Managerial Economics
Unit 3: Perfect Competition, Monopoly and Monopolistic Competition

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OBJECTIVES

- Explain how managers should respond to different competitive environments (or market structures) in terms of pricing and output decisions

- Market Power
  - A firm’s pricing market power depends on its competitive environment.
  - In perfectly competitive markets, firms have no market power. They are “price takers.” They make decisions based on the market price, which they cannot influence.
  - In markets that are not perfectly competitive (which describes most markets), most firms have some degree of market power.
Strategy in the absence of market power

- Firms cannot influence price and, because products are not unique, they cannot influence demand by advertising or product differentiation.
- Managers in this environment maximize profit by minimizing cost, through the efficient use of resources, and by determining the quantity to produce.
**MARKET STRUCTURE**

- **Perfect competition:** When there are many firms that are small relative to the entire market and produce similar products
  - Firms are price takers.
  - Products are standardized (identical).
  - There are no barriers to entry.
  - There is no nonprice competition.
Imperfect competition

- Firms have some degree of market power and can determine prices strategically.
- Products may not be standardized.
- Firms employ nonprice competition.
  - Product differentiation
  - Advertising
  - Branding
  - Public relations
MARKET STRUCTURE

- **Monopolistic competition**: When there are many firms and consumers, just as in perfect competition; however, each firm produces a product that is slightly different from the products produced by the other firms.
  - There are no barriers to entry.

- **Monopoly**: Markets with a single seller
  - Barriers to entry prevent competitors from entering the market.

- **Oligopoly**: Markets with a few sellers
  - There are significant barriers to entry.
<table>
<thead>
<tr>
<th>Market Structure</th>
<th>Examples</th>
<th>Number of Producers</th>
<th>Type of Product</th>
<th>Power of Firm over Price</th>
<th>Barriers to Entry</th>
<th>Nonprice Competition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect competition</td>
<td>Some sectors of agriculture</td>
<td>Many</td>
<td>Standardized</td>
<td>None</td>
<td>Low</td>
<td>None</td>
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<tr>
<td>Monopolistic competition</td>
<td>Retail trade</td>
<td>Many</td>
<td>Differentiated</td>
<td>Some</td>
<td>Low</td>
<td>Advertising and product differentiation</td>
</tr>
<tr>
<td>Oligopoly</td>
<td>Computers, oil, steel</td>
<td>Few</td>
<td>Standardized or differentiated</td>
<td>Some</td>
<td>High</td>
<td>Advertising and product differentiation</td>
</tr>
<tr>
<td>Monopoly</td>
<td>Public utilities</td>
<td>One</td>
<td>Unique product</td>
<td>Considerable</td>
<td>Very high</td>
<td>Advertising</td>
</tr>
</tbody>
</table>
Price and output in a perfectly competitive market

- Price and quantity are determined by the intersection of demand and supply.
- In such an industry it is important to know what drives demand and supply and thus to know what determines prices and revenues.
  - Demand shifters: prices, income, advertising, prices of other products
  - Supply shifters: input cost, technology, research and development

- Output decision
  - A firm in a perfectly competitive market cannot affect the market price of its product.
  - If it would raise the price, consumers would buy at another firm.
  - It can sell any amount of output it wants (given its capacities).
Profit maximization in a perfectly competitive market

- $P = MC$

- Marginal cost curve left of shutdown level (min. variable cost) is supply curve: at least fix cost have to be covered otherwise a firm incurs losses

- $P = MR = MC = AC$

- Firm produces at minimum of average costs!
  - optimal outcome for industry

- In a constant-cost industry an increase in demand will lead in the long term to constant prices (i.e. horizontal supply curve)
  - first, prices increase; but then new firms enter the market and prices decrease again

- (see also book)
Is this a perfect market? www.geizhals.at
### Table 2
Demand for products at Geizhals.at

<table>
<thead>
<tr>
<th>Data sample</th>
<th>All product offers</th>
<th>Censored dataset</th>
<th>Type of LCT</th>
<th>Type of LCT</th>
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<tr>
<td></td>
<td>Clicks</td>
<td>Prod</td>
<td>Subsubc</td>
<td>Prod</td>
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<td>Dependent variable</td>
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<td>(0.059)</td>
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<td>Relative shipping cost</td>
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<td>0.014***</td>
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<td>(0.002)</td>
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<td>Missing shipping cost</td>
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<td>Products</td>
<td>34,128</td>
<td>11,238</td>
<td>8,622</td>
<td>10,909</td>
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</tbody>
</table>
Larger research project on price-setting of firms and demand

