Industrial Economics

Introduction and Refresher

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Outline

About Myself

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Overview of Course

1. Refresher class: the firm in competition, consumer surplus and producer profit, rent and social welfare, elasticity, returns to scale, the nature of industrial economics
2. Monopoly, duopoly according to Cournot, Bertrand and Stackelberg, capacity limitations and rationing, equilibrium of monopolistic competition
3. Barriers to entry, Harvard vs. Chicago, limit pricing, strategic use of investments, market foreclosure with long-terms
4. Transaction costs and monopoly power: Hotelling, Coase (1937) and Williamson; location and product differentiation

Overview of Course

5. Vertical integration: double marginalization, franchising and its problems, advantages and disadvantages of vertical integration, market foreclosure through vertical integration
6. Price discrimination: non-linear prices, perfect and imperfect discrimination, self-selection, vertical integration as a substitute for discrimination
7. Contestable markets: conditions of contestability, reversibility and irreversibility of investment, commitment value of installed capacity, war of attrition
8. Network economics: natural monopoly infrastructure, welfare and positive externalities; negative externalities and congestion; price discrimination and customer lock-in

Overview of Course

9. The political economy of antitrust horizontal (antitrust) and vertical (sectoral) regulation; rate of return and incentive regulation; measurement of market power; defining the relevant market
10. Economics of information and knowledge: knowledge, information, training, education, R & D, branding, advertising and software; the issue of codification; the new knowledge economy; positive externalities
11. Risk and informational asymmetries: risk aversion and risk loving; how insurance works; selfselection, agency problems and information asymmetries, "The Market for Lemons" (class game)
12. (a) Globalization and international industrial economy: globalization and migration as extensions of the division of labour (scale and quality effect's); specialization and increasing returns (b) sustainable development and corporate strategy: the optimal internalization of externalities, sustainable development as a long-term risk management approach, the Porter hypothesis

Outline

Introduction

- Industrial economics (IE) studies the behaviour of firms when they are not working under perfect competition.
- IE deals with firms of discrete size, which possess some monopoly power and have the ability to set prices and/or quantities strategically.

Discrete Size

- The fact that firms are of a discrete (non-negligible) size and possess monopoly power, i.e., face a downward sloping demand curve, links industrial economics closely to the phenomenon of increasing returns (synergies).
- The central question of industrial economics is "How can a firm maximize its profit (which usually is surplus profit or monopoly rent)"?
- Firms can use their size strategically. For example, investment (even beyond the optimal size from a technical point of view) can be used as a barrier to entry. The questions of entry, barriers to entry and accommodation thus loom large.

Information

- The absence of perfect competition involves transaction costs and the lack of widespread information.
- Informational issues are everywhere: Branding, research, knowledge, patents, advertising, etc. Information becomes valuable and is itself subjects to strategic behaviour. Firms hide it, seek it, exchange, create or misrepresent it.
- Information, its acquisition and verification are scarce, costly and asymmetric.
- This can lead to so-called agency problems, especially with large firms, including supervision for job performance.

Product Differentiation

- Neither firms nor their goods or their prices are necessarily homogenous.
- There is product and also price differentiation.
- Differentiation is closely linked to transaction costs, e.g. when there are different transport costs between the locations of different firms and customers.
- Internal and external transaction costs pose the question whether a firm should make or buy the intermediate inputs for its final output.
- What is then the optimal size of a firm?
- How deeply should it be vertically integrated?

Regulation

- Finally, in industrial economics there are private and public actors such as governments and regulators.
- Private and general welfare do not always coincide.
- Industrial economics thus poses the questions when is it necessary to intervene in the market, why and how?
- There exist negative (pollution, congestion) and positive externalities (research, networks of all sorts).
- This poses additional questions of great interest, especially in an interconnected world.

Basic microeconomic concepts to be reviewed

- The demand curve, marginal utility, elasticity
- Variables and parameters
- The supply curve, marginal and average cost, rent and profit
- Consumer surplus, rent, profit and producer surplus
- The laws of returns, the monopolization of the market with increasing returns, increasing productivity, synergy, decreasing costs
- Negative and positive externalities

Outline

The firm in competition with rising marginal costs

- often, marginal costs of firms are rising, because
  - fixed size of firm
  - capacity constraints
  - small shop
  - SME
- total cost (TC), marginal cost (MC), average cost (AC)

$$TC = FC + \frac{1}{2}q^2, \qquad MC = q, \qquad AC = \frac{FC}{q} + \frac{1}{2}q$$

- point where average costs (AC) are minimized:

$$\frac{\partial AC}{\partial q} = 0, \Rightarrow -\frac{FC}{q^2} + \frac{1}{2} = 0, \Rightarrow q^2 = 2FC, \Rightarrow q^* = \sqrt{2FC}$$

- for the example of $FC = 8$

$$q^* = 4$$

The firm in competition with rising marginal costs

q	0	1	2	3	4	5	6	7
FC	8	8	8	8	8	8	8	8
TC	8	8.5	10	12.5	16	20.5	26	32.5
AC	na	8.5	5	4.2	4	4.1	4.3	4.6
MC	0	1	2	3	4	5	6	7
P	4	4	4	4	4	4	4	4

- firms make zero profits, why are they willing to participate in the market?

