_{\text{Direct effect}} + \underbrace{\frac{\partial \pi_1}{\partial p_1}}_{=0} \frac{\partial p_1^*}{\partial a} + \underbrace{\frac{\partial \pi_1}{\partial p_2} \frac{\partial p_2^*}{\partial a}}_{\text{Strategic effect}} = 0.$$

Direct effect:

$$\frac{\partial \pi}{\partial a} = (p_1^* - c)\frac{\partial D_1}{\partial a} > 0$$

For a given price set by firm 2, firm 1 wants to get closer (low differentiation) to the center to increase its own demand.

Strategic effect:

$$\frac{\partial \pi_1}{\partial p_2} \frac{\partial p_2^*}{\partial a} < 0$$

Moving away from the center (high differentiation) allows to soften the competition in prices.

Horizontal Differentiation: Choice of Product Characteristic

In the particular model described previously:

$$\frac{d\Pi_1}{da} < 0,$$

so that firms want to differentiate as much as possible!

→ The maximum differentiation principle!

Horizontal Differentiation: Choice of Product Characteristic

A social planner chooses the firms' locations:

$$
\begin{aligned}
W = \max_{a,b}\, & (p_1 - c)\tilde{x} + (p_2 - c)(1 - \tilde{x}) + \int_0^a (v - p_1 - tx)dx \\
& + \int_a^{\tilde{x}} (v - p_1 - t(x - a))dx + \int_{\tilde{x}}^{1-b} (v - p_2 - t(x - \tilde{x}))dx \\
& + \int_{1-b}^{1} (v - p_2 - t(x - 1 + b))dx, \\
= \underbrace{v - c}_{\text{Social surplus}} & \underbrace{- \frac{t}{2}\left[a^2 + (\tilde{x} - a)^2 + ((1 - b) - \tilde{x})^2 + (1 - (1 - b))^2\right]}_{\text{Average transportation cost}}
\end{aligned}
$$

which leads to $a = b = \frac{1}{4}$.

Horizontal Differentiation: Choice of Product Characteristic

Example

Suppose that firms' prices are exogenously fixed but that firms choose the characteristic of their products. Determine the equilibrium of this game.

$\rightarrow$ The minimum differentiation principle (Hotelling (1929))!

Vertical Differentiation

Competition w/ different qualities.

Two firms, $1, 2$, w/ qualities s_1 and s_2 resp., and $\Delta s = s_2 - s_1 > 0$.

Mass 1 of buyers:

- Heterogeneity indexed by θ uniformly distributed on $[\underline{\theta}, \overline{\theta} = \underline{\theta} + 1]$.
- Unit demand, valuation for quality given by:

$$u(\theta, s) = \theta s.$$

- Assume that the market is covered at equilibrium.

The marginal buyer:

$$\tilde{\theta} s_2 - p_2 = \tilde{\theta} s_1 - p_1 \Leftrightarrow \tilde{\theta} = \frac{p_2 - p_1}{\Delta s}.$$

Demand faced by firm 1 and 2:

$$D_1(p_1, p_2) = 1 \times Prob(\theta \leq \tilde{\theta}) = \tilde{\theta} - \underline{\theta} = \frac{p_2 - p_1}{\Delta s} - \underline{\theta},$$
$$D_1(p_1, p_2) = 1 \times Prob(\theta \geq \tilde{\theta}) = \overline{\theta} - \tilde{\theta} = \overline{\theta} - \frac{p_2 - p_1}{\Delta s}.$$

When firms set simultaneously their prices, at equilibrium:

$$p_2^* = c + \frac{2\overline{\theta} - \underline{\theta}}{3}\Delta s > p_1^* = c + \frac{\overline{\theta} - 2\underline{\theta}}{3}\Delta s.$$

Profits:

$$\Pi_2(s_1, s_2) = (2\overline{\theta} - \underline{\theta})^2 \Delta s/9 > \Pi_1(s_1, s_2) = (\overline{\theta} - 2\underline{\theta})^2 \Delta s/9$$

Vertical Differentiation and Entry

When the heterogeneity b/w buyers is low, ie $\overline{\theta} < 2\underline{\theta}$, $p_1^* = c$ and $\pi_1^* = 0$ while $\pi_2^* > 0$: Even though entry is costless, only one firm makes a strictly positive profit at equilibrium

Intuition: A firm which enters the market w/ a low quality cannot compete with the higher quality. A firm which enters w/ a high quality triggers an intense price competition.