- Price dispersion is large
- Coefficient of variation $\approx 0.1$
- Price elasticity $\approx -2.5$
- Seller reputation has big effect
  - (Dulleck, Hackl, Weiss and Winter-Ebmer, German Economic Review, 2011, 395-408)
- Competition has big effects:
  - Ten more firms reduce markup by 2.6 percentage points
    - (Hackl, Kummer, Winter-Ebmer and Zulehner, 2011)
Firms with market power: Monopoly and monopolistic competition

- Explain how managers should set price and output when they have market power

- With monopoly power, the firm’s demand curve is the market demand curve. A monopolist is the only seller of a product for which there are no close substitutes and which is protected by barriers to entry.

- Monopolistically competitive firms have market power based on product differentiation, but barriers to entry are modest or absent.
Example

- Demand function: $P = 10 - Q$
- Total revenue: $TR = PQ = (10 - Q) \times Q = 10Q - Q^2$
- Total cost: $TC = 1 + Q + 0.5Q^2$
  - $FC = 1$ and $VC = Q + 0.5Q^2$
  - $MC = 1 + Q$
- Profits
  - $Profit = TR - TC$
  - Under monopoly (as under perfect competition) the firm maximizes profit, if it sets the output at the point at which marginal revenues are equal to marginal cost
  - $10 - 2Q = 1 + Q \rightarrow Q = 3$ and $P = 10 - 3 = 7$
## TABLE 7.1

Cost, Revenue, and Profit of a Monopolist

<table>
<thead>
<tr>
<th>Output</th>
<th>Price (Dollars)</th>
<th>Total Revenue (Dollars)</th>
<th>Variable Cost (Dollars)</th>
<th>Total Cost (Dollars)</th>
<th>Total Profit (Dollars)</th>
<th>Variable-Cost Profit (Dollars)</th>
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<td>0</td>
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<td>61</td>
<td>-61</td>
<td>-60</td>
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</table>
Total Revenue, Total Cost, and Total Profit of a Monopolist
Marginal revenue

 Unlike perfect competition, MR is less than price and depends on Q.

\[ MR = P[1 + (1/\eta)] = P[1 - (1/|\eta|)] = P - P/|\eta| \]
A profit-maximizing monopolist will not produce where demand is inelastic; that is, where $|\eta| < 1$, because $MR < 0$.

$MC = MR = P[1 - (1/|\eta|)]$; so the profit-maximizing price is

$$MC = P\left[1 - \left(\frac{1}{|\eta|}\right)\right] \text{ or } P = \frac{MC}{\left[1-(\frac{1}{|\eta|})\right]}$$
Marginal Revenue and Marginal Cost of a Monopolist

FIGURE 07-03
Output and Price Decisions of a Monopolist

- **Average total cost**
- **Marginal cost**
- **Average variable cost**
- **Marginal revenue**

**FIGURE 07-04**

Managerial Economics, 7e
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Monopolists produce less, price higher than firms in competitive equilibrium

\[ MR = P(1 + 1/\eta) = MC \]

- Situation is inefficient, insofar as the sum of consumer and producer surplus is concerned
  - Producer surplus = difference b/w marginal cost and price
  - Consumer surplus = difference b/w willingness to pay and price
  - Total welfare = producer surplus + consumer surplus
- Monopolist has to take demand conditions explicitly into account
- Why is no other firm entering the market?
Monopoly and market power

- Market Power: monopolist’s ability to profitably raise price above a certain competitive level (\(=\)marginal cost).

- Impact of market power on social welfare:
  - Allocative efficiency:
    - effect on welfare if market power is exerted
  - Productive efficiency:
    - effect on welfare if market power is exerted by a technologically inefficient firm
  - Dynamic efficiency
    - the incentive to generate new technologies (innovation)
    - incentive to invest in R&D
Allocative Efficiency

- Any price above marginal cost induces a net loss in social welfare.
- Let us compare social welfare under monopoly (maximal market power) with that of perfect competition (zero market power): (Fig. 1)
  - Perfect Competition:
    Total Surplus = area $O_p c S$
  - Monopoly:
    Total Surplus = area $p_mp_c TR + area O_p m R$
  - Net welfare loss of monopoly = area RST
- Conflict of interest between producer and consumers
The determinants of welfare loss

- The **more market power**, the higher the price, hence the higher the welfare loss
  ⇒ inverse relationship between market power and social welfare.

