Kosmas Marinakis, Ph.D.

Lecture 14

Non-price competition

Industrial
Economics

Differentiation

- Consumers care not only about product ***price***, but also about ***characteristics***, ***quality***, ***brand name, location, pre-sale or post-sale services***
- Differentiation can yield ***market power***

  that is, a firm can set its price above the price of another firm and ***still have some demand*** for its product
- Product differentiation is an effort to ***separate*** your product from the competition

  differentiation is in the ***eye of the beholder***
- Differentiation is a ***form of competition***

  thus, it ***alleviates other competition*** in a later stage

Dimensions of differentiation

There are ***two dimensions*** of product differentiation:

1. ***Horizontal differentiation***
   - The perceived difference is ***subjective***
   - ***Different*** consumers pick ***different products*** when prices are the same
   - Differentiation in ***style*** or ***characteristics***
2. ***Vertical differentiation***
   - The perceived difference is ***objective***
   - ***Everyone*** will pick the ***same product*** if prices were the same
   - Differentiation in ***quality***

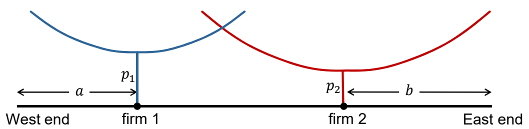
- We will start by examining ***horizontal differentiation***

Hotelling (1929)

- Consider a ***linear city*** of ***length*** L

  consumers are ***uniformly distributed*** with density 1
- Two firms are selling a ***homogeneous*** good with ***cost*** c
  - They locate at ***two random points*** of the line
  - They compete by ***setting prices*** simultaneously
- Consumers incur a quadratic ***transportation cost***

  that is, a consumer at ***distance*** x from firm incurs a cost tx^2

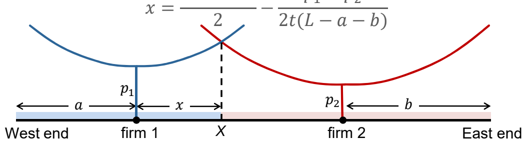


Marginal consumer

- Consumers care for the ***overall cost*** of acquiring the good
  - Not only prices but ***also*** transportation cost
  - They will shop from the ***overall cheapest*** to them firm
- At distance x from firm 1, there is a ***consumer X*** for whom

  $$p_1 + tx^2 = p_2 + t(L-a-b-x)^2$$
- The ***location*** of the ***marginal consumer*** is $a + x$ where

  $$x = \frac{L-a-b}{2} - \frac{p_1 - p_2}{2t(L-a-b)}$$



Equilibrium prices

- The ***quantity*** that ***firm 1*** will sell is $q_1 = a + x$
- The ***quantity*** that ***firm 2*** will sell is $q_2 = L - a - x$
- ***Profit*** for each firm $i \in \{1,2\}$ will be

  $$\Pi_i = (p_i - c) \cdot q_i(x(p_1, p_2))$$
- The ***system of FOCs*** then yields

  $p_1 = c + t(L-a-b)\left(L + \frac{a-b}{3}\right)$ and $p_2 = c + t(L-a-b)\left(L + \frac{b-a}{3}\right)$

  $p_i > c$ as long as firms are in ***different*** locations
- Profits will be ***positive even*** in a simultaneous-move pricing game

  plug p_1, p_2 into Π_i to calculate them

Dynamic setting

- Let us add an ***earlier stage***, where firms ***choose their locations*** simultaneously
- Now we have a ***two-stage dynamic game***:
  - At stage 1 firms choose simultaneously a and b
  - At stage 2 firms choose simultaneously p_1 and p_2
- The timing of the game captures the essence of the ***distinction*** between the ***S-R*** and the ***L-R***

  in the S-R locations are fixed
- We will apply ***backward induction***

  we have ***already solved*** stage 2 – let us see what is going on in ***stage 1***

Choice of location

- ***Profit*** (from stage 1) for firm 1 is

$$\Pi_1 = \frac{t(L-a-b)(3L+a-b)^2}{18}$$

- ***Maximizing*** w.r.t. its location a

$$\frac{d\Pi_1}{da} = -\frac{t(3L+a-b)(L+3a+b)}{18} < 0$$

- To maximize Π_1, firm 1 ***locates to the west end*** $(a = 0)$
- Similarly, firm 2 ***locates at the east end*** $(b = 0)$
- Hence, we obtain ***maximal differentiation***

  in this ***particular*** model

Differentiation

- There are ***two contradicting effects*** in our model:
  1. The ***demand*** effect

     moving towards the rival increases ***market share***
  2. The ***market power*** effect

     moving away from rival increases ***market power***
- In the ***previous setting*** the second effect ***dominates***

  thus, we get ***maximal differentiation***

Economides (1986)

- Hotelling's linear city allows for ***other possibilities***
- For ***transport costs*** tx^α
  - for $\alpha \in [1, \approx 1.26)$ there is ***no equilibrium*** (in pure locations)
  - for $\alpha \in (\approx 1.26, 5/3)$, firms ***somewhat*** differentiate
  - for $\alpha \in [5/3, 2]$, firms differentiate ***maximally***

