Industrial Organization 01
Monopoly, Regulation of monopoly, Price discrimination

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Structure

1. What is a monopoly?
2. Why do monopolies exist?
3. Single-product monopoly
   - The inverse elasticity rule and market power
   - The effect of marginal cost on price
4. Multi-product monopoly
5. The social costs of monopoly and its regulation
   - The deadweight loss
   - The rent-seeking phenomenon
   - Monopoly regulation
   - Alternatives to monopoly regulation
6. Price discrimination

What is a monopoly?

Let's assume that a "market" has been defined (definition of the *relevant market*)

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"Dominant" firms:

- Between 50% and 100% of their market
- No significant competitor

Why do monopolies exist?

Sources of monopoly:

- Natural monopoly: due to high entry costs in the industry, economies of scale or scope, it is less costly for one firm to produce than for several
- Entry barriers: due to some market characteristics (high costs or existence of an essential facility) or threats coming from firms already present in the market (strategic barriers)
- Legal restrictions to entry: exclusive licensing, patents, public service concessions...

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Symmetric situation to a monopoly: a single buyer is a *monopsony*

Single-product monopoly

Suppose a market has been defined in which there is only **one firm** (*monopoly*). This firm produces only **one product or service** (*single-product*).

- The demand function is $q = D(p)$, where q is a quantity and p is a price; demand decreases with price:

$$\frac{dD(p)}{dp} < 0$$

- The inverse demand is denoted by $P(q)$
- The production cost for q units of product is denoted by $C(q)$, and we assume that $C'(q) \geq 0$

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- We introduce the *price elasticity of demand*:

$$\varepsilon = -\frac{\partial D}{\partial p}\frac{p}{D}$$

Price elasticity of demand

Definition:

The *price elasticity of demand* measures the sensitivity of demand for a product to its price. Formally, it is defined by the equation:

$$\varepsilon = -\frac{\partial D}{\partial p}\frac{p}{D}$$

Since demand is decreasing, the price elasticity is a positive number

Idea: ε % increase in demand for a 1 % decrease in price

Some examples:

- Water: 0.16 (California), 0.17 (South Africa), 0.21 (Australia)
- Electricity: Residential market 0.20, Professional market 0.10
- Mobile telephony: 3 to 5 in France

The inverse elasticity rule

We use the *price-elasticity of demand* to express the profit-maximizing price

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- What happens when $\epsilon < 1$?

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Attention: except in some special cases (iso-elastic demand curve), the elasticity depends on the price

The inverse elasticity rule and market power

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Corollary of the inverse elasticity rule

The **monopoly's market power** is inversely proportional to the price elasticity of demand

Monopoly and market power

Article 102 of the Treaty on the Functioning of the European Union:

- A dominant position (we assume it is equivalent to a high market share) is not illegal *per se*
- What constitutes a breach of the Treaty is *an abuse of dominant position* (which is a reference to monopoly power)

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Defining a monopoly by "monopoly power" is more robust than defining it by "market share"

- Market definition problems: Apple operates as a monopoly on the Mac market
- A firm with 80% market share could have more market power than a firm with 100% market share

Example: Microsoft's defense against the DOJ

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MS claimed it could not charge a monopoly price because of competition from

- competing products
- potential entrants
- its own installed base
- pirated software

In conclusion, MS had a monopoly *position*, but not a monopoly *power*

An American industrial economist (Schmalensee) calculated that the monopoly price (without these constraints) should have been set between $900 and $2000

Comparative statics

Comparative statics: *variation of an economic variable at equilibium with respect to an exogenous factor*

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- What is the monopoly price $p^m(c)$?