- The **more elastic the demand curve** with respect to price, the lower is the welfare loss.

- The **larger the market** under consideration, the higher the welfare loss.
Rent-seeking activities

- The potential profits available to the monopolist can induce firms to waste resources in **unproductive lobbying activities** aimed at obtaining or maintaining market power.

  ▶ In particular, if other firms try to get the monopoly as well

- In the limit, all the profits created under monopoly may be sacrificed on such activities ("full rent dissipation") (Posner, 1975).

- Conditions for full rent dissipation:

  ▶ competition among the firms involved in rent-seeking
  ▶ the rent-seeking activities do not have any social value
Productive Efficiency

- Additional welfare loss if market power is exerted by a technologically inefficient firm.
- Monopolist may produce at a higher marginal cost than a firm under perfect competition (productive inefficiency).
- Why?
- Managerial slack
  - Managers may not have the right incentives to adopt the most efficient technology
- Darwinian selection mechanism
  - In a competitive market, a selection mechanism similar to the Darwinian type in biology forces market exit by the least efficient firms
Incentive to generate *new technologies* (**innovation**) is lower

**Example:**

- Possibility to introduce a technological innovation at fixed cost $F$ which allows your firm to produce at a lower marginal cost $c_b < c_a$
- **Monopolist** adopts the new technology if: $\Pi_b - \Pi_a > F$
- **New firm under perfect competition** adopts the new technology if: $\Pi_b > F$

$\Rightarrow$ **Monopolist** has lower incentives to innovate because it considers only the additional profit.
Other aspects of monopoly

- “Natural monopoly” if minimum of average cost occurs only at very high output level (minimum efficient scale) ⇒ there is only place for one firm in the market!

- Measure of monopoly power (markup of price over cost):

\[
\text{markup} = \frac{P - MC}{MC}
\]
Sources of monopoly power

- Natural monopoly (public utilities best example, railway tracks), economies of scale,
- Capital requirements on production or big sunk costs on entry
- Patents (17 years), trade secrets (Coke)
- Exclusive or unique assets (minerals, talent)
- Locational advantage (popcorn shop in cinema - but in general you pay rent for these advantages)
- Regulation (TV, taxi, telephone in the past)
- Collusion by competitors
What can a monopolist do? Erect strategic entry barriers

- Excessive patenting and copyright
- Limit pricing (set price below monopoly price)
- Extensive advertising to create brand name to raise cost of entry
- Create intentionally excess capacity as a warning for a price war
Franchising “McFood”

- A franchiser (mother company) with monopoly power gets a fixed percentage of sales, i.e. total revenues
- The franchisee is the residual claimant
  - It gets the full profit - deducting costs.
- What are the incentives for the two partners?
  - Franchiser wants to maximize revenues (MC=0!), better the revenue she gets from the franchisee
  - Franchisee wants to maximize profits
- Other problems like number of shops in a region . . .
- Other examples:
  - Authors and publishers - bargaining power b/w parties
AMD 11.1 Franchiser versus Franchisee?
Cost-plus pricing

- When you ask managers, how they set prices, they always say “related to costs”, but not demand

Two steps:

- The firm estimates the cost per unit of output of the product
  … usually average cost
- The firm adds a markup to the estimated average cost

\[
\text{Markup} = \frac{\text{Price} - \text{Cost}}{\text{Cost}}
\]
Does mark-up pricing maximize profit?

\[ MC = MR = \ldots \quad \Rightarrow \quad P = MC \frac{1}{1 + \frac{1}{\eta}} \]

\[ P = C (1 + \text{Markup}) \]

- Optimal markup easily calculated
- A markup system will maximize profit if:
  - Price elasticity of demand is known
  - Marginal costs are known (in general only average costs are used)
<table>
<thead>
<tr>
<th>Price Elasticity of Demand</th>
<th>Optimal Percentage Markup of Marginal Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>−1.2</td>
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<td>−1.4</td>
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<td>−21.0</td>
<td>5</td>
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<tr>
<td>−51.0</td>
<td>2</td>
</tr>
</tbody>
</table>
So far: firm has only ONE product

No problem, if firm has more products, but they are not related

But

- Demand interrelationship
  - or
- Production interrelationship
The Multiproduct firm

Demand interrelationships

\[ TR = TR_X + TR_Y \]

\[ MR_X = \frac{dTR}{dQ_X} = \frac{dTR_X}{dQ_X} + \frac{dTR_Y}{dQ_X} \]
\[ MR_Y = \frac{dTR}{dQ_Y} = \frac{dTR_X}{dQ_Y} + \frac{dTR_Y}{dQ_Y} \]

- Products can be complements or substitutes for consumers.
Demand interrelationship

- What effect does it have on prices?
  - How should you react with your price-setting behavior???