Finiteness Property [Shaked-Sutton (1983) and Sutton (1991)]: Price competition b/w high quality firms drives prices down to a level at which there is no room for low-quality products.

Contrast this result with the horizontal differentiation case with no entry cost (see Homework 2, exercise 1).

Vertical Differentiation: Choice of Product Characteristics

Suppose that prior the price competition stage, firms choose simultaneously the quality of their product (s_i for firm i, with $s_i \in [\underline{s}, \bar{s}]$).

Example

Show that there are two equilibria with maximal differentation.

Cournot Analysis

Quantities may sometimes be the relevant variables:

- "Ventes à la criée" on daily markets in which prices adjust so that the quantities of product are sold.
- Tour operators: Approximately 18 months before the season, tour operators decide their offers and book hotel rooms and flights. Once catalogues are determined, prices adjust in the short run.
- As hinted previously, the Cournot reduced form can, *sometimes*, be rationalized with a two stage game in which firms offer a homogenous product and, first, they decide their capacities and, second, they compete in prices.

Cournot Analysis

Two firms, $1, 2$, produce a homogenous product.

Inverse demand function:

$$p = P(q) \quad \text{where } q = q_1 + q_2.$$

Firms choose simultaneously their quantities and then the market price adjusts consequently.

Profit of firm i:

$$\max_{q_i} \pi_i(q_i, q_j) = P(q_i + q_j)q_i - C(q_i).$$

Cournot Analysis

Example

Suppose that $D(p) = 1 - p$ and $C_i(q) = cq$. Determine the Cournot equilibrium. Same question when there are n firms.

The Role of Conjectures

Two firms, same marginal cost c. Products are differentiated:

$$\begin{aligned} q_1 &= D_1(p_1, p_2) = d - p_1 - \sigma(p_1 - p_2), \\ q_2 &= D_2(p_1, p_2) = d - p_2 - \sigma(p_2 - p_1), \end{aligned}$$

with $d > c$ et $\sigma \in [0, +\infty)$.

The Role of Conjectures

Questions:

1. Bertrand-Nash equilibrium:
   - Interpret the demand functions.
   - Equilibrium when firms choose simultaneously their prices.
2. Cournot-Nash equilibrium:
   - Show that demand functions can be expressed as:

$$
\begin{aligned}
p_1 &= P_1(q_1, q_2) = d - \frac{(1+\sigma) q_1 + \sigma q_2}{1+2\sigma}, \\
p_2 &= P_2(q_1, q_2) = d - \frac{\sigma q_1 + (1+\sigma) q_2}{1+2\sigma}.
\end{aligned}
$$

   - Equilibrium when firms choose simultaneously their quantities.
3. Compare the Bertrand and the Cournot equilibria.
4. Show that in, for instance, the Cournot equilibrium, the individual behavior of each firm is the same if it is expressed in terms of quantity or in terms of price.
5. Explain why the difference b/w Cournot and Bertrand comes from the conjectures held by firms, and not on the choices of price vs quantity.

The Nature of Competition

Under perfect competition or monopoly, the equilibrium depends only on the fundamentals of the economy (supply and available technologies, demand and the buyers' preferences)

The Nature of Competition

Under oligopolistic competition, the equilibrium depends *also* on the assumptions made on the anticipations of each firm with respect to the reaction of its rivals following a modification of its behavior.

This highlights the need to study carefully the industry under consideration.

Strategic Interaction

The best-response functions are increasing under Bertrand competition and decreasing under Cournot competition. [Stability condition: absolute value of their slopes is smaller than 1]

Framework:

- Simultaneous game b/w two firms, $i = 1, 2$.
- Firm i's strategy: a_i (price, qty, etc.)
- Firm i's profit function: $\pi_i(a_i, a_j)$.