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- What is the monopoly price $p^m(c)$?
- We maximize the profit $(p - c)(1 - p)$ with respect to p, and we have $p^m(c) = (1 + c)/2$, which is increasing in c

Multi-product monopoly

- Let's consider a "multi-product monopoly" that produces 2 goods
- The monopoly sets a vector of prices $p = (p_1, p_2)$ and quantity $q = (q_1, q_2)$
- The demand for good i, with $i = 1, 2$, is $q_i = D_i(p)$
- The cost of production, $C(q_1, q_2)$, is separable:

$$C(q_1, q_2) = C_1(q_1) + C_2(q_2)$$

- The profit maximization problem for the monopoly is then as follows:

$$\max_p \{(p_1 D_1(p) - C_1(q_1)) + (p_2 D_2(p) - C_2(q_2))\}$$

Multi-product monopoly

The first-order condition for good i (1 or 2) is:

$$\frac{p_i - C_i'}{p_i} = \frac{1}{\varepsilon_{ii}} - \varepsilon_{ij}\frac{\left(p_j - C_j'\right)D_j}{p_i D_i \varepsilon_{ii}}$$

with

$$C_i' = \frac{\partial C}{\partial q_i}$$

$$\varepsilon_{ii} = -\frac{\partial D_i}{\partial p_i}\frac{p_i}{D_i} \text{ and } \varepsilon_{ij} = -\frac{\partial D_j}{\partial p_i}\frac{p_i}{D_j}$$

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– If $\varepsilon_{ij} = 0$, the demands are independent: it is as if we had two independent single-product monopoly problems

– Otherwise, we have to adjust the inverse elasticity rule

Substitute goods

If goods 1 and 2 are substitutes, we have $\partial D_j / \partial p_i > 0$, which implies that

$$\varepsilon_{ij} < 0$$

and thus we have

$$\frac{p_i - C_i'}{p_i} = \frac{1}{\varepsilon_{ii}} + \text{a positive term}$$

The monopoly sets higher prices than two independent monopolies would

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$\rightarrow$ The monopoly "internalizes" the negative externality (competition effet) resulting from the substitution between the two goods

Complementary goods

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The monopoly sets lower prices than two independent monopolies

$\rightarrow$ the monopoly "internalizes" the positive externality resulting from the complementarity between the two goods

Inefficiency of monopoly

Two main reasons for the inefficiency of a monopoly:

- The deadweight loss
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But there are other arguments to say that a monopoly situation is efficient:

- In a natural monopoly situation, it is less costly for only one firm to produce than for several firms to produce
- Schumpeterian argument: "Big firms" are more innovative than "small firms"

Measuring social welfare

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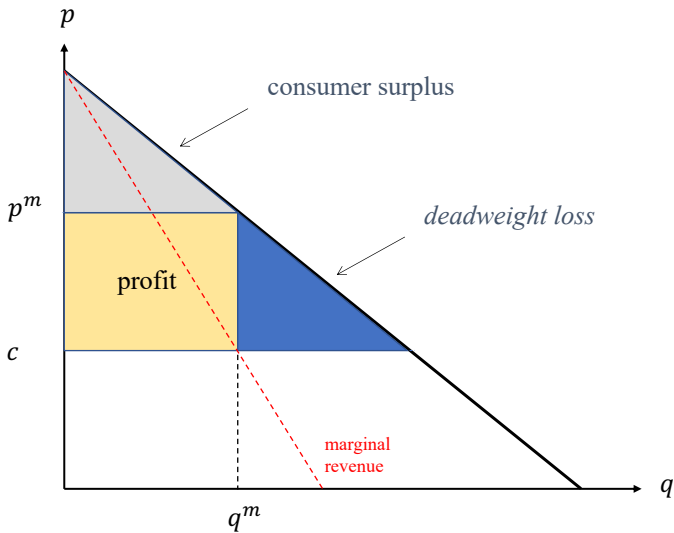
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Total surplus = measure of *social welfare*

The deadweight loss

Deadweight loss: estimations

Some economic studies have attempted to calculate the **deadweight loss** at the national level:

- Worcester (1973) for the US: between 0.4 and 0.7% of GDP
- Cowling and Mueller (1978): between 4 and 13%
- For France: Jenny and Weber (1983): 7.4%

The real social cost of a monopoly

Posner (1975) argues that the deadweight loss, as we have defined it, under-estimates the real social cost of a monopoly

$\rightarrow$ The prospect of monopoly profits could act as an incentive for firms (or any economic agent) to expend real resources to obtain a monopoly situation

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$\rightarrow$ The prospect of monopoly profits could act as an incentive for firms (or any economic agent) to expend real resources to obtain a monopoly situation

$\rightarrow$ Idea of "rent seeking"

At the extreme, a firm might be willing **to spend all of its future monopoly profits**to become a monopoly

Optimal regulation of a monopoly

Principle:

In a market, we achieve *allocative efficiency* when all units of production that generate a positive surplus are produced

- *In other words*: the consumer's willingness to pay for an additional unit should be at least as high as the marginal cost of production
- Efficient allocation of resources = marginal cost pricing

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A simple example

Suppose that $C(q) = F + cq$. What is the efficient price? What is the firm's profit at this efficient price?

