Lecture 5: Spatial Competition and Product Differentiation

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Introduction

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- Lots of examples: cars, news coverage, political parties, etc.

- This opens up other dimensions for competition.

- Could be location, quality, color, attributes, etc.

Product Differentiation

- It is actually hard to define what it means for products are differentiated.

- For the sake of this class, I will use this definition.

Definition 1
A market features **product differentiation** if there is an aspect of a good other than price that enters consumers' utility.

- This can be an attribute: like car color or toothpaste additives.

- It can also be something less tangible like "quality" (reputation or prestige of the brand) or partisanship (of a news channel).

Bertrand with Differentiation

The following example is adapted from N&S Example 15.4.

- Google produces Android and Apple produces iOS. The software licenses are demanded by phone manufacturers and are substitutes.

- Demand for each is given by:

$$q_i = a_i - p_i + p_{-i}/2$$

- The software has a fixed cost to invent of C but has 0 cost per license.

- We can interpret the positive coefficient on price as reflecting the fact that the goods are substitutes.

- a_i reflects unique attributes of each operating system that shift up demand.

- Write down profit and derive the first-order condition when Google and Apple compete in prices.

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- Write down profit and derive the first-order condition when Google and Apple compete in prices.

- Solve for the Nash Equilibrium of the pricing game.

Solving Bertrand with Differentiation

See handwritten notes.

Interpreting Bertrand with Differentiation

- Remember that in regular Bertrand, $p = MC$ and we achieve perfect competition. With unit costs of production, this means 0 profit.

- Now look at profit when we add differentiation:

$$\pi_i^* = \left(\frac{8}{15} a_i + \frac{2}{15} a_j \right)^2$$

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- Intuition: Greater demand for competitor's product (through attribute differences) results in competitor increasing price, which allows me to increase price.

- Broader intuition: Product differentiation can help reduce competition and raise profit.

Spatial Competition is Product Differentiation

- We can think of spatial competition as product differentiation.

- The location of a store determines who pays a transport cost to get there.

- Have you ever wondered why gas stations locate across the street from each other?

- We will eventually answer this question.

Source: Ghetty

Hoteling Model

- **Players.** Two hot dog stands (A and B) on Santa Monica pier with predetermined locations (for now).

- Model the pier as a line segment of length L. Locations denoted as a and b.

- We assume A is to the left, B is to the right.

- Consumers are uniformly distributed on the pier. Denote their location as l.

- Utility for each consumer at location x of a hotdog from location l and price p:

$$u_l = v - p - t(x - l)^2$$

- Notice that if $t = 0$ this is just Bertrand competition!

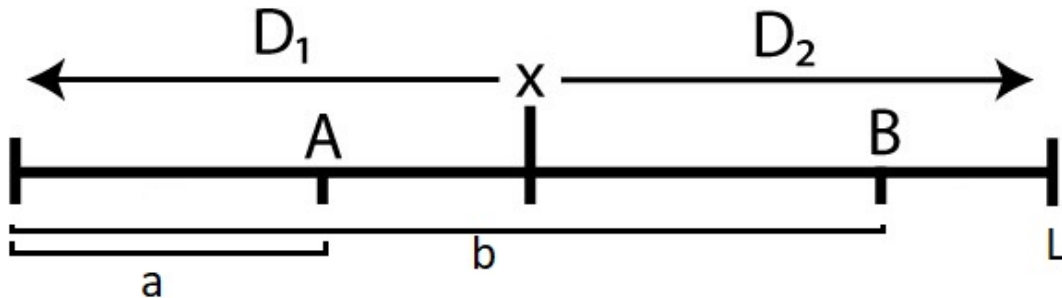- What price is charged in equilibrium?

Solving Hoteling

Photo Credit: Policonomics

Key Insight: We can focus on the indifferent consumer. All people to the left of the indifferent consumer buy from A. All to the right buy from B.

Solving Hoteling

See handwritten notes.

Interpreting Hoteling

- We can take the model literally as describing physical location.

- Can you think of alternative interpretations?

Interpreting Hoteling

- We can take the model literally as describing physical location.

- Can you think of alternative interpretations?

- Or we can think of it as describing quality.

- Or we can think of it as describing political ideology.

- In political science, a similar model is used to discuss voting in a two party system.

- Then the indifferent consumer becomes the median voter.

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- Examine equilibrium profits:

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- One interpretation: higher transport costs make products more differentiated, which softens competition.

General Discussion of Differentiation

- Regular Bertrand: intense competition, resulting in perfect competition outcome.

- Bertrand with Differentiation: product differentiation raises profit/softens competition.

- Hoteling: greater transportation cost/spatial differentiation raises profit/softens competition.

- Diamond product Search: costly search for prices raises profit/softens competition.[1]

- General Result: Product differentiation softens competition.

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[1]See N&S 15.5.3