Extension – fixed prices

- What will happen to the game if we ***remove stage 2***?

  if ***prices are fixed*** and firms compete only in location
- Now, differentiation ***cannot lead*** to ***market power***

  the ***purpose*** of differentiation is to ***alleviate*** competition in stage 2 (iff actions are strategic complements)
- The ***market power effect*** will be ***completely eliminated***

  firms will ***tend to cluster***

$n > 2$ paradox

- Under ***uniform density*** clustering will ***not be an equilibrium*** if $n > 2$
- In fact, an equilibrium in pure locations will ***not exist*** at all
- This paradox can be ***resolved*** in two ways:
  1. ***Non-uniform density*** cities may develop clusters near or between population poles
  2. ***Positive externalities of concentration*** will strengthen the benefit from clustering

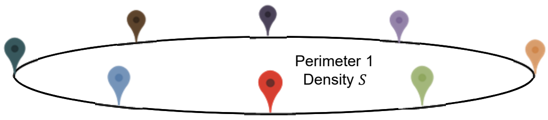
Location and differentiation

- The linear model can easily be interpreted as a ***product differentiation*** rather than a spatial model
  - ***"City"*** can be interpreted as ***differentiation space***
  - ***"Firm location"*** can be interpreted as ***product specification***
  - ***"Consumer location"*** represents ***individual preferences***
  - ***"Transport costs"*** represent ***dis-utility*** from not consuming the preferred variety
- In general
  - Consumers ***benefit*** from product ***diversity***
  - If density is ***not uniform***, consumers with ***less prevalent*** tastes may not get the variety they want

Salop (1979)

- A ***circular city*** of perimeter 1 and density S
- ***Entry*** is open at a ***fee*** f

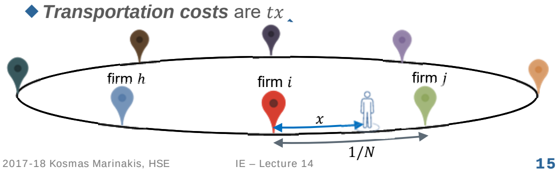
  once a firm settles to a location it ***cannot relocate***
- Stages
  1. ***Entrants scatter*** around the city
  2. ***Bertrand*** competition



Model properties

- ***Distance*** between firms is equal to $1/N$
- Competition is ***localized***

  because of ***symmetry***, every consumer will buy from either firm in the ***vicinity***
- For any ***distance*** x on the perimeter
  - Total ***demand*** is Sx
  - ***Transportation costs*** are tx



Stage 2

- N firms ***have entered*** from the previous stage
- Because of symmetry we can assume that **at equilibrium** all firms set a ***uniform price*** $\bar{p}$
- Now check if any firm i wants to ***deviate*** from $\bar{p}$ to p_i

  recall, firm i competes ***only with its neighbors*** h, j
- A consumer located at distance x from i between h (or j) will be ***indifferent*** between i and h (or j) iff

$$p_i + tx = \bar{p} + t\left(\frac{1}{N} - x\right) \quad \Rightarrow \quad x = \frac{\bar{p} - p_i + t/N}{2t}$$

- Then, ***demand*** for firm i is $q_i = 2 \cdot S \cdot x(\bar{p} - p_i)$

Firm's i problem at stage 2

- Firm i will maximize

$$\Pi_i = (p_i - c) \cdot 2 \cdot S \cdot \frac{\bar{p} - p_i + t/N}{2t}$$

- The FOC is

$$\frac{d\Pi_i}{dp_i} = \frac{S}{t}\left(\bar{p} - 2p_i + \frac{t}{N} + c\right) = 0$$

- Because of symmetry, ***at equilibrium***: $p_i = \bar{p}$, thus

$$\bar{p} = c + t/N$$

- Profit is

$$\bar{\Pi}(N) = S \cdot t/N^2$$

Stage 1

- New firms ***will stop*** entering when

$$\bar{\Pi}(N) = f \quad \Rightarrow \quad S \cdot \frac{t}{N^2} = f \quad \Rightarrow \quad N^* = \sqrt{S \cdot t/f}$$

- ***Maximum number*** of firms increases with
  - Market size, S
  - Transportation cost, t
  - Market can ***accommodate*** less firms if entry is more costly
- Equilibrium ***price*** becomes

$$\bar{p} = c + \sqrt{t \cdot f/S}$$

Thank you!

Kosmas Marinakis
www.kmarinakis.org
kmarinakis@hse.ru

WARNING

This printout is provided as a courtesy, so that lecture time can be dedicated to note taking. These slides are **not standalone material** and should be used strictly as **reference**, side by side with notes taken in the lecture. Studying solely from the slides **is not recommended** and might in some cases **mislead** those who have not attended the relevant lecture. **Less than 5% of tasks in tests and exams can be answered from the slides**.