

IOSSA Rev Part III. Sources of market power

Chapter 5. Product differentiation



Slides

Industrial Organization: Markets and Strategies

Paul Belleflamme and Martin Peitz, 2d Edition

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Case. Competition in the banking deposit market

- There exists market power
 - Positive intermediation margins
 - Lerner index: US, 23% / Japan, 20% / EU, 15%
- Where does it come from?

1) Consequence of firms' conduct

- Pricing strategy to deter entry (see Part IV)
- Product differentiation

2) Consumer inertia due to (i) lack of information or (ii) switching costs.

- It's time-consuming to compare deposit rates of competing banks
- or moving accounts from one bank to another takes time (and possibly money)

Chapter 5. Learning objectives

- Understand that product differentiation involves two conflicting forces: it relaxes price competition, but it may reduce the demand that the firm faces.
- Be able to distinguish between horizontal and vertical product differentiation.

Views on product differentiation

- Product differentiation depends on consumers' preferences.
- Two cases:
 - Horizontal product differentiation
 - Each product would be preferred by some consumers.
 - Vertical product differentiation
 - Everybody would prefer one over the other product.
 - More formally (naïve definition): if, at equal prices,
 - consumers do not agree on which product is the preferred one → products are *horizontally* differentiated;
 - all consumers prefer one over the other product → products are *vertically* differentiated.

Hotelling model

- Now, **firms choose location and price.**
- 2 stage model
 1. Location choice (long term decision)
 2. Price choice (short term decision)
- Recall (in Chapter 3) the price stage with extreme locations (i.e., 0 and 1).
- We repeat the analysis for any pair of locations
→ 2 scenarios:
 - **Linear** transportation costs (complicated)
 - **Quadratic** transportation costs (easier!)

Quadratic Hotelling model

- Only difference: transport costs increase with the square of distance

$$v_i(x) = r - \tau(x - l_i)^2 - p_i$$

- Indifferent consumer

$$r - \tau(\hat{x} - l_1)^2 - p_1 = r - \tau(l_2 - \hat{x})^2 - p_2 \Leftrightarrow \hat{x} = \frac{l_1 + l_2}{2} - \frac{p_1 - p_2}{2\tau(l_2 - l_1)}$$

- Backward induction: Consider Price stage (stage II)

$$\begin{aligned} & \max_{p_1} (p_1 - c)\hat{x}(p_1, p_2) \text{ and } \max_{p_2} (p_2 - c)[1 - \hat{x}(p_1, p_2)] \\ \rightarrow & \begin{aligned} p_1^* &= c + \frac{\tau}{3}(l_2 - l_1)(2 + l_1 + l_2) \\ p_2^* &= c + \frac{\tau}{3}(l_2 - l_1)(4 - l_1 - l_2) \end{aligned} \quad (\text{unique price equilibrium}) \end{aligned}$$

Quadratic Hotelling model (cont'd)

- Location stage (Stage I)

$$\begin{aligned} \hat{\pi}_1 &= \frac{1}{18} \tau(l_2 - l_1)(2 + l_1 + l_2)^2 & \partial \hat{\pi}_1 / \partial l_1 < 0 \text{ for all } l_1 \in [0, l_2) \\ \hat{\pi}_2 &= \frac{1}{18} \tau(l_2 - l_1)(4 - l_1 - l_2)^2 & \partial \hat{\pi}_2 / \partial l_2 > 0 \text{ for all } l_2 \in (l_1, 1] \end{aligned} \rightarrow$$

- Subgame perfect equilibrium: firms locate at the extreme points → “maximum differentiation”
- 2 forces at play
 - Competition effect** → differentiate to enjoy market power
→ drives competitors apart
 - Market size effect** → meet consumers preferences
→ brings competitors together
 - Balance* depends on distribution of consumers, shape of transportation costs function and feasible product range

Quadratic Hotelling model (cont'd)

- **Lesson:** With endogenous product differentiation, the degree of differentiation is determined by balancing
 - the competition effect (drives firm to \uparrow differentiation)
 - the market size effect (drives firm to \downarrow differentiation).

