Lecture 1: Introduction to Industrial Organization

EC 105. Industrial Organization. Fall 2012

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Outline

1. Course Information
2. Overview of the Course
3. Technology and Costs
Course Information
Contact Information

- Office: 301D Baxter; email: mshum@caltech.edu
- Secretary: Barbara Estrada (bestrada@hss.caltech.edu)
- Website: www.hss.caltech.edu/ mshum/ec105.html
  Please check website regularly for announcements; class handouts, notes, & etc
Suggested Textbooks and References

- Standalone lecture notes, supplemented by papers and handouts
- Some suggested textbooks:
Course Policies

- Grades are based on the following weighting scheme: Problem Sets (0.15), Midterm (0.25), Paper/Presentation (0.30), Final (0.30).

- Midterm and Final examinations will be *closed-book*. Collaboration on the examinations is prohibited.

- Paper/presentation will be to find and study real world examples of the phenomena we discuss in this class. Periodic “progress reports” (every 2-3 wks) will be required.

- Collaboration on Assignments is allowed and encouraged, but final solutions must be written independently. Each student should participate fully in solving each problem and understand the answer.

- Late assignments will not be accepted (unless approved by the Dean of Students). The date that an assignment is due will be announced in lecture when the assignment is distributed. Assignments will be due in class at the start of the lecture on the day they are due.
Overview of the Course
Topics to be covered

I. Market structure


II. Firm practices

1. **Incumbent advantage.** Incumbent advantage. Limit pricing and credibility. Dixit model of capacity investment.


4. **Vertical restraints.** Vertical Externalities (Double Marginalization, Downstream Moral Hazard) and Vertical Restraints (Exclusive Territories, Tie-In, Resale Price Maintenance, etc.).
Topics to be covered

III. Information economics


3. Additional topics (as time allows).

Various sections of these lecture notes draw heavily on lecture notes written by Matias Iaryczower (Princeton). ¡Muchas gracias!
The Cost Function

Cost function $C(q)$: **minimum** cost of producing a given quantity $q$

$C(q) = F + VC(q)$, where

- **Fixed costs** $F$: cost incurred regardless of output amount. Avoidable vs. sunk: crucial for determining shut-down decisions for the firm.
- **Variable costs** $VC(q)$: vary with the amount produced.
- **Average cost** $AC(q) = \frac{C(q)}{q}$
- **Marginal cost** $MC(q) = \frac{\partial C(q)}{\partial q}$
- $AVC(q) = \frac{VC(q)}{q}$; $AFC(q) = \frac{F}{q}$; $AC(q) = AVC(q) + AFC(q)$. 
Example

- \( C(q) = 125 + 5q + 5q^2 \)
- \( AC(q) = \)
- \( MC(q) = \)
- \( AFC(q) = 125/q \)
- \( AVC(q) = 5 + 5q \)

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<th>q</th>
<th>AC(q)</th>
<th>MC(q)</th>
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<td>15</td>
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<tr>
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AC rises if MC exceeds it, and falls if MC is below it. Implies that MC intersects AC at the minimum of AC.
Short-run vs. long-run costs:

- Short run: production technology given
- Long run: can adapt production technology to market conditions
- Long-run AC curve cannot exceed short-run AC curve: its the lower envelope

Example: “The division of labor is limited by the extent of the market” (Adam Smith)

- Division of labor requires high fixed costs (for example, assembly line requires high setup costs).
- Firm adopts division of labor only when scale of production (market demand) is high enough.
- Graph: Price-taking firm has “choice” between two production technologies.
The *opportunity cost* of a product is the value of the best forgone alternative use of the resources employed in making it.

**Normal profit** of a product is its selling price minus opportunity cost. Quit when normal profit < 0.

*(vs. *accounting profits*)

**Example:**
- Car factory: a worker would make $5 an hour
- Two brothers, who make one lamp each hour, with materials costing $7
- What is opportunity cost of lamp?
- Normal profit when market price of lamp is $11? $10? $9?
Economies of scale: slope of AC curve

- $AC'(q) < 0$: increasing returns to scale
- $AC'(q) > 0$: decreasing returns to scale
- $AC'(q) = 0$: constant returns to scale
- Example: U-shaped AC curve
- Factors affecting scale economies:
  - Fixed costs
  - Congestion
  - Specialization
- Minimum efficient scale of production: smallest output which minimizes (long-run) AC.
Multiproduct firms: Economies of Scope

- \[ C(q_1, q_2) < C_1(q_1) + C_2(q_2) \]
- Example (common fixed costs):
  - \[ C_1(q_1) = 10 + 2q_1 \]
  - \[ C_2(q_2) = 10 + 3q_2 \]
  - \[ C(q_1, q_2) = 10 + 2q_1 + 3q_2 \]
- Depends on levels of \( q_1, q_2 \):
  - \[ C_1(q_1) = 5 + 2q_1 \]
  - \[ C_2(q_2) = 5 + 3q_2 \]
  - \[ C(q_1, q_2) = 10 + 3q_1 + 2q_2 \]

Consider two output levels: 1 and 2

<table>
<thead>
<tr>
<th>( q_1, q_2 )</th>
<th>( C_1(q_1) )</th>
<th>( C_2(q_2) )</th>
<th>( C(q_1, q_2) )</th>
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Economies of Scope: Ray Average Costs

How to measure economics of scale for multiproduct firms? Need to define appropriate notion of “average costs” for this firm.

- What is AC for a multiproduct firm?
- Assume production of the different products $i = 1, \ldots, N$ in fixed proportions, and let these proportions be $\lambda_1, \ldots, \lambda_N$, with $\sum_i \lambda_i = 1$.
- Let $q_1, \ldots, q_N$ denote production of the different products, and $q = q_1 + q_2 + \ldots$.
- Then define $\lambda_i = q_i / q$, the “proportion” of component $i$ in the total production. Note that $q_i = \lambda_i q$. 
Economies of Scope: Ray Average Costs (contd)

- Example: Shoe factory
  \( q_1 \) is number of right shoes
  \( q_2 \) is number of left shoes
  \( \lambda_1 = 0.5, \lambda_2 = 0.5 \)

- Example: auto (one body plus four wheels)

- Define: **Ray Average Costs** (RAC(\( q \))) for the composite quantity \( q \):
  \[
  C(\lambda_1 q, \ldots, \lambda_N q) = \frac{q}{q}
  \]

- Graph: RAC concept only considers production combinations along “rays”.

- Example: Shoe factory \( C(q_1, q_2) = 100 + 5q_1 + 5q_2 \), then RAC(\( q \)) is
  \[
  \frac{1}{q} \times [100 + 5\lambda_1 q + 5\lambda_2 q] = \frac{100 + 5q}{q}.
  \]

- Slope of RAC(\( q \)) curve determines economies of scale for a multiproduct firm.
Economies of Scope: discussion

Reasons for Economies of Scope

1. Common inputs (cow yields beef and leather)
2. Marketing channels (“umbrella branding”: Regular, Honey Nut, and Apple-Cinnamon Cheerios)
3. Deregulation: leads to consolidation in many sectors (telecom, FIRE). Reveals underlying economies of scope? Are there alternative explanations?
4. Japanese *keiretsu*; Korean *chaebol*
Summary

- Define: cost function
- Returns to scale
- Economies of Scope