Strategic Interaction

Firm i's best-response:

$$BR_i(a_j) = \arg\max_{a_i} \pi_i(a_i, a_j) \overset{\text{concavity}}{\Leftrightarrow} \frac{\partial \pi_i}{\partial a_i}(BR_i(a_j), a_j) = 0, \qquad (1)$$

The derivative of $BR_i(a_j)$ indicates how a change in firm j's action affects the choice of action by firm i.

After differentiation of (1):

$$\underbrace{\frac{\partial^2 \pi_i}{\partial a_i^2}}_{<0} \times BR_i'(a_j) + \frac{\partial^2 \pi_i}{\partial a_i \partial a_j} = 0 \Rightarrow \text{Sign}\left(BR_i'(a_j)\right) = \text{Sign}\left(\frac{\partial^2 \pi_i}{\partial a_i \partial a_j}\right).$$

Strategic Interaction

Bertrand competition w/ differentiated products:

$$\pi_i(p_i, p_j) = p_i D_i(p_i, p_j) - C(D_i(p_i, p_j))$$
$$\Rightarrow \frac{\partial^2 \pi_i}{\partial p_i \partial p_j} = \left[1 - \frac{\partial D_i}{\partial p_i} C_i''\right] \frac{\partial D_i}{\partial p_j} + (p_i - C_i') \frac{\partial^2 D_i}{\partial p_i \partial p_j}.$$

Cournot competition w/ differentiated products:

$$\pi_i(q_i, q_j) = P_i(q_i, q_j) q_i - C_i(q_i) \Rightarrow \frac{\partial^2 \pi_i}{\partial q_i \partial q_j} = \frac{\partial P_i}{\partial q_j} + q_j \frac{\partial^i P_i}{\partial q_i \partial q_j}.$$

Remark: Stability condition: $|R_i'(a_j)| < 1$, which implies uniqueness of equilibrium.

Strategic Interaction

Implications:

- To encourage its rivals to be less aggressive on the market, a firm would like to convince them that it will be less (resp. more) aggressive if choices variables are strategic complements (resp. substitutes).
- The incentives to become more aggressive (investment to reduce cost, increase quality, etc.) depends on the anticipation about the reaction of the rivals.
- Same spirit: the incentives to disclose information about its cost.
- Prediction on mergers: A merger b/w two firms make the merging parties internalize the negative externalities there were creating on each other; hence they become less aggressive; positive reaction from the rivals under Bertrand competition, but negative one under Cournot competition.

Market Definition

Market definition is the first step to establish the presence or absence of market power.

The relevant set of products: Not the products which "resemble" each other, but rather the set of products (and geographical areas) that exercise some competitive constraints on each others.

The SSNIP (Small but Significant Non-transitory Increase in Prices) or "hypothetical monopoly test":

- Consider a product and suppose that there exists a hypothetical monopolist that is the only seller.
- Would this hypothetical monopolist find it profitable to increase the price of this product above the current level by $5-10\%$?

Market Definition

If yes, the product concerned does not face significant competitive constraints from other products: separate market.

If no, there exist other products that are substitutes (demand substitutability) enough to exercise competitive constraints: Apply the SSNIP test to a broader market.

There could also be supply substitutability, if producers that are currently producing a different product can switch production if a price rise occurs. For supply substitutability to be a competitive constraint, switching production must be easy, rapid and feasible.

Market Definition

However, the “cellophane fallacy” when applying the SSNIP test to non-merger case: In the case of a firm alleged of abuse of dominant position, the relevant price level is not the *current* level, but the *competitive* one.

When defining the relevant market, many considerations have to be taken into account: the presence of secondary markets, the change of market over time, the geographic dimension, etc.

Assessment of Market Power

Once the relevant market is defined, antitrust agencies measure the market power with market shares (and their persistence over time). In practice: below 40% a firm is unlikely to be considered as dominant, above 50%, dominance can be presumed.