- Example: Why do you get peanuts for free in Pubs, but you have to pay for tap water?

- What about water in wine bars or coffee shops?
Production interrelationships

- Products are produced jointly for technical reasons
- Example: by-products (Abfallprodukte) in plastic production, oil industry . . .
- Costs of separate production cannot be separated properly. 2 possibilities:
  - A) products always produced in same proportions
  - B) substitution in production possible
Optimal Pricing for Joint Products Produced in Fixed Proportions (Case 1)
Optimal pricing: fixed proportions

- By producing one good, you automatically produce the other

- Total marginal revenue curve: The vertical summation of the two marginal revenue curves for individual products

- Pricing rule: Total marginal revenue curve = marginal cost
  - The marginal revenue (from both products) you get once you produce one more unit
Optimal Pricing for Joint Products Produced in Fixed Proportions (Case 2)
Example: Profit maximizing at Humphrey

- One piece of metal = two table legs in two designs
- Total cost function: $TC = 100 + Q + 2Q^2$
- Demand: $P(A) = 200 - Q(A)$ and $P(B) = 150 - 2Q(B)$
- Total revenue:
  - $TR = P(A)Q(A) + P(B)Q(B)$
  - $= (200 - Q(A))Q(A) + (150 - 2Q(B))Q(B)$
  - Humphrey wants to sell all they produce: $Q(A) = Q(B) = Q$
  - $\rightarrow TR = 350Q - 3Q^2$
Example: Profit maximizing at Humphrey

Profits:

\[ \Pi = TR - TC = \ldots = -100 + 349Q - 5Q^2 \]

\[ \text{FOC: } 349 - 10Q = 0 \rightarrow 10Q = 349 \rightarrow Q = 34.9 \]

\[ P(A) = $165.10 \text{ and } P(B) = $80.20 \]

Finally check, whether MR(A) and MR(B) are nonnegative.
Joint products: variable proportions

- Output A can be substituted for output B
- Iso-revenue curve: combination of output levels A and B with same revenue
- Iso-cost curve: combination of output levels A and B with same costs
- Tangency condition
FIGURE 13.3 Optimal Outputs for Joint Products Produced in Variable Proportions
Production interrelationship: variable proportions

Output of Joint Products: Variable Proportions

- Optimal combinations of goods are found where isocost and isorevenue lines are tangent.
- Optimal total production is found where profit is maximized, which occurs at a point of tangency where the difference between cost and revenue is maximized.
Monopsony: Markets that consist of a single buyer

- Contrast with monopoly markets that consist of a single seller
- Buyers on a competitive market face a horizontal supply curve; they are price takers.
Monopsony: Markets that consist of a single buyer

- There is only one buyer on a monopsony market, and this buyer faces the upward-sloping market supply curve, which means that marginal cost is above the supply price.
- Under monopsony, the buyer will purchase a quantity where marginal cost is equal to marginal revenue product and pay a price below marginal cost.
Example: Monopsony labor market

- Labor supply: $P = c + eQ$
- Total cost: $C = PQ = (c + eQ)Q$
- Marginal cost: $\frac{\Delta C}{\Delta Q} = c + 2eQ = MC$
- Figure 7.8: Optimal Monopsony Pricing
- The wage ($P$) and quantity hired ($Q$) are both less than at the competitive equilibrium
Optimal Monopsony Pricing

FIGURE 07-08
Characteristics of monopolistic competition

- Product differentiation - products are not perceived as identical by consumers
- Managers have some pricing discretion, but because products are similar, price differences are relatively small.
- Competition takes place within a product group.
  - Product group: Group of firms that produce similar products
- Demand curve not completely flat
Conditions that must be met, in addition to product differentiation, to define a product group as monopolistically competitive:

- There must be many firms in the product group.
- The number of firms in the product group must be large enough that no strategic motives possible (no retaliation).
- Easy entry and exit into the market.
Behavior of monopolistically competitive firms