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Suppose that $C(q) = F + cq$. What is the efficient price? What is the firm's profit at this efficient price?

- Efficient price: $p^\star = c$
- Leads to a loss for the monopoly: $\pi^\star = -F$

Optimal regulation and balanced budget

- In the previous example, we obtained $\pi^\star = -F < 0$!
- There is a budget balance problem $\rightarrow$ the optimal regulation is not feasible
- **A solution:** give the firm a subsidy of F
- Problem?

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  - Subsidies may be prohibited by law
  - To get F, the regulator or the government should raise a tax, which will lead to a loss of efficiency... higher or lower than the efficiency loss that the regulator is supposed to eliminate
  - A budget transfer from the State to the regulated firm introduces a risk of "rent seeking": we talk about "regulator capture"

Regulation with a budget balance constraint

Principle:

Maximize social welfare under the constraint that the regulated firm has a balanced budget ($\pi \geq 0$)

Single-product monopoly case?

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- More complex: there are many combinations of prices and quantities such that the monopoly firm makes a non-zero profit
- Optimal price combination: "Ramsey-Boiteux" pricing
- Any idea?

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- Any idea?
- Ramsey-Boiteux prices are proportional (but lower) to the inverse elasticity: the idea is to cover the fixed costs by charging more for the least elastic services

Alternatives to regulation

Costs of regulation:

- Information asymmetries (costs, demand)
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- Risks of capture

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Other solutions than regulation?

- Competition "à la Demsetz"
- Contestable markets
- Intermodal competition

Competition "à la Demsetz"

- If competition in the market is not possible, we can organize an auction to grant the market to the firm offering the "highest bid" (i.e., proposing the lowest price for the good)

- Auction for the market = competition "for the market" instead of competition "in the market"

- In a single product industry, if there is no collusion between the bidders, and if production inputs are available to all at a competitive price → competition "à la Demsetz" should lead to average cost pricing

Contestable markets

- Theory of Baumol, Panzar and Willig (1982)
- Competition for the market should lead to the optimum with budget balance without public intervention (such as bidding for the market), if there are no sunk costs
- **Sunk costs** = fixed costs that cannot be recouped when production stops

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- **Sunk costs** = fixed costs that cannot be recouped when production stops
- If the monopoly sets a price higher than marginal cost, competitors will enter and take over the market by setting a slightly lower price (*"hit and run" strategy*)

Intermodal competition

Competition between different "modes" of production

Examples:

- Competition between different modes of transportation: rail versus road for freight
- Competition between different electronic communication networks: telecom networks versus cable TV or satellite networks

Price discrimination

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Examples:

- Student price
- Airline fares ("yield management")
- Volume discounts ("2nd product offered")
- Vouchers ...

Tests

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Stigler test (1987):

$$\frac{p_1}{p_2} \neq \frac{c_1}{c_2}$$

Philips test (1983):

$$(p_1 - c_1) \neq (p_2 - c_2)$$

Conditions for price discrimination

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Resale (or arbitrage) is difficult:

- If the good is a service
- If the warranty applies only to the buyer
- If transaction costs are high (storage costs, search costs...)
- If there is a legal restriction on resale

Pigou classification

Pigou (1920) identifies three forms of price discrimination:

- First degree discrimination (or personalized pricing)
- Third degree discrimination (or group pricing)
- Second degree discrimination (or versioning, or menu pricing). Includes volume discounts (and all forms of non-linear pricing)

These three forms of price discrimination require some level of information about consumers, in decreasing order (1st degree > 3rd degree > 2nd degree)

First-degree price discrimination

Definition (Tirole, 1988)

The producer captures the entire consumer surplus

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Examples of first-degree price discrimination? → Bazaar, fortune teller, Amazon experience (2000)...