Vertical product differentiation

- All consumers agree that one product is preferable to another, i.e., has a higher *quality*
- Consumers
 - Quality is described by $s_i \in [\underline{s}, \bar{s}] \subset \mathbb{R}_+$
 - Preference parameter for quality: $\theta \in [\underline{\theta}, \bar{\theta}] \subset \mathbb{R}_+$
 - larger $\theta \rightarrow$ consumer more sensitive to quality changes
 - Each consumer chooses 1 unit of 1 of the products
 - Uniform distribution on $[\underline{\theta}, \bar{\theta}]$, mass $M = \bar{\theta} - \underline{\theta}$
 - Utility for consumer θ from one unit of product i

$$r + \theta s_i - p_i$$

Vertical product differentiation (cont'd)

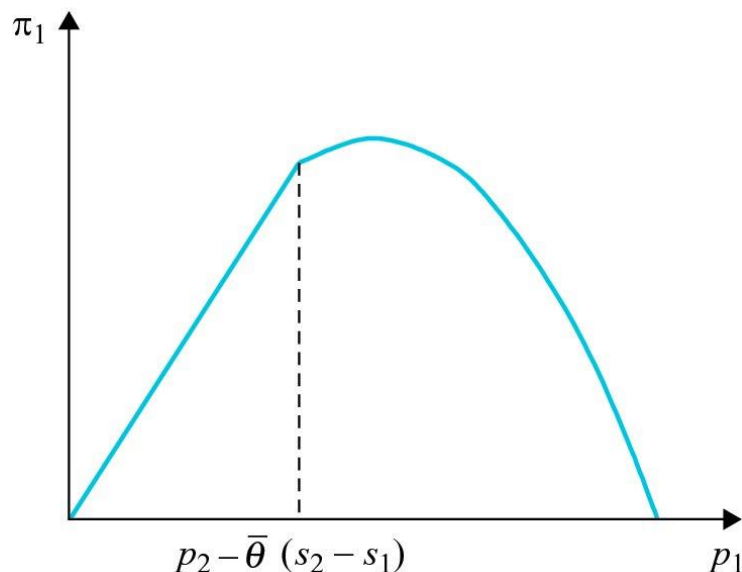
- Firms
 - Duopolists play game:
 1. Choose quality: s_1, s_2
 2. Choose price: p_1, p_2
 - Constant marginal cost, $c = 0$
- Price stage
 - Suppose $s_1 < s_2$
 - Indifferent consumer is determined by the ratio of price and quality differences:

$$r - p_1 + \hat{\theta}s_1 = r - p_2 + \hat{\theta}s_2 \Leftrightarrow \hat{\theta} = \frac{p_2 - p_1}{s_2 - s_1} \text{ for } \hat{\theta} \in [\underline{\theta}, \bar{\theta}]$$

Vertical product differentiation (cont'd)

- Price stage (cont'd)

$$\pi_1(p_1, p_2; s_1, s_2) = \begin{cases} 0 & \text{if } p_1 > p_2 - \underline{\theta}(s_2 - s_1), \\ p_1 \left(\frac{p_2 - p_1}{s_2 - s_1} - \underline{\theta} \right) & \text{if } \underline{\theta}(s_2 - s_1) \leq p_2 - p_1 \leq \bar{\theta}(s_2 - s_1), \\ p_1(\bar{\theta} - \underline{\theta}) & \text{if } p_1 < p_2 - \bar{\theta}(s_2 - s_1). \end{cases}$$



Solving the system of F.O.C.:

$$p_1^* = \frac{1}{3}(\bar{\theta} - 2\underline{\theta})(s_2 - s_1)$$

$$p_2^* = \frac{1}{3}(2\bar{\theta} - \underline{\theta})(s_2 - s_1)$$

(parameter restriction: $\bar{\theta} > 2\underline{\theta}$)

→ Even the price of the low-quality firm increases with the quality difference!

Vertical product differentiation (cont'd)

- Quality stage
 - Substitute for second-stage equilibrium prices in profit function:

$$\begin{aligned}\tilde{\pi}_1(s_1, s_2) &= \frac{1}{9}(\bar{\theta} - 2\underline{\theta})^2(s_2 - s_1) \\ \tilde{\pi}_2(s_1, s_2) &= \frac{1}{9}(2\bar{\theta} - \underline{\theta})^2(s_2 - s_1)\end{aligned}$$
 - Both profits \uparrow in the quality difference \rightarrow equilibrium quality choices:
 - Simultaneous: $(s_1, s_2) = (\underline{s}, \bar{s})$ or (\bar{s}, \underline{s})
 - Sequential: 1st (2nd) chooses highest (lowest) quality

- **Lesson:** In markets in which products can be vertically differentiated, firms offer different qualities in equilibrium so as to relax price competition.

Review questions

- In which industries is product differentiation important? Provide two examples.
- What makes firms locate close to each other in the product space? And what does it make them to differentiate themselves from their competitors?
- When is vertical product differentiation present in an industry? Discuss demand and cost characteristics.