Outline

Rule 1: Maximisation of private profit

- consider a firm that maximizes private profit
- marginal cost may be constant or decreasing
- profits: $\Pi = TR - TC$
- maximizing profits (general form)

$$0 = \frac{\partial(pq - TC)}{\partial q} = p + \frac{\partial p}{\partial q}q - MC = MR - MC$$

- therefore $MR = MC$
- or:

$$p - MC = -\frac{\partial p}{\partial q}q \Rightarrow \frac{p - MC}{p} = -\frac{\partial p}{\partial q}\frac{q}{p} = -\frac{1}{\epsilon_D} > 0$$

where the elasticity is $\epsilon_D = \frac{\partial q}{q} / \frac{\partial p}{p} < 0$

this is also know as Lerner's rule

Maximizing Profits

- fixed cost $FC = 1$, marginal cost $MC = 1$, demand $q = 17 - p$, inverse demand $p = D^{-1}(q) = 17 - q$
- profits: $\Pi = TR - TC = 17q - q^2 - 16 - q$
- maximizing profits:

$$0 = \frac{\partial \Pi}{\partial q} = \frac{\partial((17 - q)q - FC - TVC)}{\partial q} \Rightarrow q^* = 8$$

- alternatively: $MR = MC$, here $MR = 17 - 2q$, $MC = 1$, $\Rightarrow$ $17 - 2q = 1$, $\Rightarrow$ $q^* = 8$

Maximizing Profits

Q	0	1	2	4	6	8	10	12	14	16
TC	16	17	19	20	22	24	26	28	30	32
AC	n/A	17	9.5	5	3.7	3	2.6	2.3	2.1	2
MC	1	1	1	1	1	1	1	1	1	1
P	17	16	15	13	11	9	7	5	3	1
Π	-16	-1	12	32	44	48	44	32	12	-16

- total cost $TC(8) = 24$
- total revenue $TR(8) = pq = 9 \times 8 = 72$
- surplus profit or monopoly rent $\Pi = TR - TC = 48$
- profit can be seen as
  - remuneration of capital under competition
  - surplus profit
  - monopoly rent

Maximizing Profit

- consumer surplus $CS(8) = \text{utility} - \text{price} = ((17-9) \times 8)/2 = 32$
- $\rightarrow$ draw graph
- total surplus $TS = SC + \Pi = 32 + 48 = 80$

Rule 2: Maximizing the total economic surplus

- consider a firm that maximizes total economic surplus
- general rule marginal cost equal marginal utility $MC = MU$
- therefore here $1 = 17 - q$ and $q^* = 16$ with $p^* = 1$; assuming $FC = 16$ as previously
- total cost $TC(16) = 32$
- total revenue $TR(16) = pq = 1 \times 16$
- profit $\Pi = TR - TC = -16$
- consumer surplus $CS = (17 - 1) \times 16/2 = 128$
- total economic surplus $TS = \Pi + CS = 128 - 16 = 112$
- The total surplus is larger but the firm is no longer viable in autonomy and needs to be subsidised by general taxes. This is inconvenient since it will create a deadweight loss.
- $\rightarrow$ graph showing efficiency loss of a unit sales tax

Rule 3: Average cost pricing; ensuring the viability of the firm; quasi-rationality

- consider a firm that prices at average costs
- general rule: $AC = \text{price}$
- therefore here $(16 + q)/q = 17 - q \Rightarrow q^* = 14.93$ and $p^* = 2.07$
- total return $TR(14.93) = pq = 14.93 \times 2.07 = 30.9$
- total cost $TC = 30.0$
- profit $\Pi = TR - TC = 0$
- consumer surplus $CS = (14.93 \times 14.93)/2 = 111.5$
- total surplus $TS = CS + \Pi = 111.5 + 0 = 111.5$
- The difference with the theoretical optimum is minimal and the firm is viable. We will call this quasi-optimality. The average cost pricing is a sensible rule in the regulation of natural monopolies.

Outline

The limitation of monopoly power in the market - monopolistic competition

- We assume entry of a competitor with a non-identical but substitutable product. The degree of substitution degree is determined by the elasticity of substitution:

$$e_{21} = \frac{d(q_2/q_1)}{q_2/q_1} \Big/ \frac{d(p_2/p_1)}{p_2/p_1}$$

- We suppose that everything remains the same except that the individual demand function of the erstwhile monopolist becomes due to the entry of a new competitor:

$$p = D^{-1}(q) = 9 - q$$

Monopolistic Competition

Q	0	1	2	4	6	8	10	12	14	16
TC	16	17	19	20	22	24	26	28	30	32
AC	n/A	17	9.5	5	3.7	3	2.6	2.3	2.1	2
MC	1	1	1	1	1	1	1	1	1	1
P	9	8	7	5	3	1	0	0	0	0

Monopolistic Competition

- The general rule of the profit maximizing firm is still valid: $MR = MC$, and hence $9 - 2q = 1$ and thus $q^* = 4$
- It also holds that entry will take place until profits have been pushed to zero and exit occurs and hence:

$$AC = p, \qquad AC(4) = 5, \qquad p(4) = 5, \qquad \Pi = 0,$$

$$SC = (8 - 4) \times 4/2 = 8$$

- Surely this is much lower than for our initial firm. However, somewhere out there are one or more competitors that create additional surpluses, so final welfare impacts are difficult predict. What is certain that this is a situation much less favourable than the initially protected monopoly for the initial firm.

Recall major differences between competition and monopoly

- Average cost curve (decreasing returns to scale vs. constant or increasing returns to scale)
- Elasticity of demand and market size (market segmentation is a strategy of monopolisation)
- Fixed costs (which if sunk are a deterrent and a barrier to entry)