Many other aspects must be taken into account: Ease and likelihood of entry, buyers' power, etc.

Market Power, Market Share and Concentration

Consider the Cournot framework, with n firms:

$$\pi_i(q_i, q_{-i}) = P(Q)q_i - c_i q_i \quad \text{where } Q = \sum_{i=1}^{n} q_i.$$

Optimality condition for firm i:

$$\frac{d\pi_i}{dq_i} = P(Q) + \frac{dP}{dq_i}q_i - c_i = 0 \Leftrightarrow p - c_i = -\frac{dP}{dQ}\frac{dQ}{dq_i}q_i \Leftrightarrow \overbrace{\frac{p - c_i}{p}}^{\text{Lerner index } L_i} = \frac{m_i}{\varepsilon(p)},$$

where $m_i = q_i/Q$.

Define the average Lerner index:

$$L = \sum_{i=1}^{n} m_i L_i = \sum_{i=1}^{n} \frac{m_i^2}{\varepsilon} = \frac{HHI}{\varepsilon}.$$

HHI: Herfindhal-Hirschman Index of concentration: link b/w the degree of industrial concentration and the average degree of market power; used in merger analysis.

Discrimination in Oligopoly

Under monopoly: When the firm has access to more detailed information about its buyers or can use a wider range of instruments, it can do no worse than before.

Under oligopoly: Effects are less clear-cut!

- Impact of more information depends on the kind of information which becomes available.
- Factor for predicting the impact of more information is whether firms agree about which buyers are "strong" and "weak": best-response symmetry/asymmetry.
- Incentives to acquire and share information.

Discrimination in Oligopoly

Hotelling framework:

- Two firms, 1, 2, located at the extremities of $[0,1]$; no production costs. Buyers uniformly distributed on $[0,1]$.
- Buyer's utility if buys from firm i:

$$u_i = v - p_i - t|x - x_i|.$$

- Parameters (v, x, t) independently distributed.
- Market covered at equilibrium.

Buyer w/ preference (v, x, t) prefers firm 1 to firm 2 if:

$$u_1 \geq u_2 \Leftrightarrow p_1 + tx \leq p_2 + t(1 - x).$$

Discriminating on Valuation

Suppose that both firms observe the buyers' valuations v. Suppose moreover that t is observable too.

Firm i's profit from the type-v segment:

$$\pi_i = \left(\frac{1}{2} - \frac{p_i - p_j}{2t}\right) p_i.$$

Equilibrium prices $p_1 = p_2 = t$ do not depend on v.

→ *Profit neutrality result*: Information about "vertical" taste parameter has no effect on outcomes in competitive discrimination; firms could not extract anything extra from high-value buyers due to competitive pressure.

Discriminating on Choosiness

Suppose buyers' brand preference parameter t is unknown to the firms and distributed on $[t_l > 0, t_h]$.

If firms were able to observe t, prices are $p_t = t, \forall t \in [t_l, t_h]$, and industry profit is $\bar{t} \equiv \mathbb{E}\{t\}$.

If firms cannot price discriminate, firm i's market share is:

$$\mathbb{E}\left\{\frac{1}{2} - \frac{p_1 - p_2}{2t}\right\} = \frac{1}{2} - \frac{p_1 - p_2}{2\hat{t}} \quad \text{where } \hat{t} \equiv \mathbb{E}\left\{\frac{1}{t}\right\}.$$

Non-discriminatory prices are $p_1 = p_2 = \hat{t}$, industry profit is $\hat{t}$. Industry profit $\nearrow$ when firms can discriminate according to choosiness b/c $\hat{t} \leq \bar{t}$.

Wrt nondiscrimination, under discrimination both firms set lower (resp. higher) prices for the more (less) price-sensitive buyers; the non-discriminatory price is an "average" of the discriminatory prices: An instance of *best-response symmetry*.

Understanding Best-Response Symmetry

Framework:

- Two markets, A, B w/ independent demands.
- Profit on market k: $\pi^k(p^k)$, $k = A, B$.