- Firms in an “industry group” are similar i.e. they have the same incentives
- What happens if firm changes price alone? (dd)
- If all firms change price? (DD)
  - → demand is steeper in this case
  - ▶ In the extreme: a very small firm - changing the price alone - has a very flat demand curve!
- Marketing is important: firms want to make their product “unique”, in other words:
  ▶ Demand for their product should get more inelastic (steep)
  ▶ Use advertising!
Demand curve if the firm (dd) or the whole industry (DD) changes price.
Short-run and long-run equilibrium

- Like a monopolist: set price where
  - marginal revenue = marginal cost

- Profits arise

- \( \rightarrow \) market entry of similar products (firms)

- Each firm competes for a percentage of total demand, new entry means
demand for the individual firm must be lower (shifts left/down)

- Shift must be so far, that profits disappear

- I.e. Demand curve must finally be tangential to long-run average cost curve
Figure 11.8 Short-Run Equilibrium in Monopolistic Competition
Long-run equilibrium

- Profits in the market attract new entrants
- Due to market entry demand shifted to the left for the firm
- Zero profit condition met (Revenue=Costs)
- Profit-maximization condition met (MC=MR)
- Problem: production is not cost-efficient
  - Long-run average costs not at minimum
  - "cost" of product variety
Monopolistic Competition: summing up

- Very common market form
- No interaction between firms
- Firm could reduce average cost by producing more
- Firms try to bind their customers to the firm:
  - Marketing, advertising plays a role (not in perfect competition)
  - Make the product different from the crowd
Optimal advertising rule

- For small variations in output (and/or) if the firm is only small part of the market, we can assume that price and marginal cost do not change following small changes in advertising.

- To determine optimal advertising, cost of advertising and cost of production must be considered.

- Simple rule: do so much advertising that...

  \[
  \text{Marginal revenue from an extra euro of advertising} = \eta \text{ (elasticity of demand)}
  \]
Optimal advertising rule

- Marginal revenue from an extra euro of advertising $= \eta$

- Recall: $MR = P(1 + 1/\eta)$
  - $P - MC$ are gross profits from an additional unit of output (not taking advertising expenditure into account)
  - Set advertising such, that add. profit from adv. is equal to cost
  - $\Delta Q (P - MC) = 1$
  - $\Rightarrow P\Delta Q = P/(P - MC)$
  - Substitute for $MC = MR$, then we see that
    - Left side is marginal revenue from advertising
    - Right side is elasticity of demand
Optimal advertising rule

- Marginal revenue from an extra euro of advertising $= \eta$

- Assume: $\eta = -1.6$

- Suppose, however, managers believe that an extra $100,000$ of advertising will increase sales by $200,000$.

  $\rightarrow$ this implies an effect of $2$ rather than $1.6$

- In this case the manager can increase profits by advertising more as the marginal revenue exceeds the absolute value of the price elasticity

- To maximize profits managers should increase advertising to the point where the return to an extra euro of advertising falls to $1.6$
Optimal advertising expenditure: advertising meant to increase brand consciousness of clients

- With little advertising, elasticity will be high, because product will be considered as easily substitutable to others,
- Increase advertising and elasticity will fall
Advertising can have two effects:

- **High-price strategy**: increase brand consciousness, don't talk about price:
  - Price elasticity of demand should decrease (demand curve should get steeper)

- **Low-price strategy** “promotions”, i.e. increase sales:
  - Advertise price cuts which should increase price consciousness of customers, i.e. price elasticity should increase
Price elasticity and advertising

<table>
<thead>
<tr>
<th>Brand</th>
<th>Advertised price change</th>
<th>Unadvertised price change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chock Full o’nuts</td>
<td>8.9</td>
<td>6.5</td>
</tr>
<tr>
<td>Maxwell House</td>
<td>6.0</td>
<td>*</td>
</tr>
<tr>
<td>Folgers</td>
<td>15.1</td>
<td>10.6</td>
</tr>
<tr>
<td>Hill Brothers</td>
<td>6.3</td>
<td>4.2</td>
</tr>
</tbody>
</table>

* Not significantly different from zero.

Source: Katz and Shapiro, “Consumer Shopping Behavior in the Retail Coffee Market.”
Evidence

- Promotions do increase the price elasticities of consumers.
- Promotions have less effect on brand loyalists.
- The effects of promotions decay over time.
- Price elasticity of non-loyalists was found to be four times that of loyalists in one study.
- The effects of advertising on brand loyalty erode over time and price becomes more important to consumers.