What is the deadweight loss? → No deadweight loss...

Remark

If a monopoly implements first-degree price discrimination, allocative efficiency is reached

An example of first-degree price discrimination

First-degree price discrimination is possible when consumers consume more than one unit of the good or service

Let's consider a monopoly telecommunication operator
- All consumers are identical

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What is the optimal price for the monopolist? How can it implement first-degree price discrimination?

An example of first-degree price discrimination

First step: once a consumer has subscribed to the service, he chooses the number of calls q he wants to make to maximize his net utility, $u(q) - pq$, and obtains the following utility from making this optimal number of calls:

$$v(p) = \max_q \{u(q) - pq\}$$

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Third step: let's write $q(p)$ the demand for calls. The monopoly problem is:

$$\max_{p,f} \pi = (p - c)q(p) + f$$

under the constraint that

$$f \leq v(p)$$

An example of first-degree price discrimination

Let's replace f by $v(p)$ and differentiate wrt p (CPO):

$$q(p) + (p-c)\frac{\partial q(p)}{\partial p} + \underbrace{\frac{\partial v(p)}{\partial p}}_{=-q(p)} = 0$$

we have therefore

$$(p-c)\frac{\partial q(p)}{\partial p} = 0$$

such that

$$p^* = c$$

An example of first-degree price discrimination

Result

The optimal price is such that $p^* = c$ and $f^* = v(p^*)$

Intuition:

An example of first-degree price discrimination

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Intuition:

- The monopoly sets a price for calls that maximizes consumer surplus
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- And extracts all the surplus with the subscription price

Remark: all consumers pay the same price

The European car market in the 1990s

Relative margin ($= (p - c)/c$) for a list of car models in Europe (in %)
Source: Verboven (1996)

Car model	Belgium	France	Germany	Italy	UK
Fiat Uno	7.6	8.7	9.8	21.7	8.7
Nissan Micra	8.1	23.1	8.9	36.1	12.5
Ford Escort	8.5	9.5	8.9	8.9	11.5
Peugeot 405	9.9	13.4	10.2	9.9	11.6
Mercedes 105	14.3	14.4	17.2	15.6	12.3

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Ford Escort	8.5	9.5	8.9	8.9	11.5
Peugeot 405	9.9	13.4	10.2	9.9	11.6
Mercedes 105	14.3	14.4	17.2	15.6	12.3

$\rightarrow$ Example of third-degree discrimination (multi-market)

Third-degree price discrimination

Definition

Third-degree price discrimination occurs when the monopoly sets a different price for each of its customer segments and is able to identify which segment each of its customers belongs to

Example: movie tickets

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The price of the good is lower in the market where the demand is the most elastic

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- The monopoly can define an offer to discriminate between the different types of customers
- How? What constraints should be taken into consideration?

Discrimination and competition policy

In the US, the Robinson-Patman Act states that:

... it shall be unlawful...to discriminate in price between different purchasers of commodities of like grade and quality...where the effect of such discrimination may be substantially to lessen competition...in any line of commerce,...or to injure...competition with any person who either grants or knowingly receives the benefit of such discrimination, or with customers of either of them.

Exceptions:

- The price difference reflects the cost difference
- A lower price in response to a lower price of a competitor

Discrimination and competition policy

In Europe, price discrimination in retail markets is not prohibited

Could be abusive on an intermediate market if the firm is dominant and the input offered is important to the buying firms

United Brand case (1978):

- United Brands sold bananas in different European countries
- Cost roughly similar, but wholesale price very different: e.g., price in Denmark > 2 x price in Ireland
- United Brands stated that it priced according what "each market could bear"
- Considered as an abuse of dominant position by the European Commission

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- A monopoly does not necessarily use its market power
- A "multi-product" monopoly sets its prices by taking into account the substitutability or complementarity of the goods
- A monopoly can use its market power even more if it can price discriminate

Take-aways (2)

Monopoly social costs and benefits

Social Benefits

– Efficiency gains if increasing returns

– Investment in R&D (Schumpeter vs. Stiglitz)

– Market power is not necessarily exercised

Social Costs

– Exercise of market power on consumers: deadweight loss

– Dissipation of monopoly rents

– Cost of monopoly regulation (information asymmetry)