Monopoly:

Discriminatory prices:

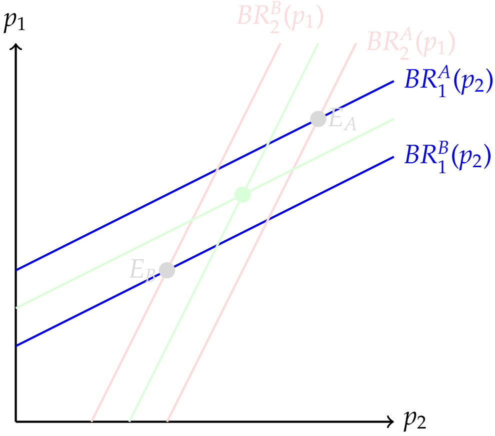
$$(\pi^k)'(p^k) = 0, \quad k = A, B.$$

Non-discriminatory price:

$$\sum_{k=A,B} (\pi^k)'(p) = 0,$$

which implies, for instance: $(\pi^A)'(p) > 0 > (\pi^B)'(p)$: If the monopoly can price discriminate, it will raise its price in the strong market A and reduce it in the weak market B.

Duopoly: Best-response symmetry: Firms do not differ on their judgement of the market, or: $BR_i^A(p_j) > BR_i^B(p_j) \quad \forall i \neq j \in \{1, 2\}$.



Understanding Best-Response Symmetry

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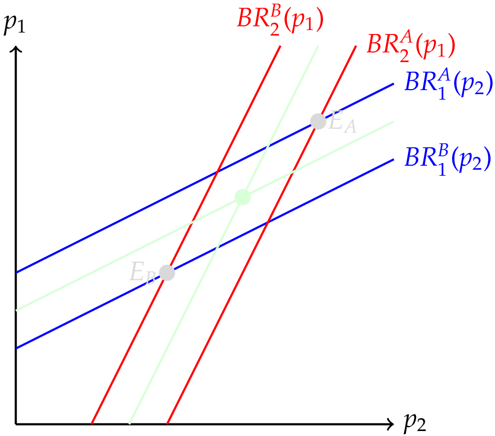

Understanding Best-Response Symmetry

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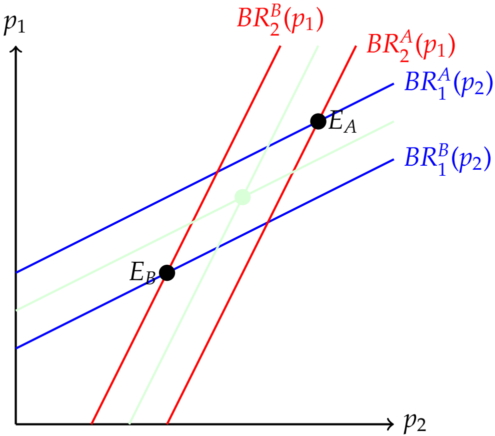

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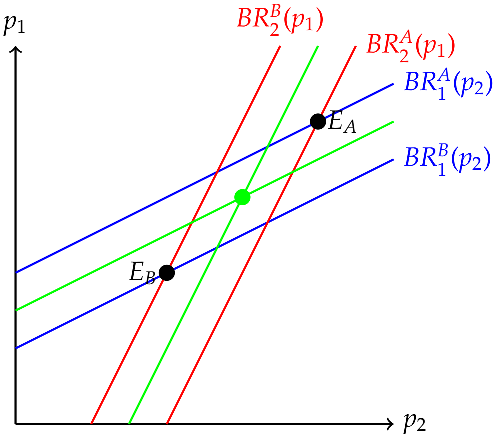


Discriminating on Brand Preferences

In the Hotelling framework, suppose buyers have the same t and that location x is observable.

If firm 2 offers $p_2(x)$ to buyer located in x, firm 1 can profitably serve this buyer if:

$$tx < \overbrace{p_2(x) + t(1-x)}^{\text{Net price if buy from firm 2}},$$

in which case, first, firm 2 sets $p_2(x) = 0$ and, second, firm 1 sets $p_1(x)$ st:

$$p_1(x) + tx = p_2(x) + t(1-x) \Leftrightarrow p_1(x) = t(1-2x).$$

Small x buyers are the strong market for firm 1 (high price p_1) but the weak market for firm 2 (low price p_2): An instance of *best-response asymmetry*.

Discriminating on Brand Preferences

At a symmetric equilibrium, firm 1 sets:

$$p_1(x) = \begin{cases} t(1-2x) & \text{if } x \leq \frac{1}{2}, \\ 0 & \text{if } x \geq \frac{1}{2}. \end{cases}$$

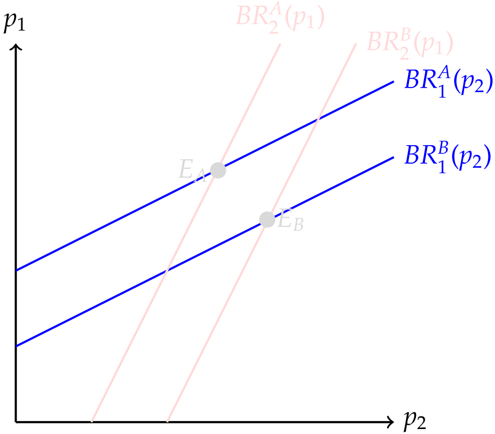
Prices paid by buyers:

$$p(x) = \begin{cases} t(1-2x) & \text{if } x \leq \frac{1}{2}, \\ t(2x-1) & \text{if } x \geq \frac{1}{2}. \end{cases}$$

Under uniform pricing, $p_1 = p_2 = t$.

Price discrimination leads to a fall in equilibrium for *every* market segments!

Duopoly: Best-response asymmetry: Firms differ on their judgement of the market, or: $BR_1^A(p_2) > BR_1^B(p_2)$ and $BR_2^A(p_1) < BR_2^B(p_1)$.



Impact of discrimination depends on the relative importance of the strong and weak markets for each firm.

Understanding Best-Response Asymmetry

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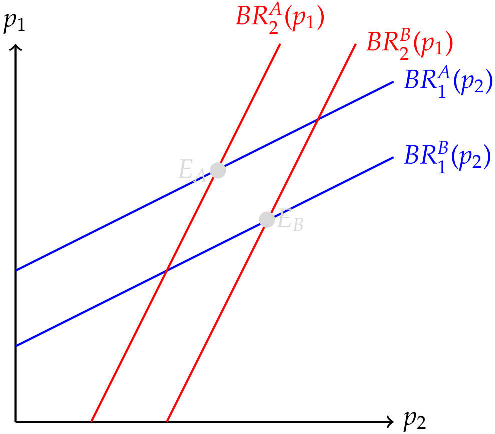

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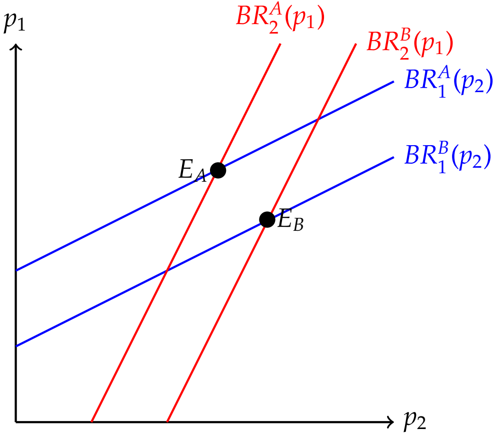

Impact of discrimination depends on the relative importance of the strong and weak markets for each firm.

Communication in Oligopoly

In 2005, the French competition authority has condemned firms for information exchange on volumes of sales (€534M for French telecom operators). Reference to the John Deere case.

From the viewpoint of economic theory: Two relevant frameworks, static or dynamic.

Static approach: communication has an ambiguous impact on competition.

Dynamic approach: communication tends to favor tacit collusion.