IOA notes

Chapter 2 – Consumers

2.1 – Consumer preferences and demand

“Creating demand: Move the masses to buy your product, service, or idea.”
No demand = no business

To summarize, the quantity of a product demanded by an individual consumer depends on:

- The individual’s tastes, expressed by indifference curves.
- The price of the product. Generally, the lower the price the higher the quantity demanded. Depending on the curvature of the indifference curves, a change in price might have a small or a large impact on the quantity demanded.
- The price of other products. Decisions are not made in isolation: if we spend less on one product, that necessarily leaves more to spend on others.
- Income. At higher income levels, we can buy more of everything (and generally do).

A change in price leads to a movement along the demand curve; a change in other factors leads to a shift in the demand curve itself.

2.2 – Demand elasticity

We can use the elasticity for estimating revenue:
It can be shown that, if demand is inelastic, then an increase in price leads to an increase in revenue; whereas, if demand is elastic, then an decrease in price leads to an increase in revenue.

Cross-price elasticity

If cross-price elasticity is positive, we say that the products are substitutes. Conversely, If cross-price elasticity is negative, we say that products are complements.

2.3 – Estimating the demand curve

Identification problem

If only the demand curve shifted around, we would be able to identify the supply-curve. If only the supply curve shifted, we would be able to identify the demand curves.

Chapter 3 – Firms

3.1 - The Firm's production, cost and supply functions

Production function

Is the mapping that tells us, for a given set of inputs, how much output a firm is able to produce.

- Perfect complements
- Perfect substitutes

Cobb-Douglas production function

Productivity

Total factor productivity (TFP)

$$q_i = w_i * K_i^{\alpha} * L_i^{\beta}$$

The coefficient, w_i, would then be a measure of a firm's performance, namely its total factor productivity.

Cost function

Shows the least total cost of inputs the firm needs to pay in order to produce output, q.

- Fixed cost (FC)
- Variable cost (VC)
- Total cost (TC)
- Average cost (AC)
- Marginal cost (MC)

Marginal cost is the appropriate cost concept to decide how much to produce, whereas average cost is the appropriate cost concept to decide whether to produce at all.
A price-taking firm's supply function is given by the marginal cost function for values of price greater than the minimum of average cost.

3.2 – Pricing

Incremental revenue & cost

Can be used to see whether it is more profitable to produce x number of goods instead of y number of goods – or reversed.
We find profit be subtracting incremental cost from incremental revenue to get profit. By using this reasoning, we can find the most suitable price for the good being sold.

Optimal price – calculus approach

The extra revenue a seller gets from increasing output level is less than the price at which the seller sells such additional output.

We maximize profit where MR = MC

Elasticity rule of optimal pricing

$$\frac{p - MC}{p} = -\frac{1}{\epsilon}$$

The elasticity rule is frequently referred to with reference to the margin (also known as the Lerner index), which is defined as:

$$m = \frac{p - MC}{p}$$

The lower the price elasticity of demand (in absolute value) the higher the price-cost margin should be set.

In words, if the margin is lower than the inverse of the elasticity (in absolute value), then an increase in price leads to an increase in profit. Likewise, if the margin is greater than the inverse of the elasticity, then a decrease in price leads to an increase in profits. We conclude that the only price such that profits cannot be further increased is given by the elasticity rule.

Margin and markup

Frequently, instead of price margins, price data are presented in terms of markups. The price markup is given by:

$$k = \frac{p - MC}{MC}$$

The elasticity rule may be written as:

$$\frac{k}{1 + k} = \frac{1}{-\epsilon}$$

Or alternatively,

$$k = \frac{1}{-\epsilon - 1}$$

It is always optimal for the seller to increase price as long as $|\epsilon| < 0$

Multiproduct pricing

Phenomenon of dynamic pricing
Interesting case of demand dynamics is durable goods - goods that have consumer flexibility.
You need to buy lunch every day, you can upgrade your car this year or next year.
If you've upgraded your car this year, your demand for a new car will probably diminish quite drastically for next year.

3.3 – Do firms maximize profits?

There are different factors that argue for a firm's profit maximization;

1. Internal discipline
    a. Agency theory – area of economics that deals with these conflicts
    b. Conflicts between the interests of managers, executives and shareholders
2. Labor market discipline
    a. A manager can risk a negative reputation in the labor market if results are not as good as they're wanted
3. Product market discipline
    a. When product market competition is very intense, firms cannot survive unless they maximize profits.
    b. Alignment of shareholders' and manager's interests.
4. Capital market discipline
    a. If the firm is not maximizing profits, and thus not living up to its potential, a "raider" can acquire the firm, change management and make a huge capital gain.

In summary, although management and ownership are normally separated, there are reasons to believe that deviations from profit maximization cannot be too large. These reasons include management incentive contracts, labor market discipline, product market discipline, and capital market discipline.

Maximizing profits/economics cost maximize the value of both debt and equity

Economically relevant costs:

- Sunk Costs (unavoidable)
- Opportunity cost best alternative use of other opportunities

Rules for economic decision making

1. Ignore sunk costs
2. Count everything at opportunity cost

- Economics has a different view of costs from accounting
    - Accounting (typically) takes a retrospective view of costs ("How much did I pay?").
    - Economics takes a forward looking view of cost ("How much can I get?")

A PC manufacturer buys 10000 processors at the price $200.00 each. Shortly thereafter market price is $XXX and it will stay at this price forever after. Manufacturer is able to sell 10000 PC at $1000 each and knows that all costs excluding the processor come to $YYY. Consider two different scenarios.

Case 1: PC manufacturer <u>cannot</u> resell processors.

Case 2: PC manufacturer <u>can</u> resell processors at current market price.

Current market price of processor (XXX)	Costs excl. processor (YYY)	Sell PCs? Case 1	Sell PCs? Case 2
$200	$750		
$200	$850		
$100	$850		
$300	$750		

Scenario	Current market prices of processors	Costs excl. Processors	Sell PC's? Case 1	Sell PC's Case 2
A	200	750	Yes	Yes
B	200	850	Yes	No
C	100	850	Yes	Yes
D	300	750	Yes	No

Taxi Medallions: Sunk, fixed, or variable cost?

The market value of a taxi medallion in NYC is 1,000,000 USD.
The capital cost of the medallion is:

1. <u>Sunk</u> in the short run (until it can be sold)
2. <u>Fixed</u> in the medium run (When it can be sold and the firm can close down)
3. <u>Variable</u> in the long run (when more medallions can be acquired and the firm can grow)

Shale oil exercise

Start of by making assumptions
We assume that AVC is flat until it reaches maximum capacity of 600k barrels

Calculate profit, 13% of 13 million

$$\pi = 0{,}13 * 13\, million = 1.69\, million$$

How do we find profits?

$$\pi = TR - TC = p * q - VC(q) - FC \rightarrow= P * Q - AVC * Q - F$$

Plug in the numbers

$$1.69m = (79 - AVC) * 600{,}000 - 13m AVC = 45.5\, per\ barrel$$

$$AFC = \frac{13m}{600{,}000} = 23\, per\ barrel$$

Canadian Oil calculation

$$AC = AVC + AFC$$

$$36 + \frac{2bn}{40000 * 365 * X}$$

$$X = 1 \rightarrow AFC = 133/barrel$$

$$X = 10 \rightarrow AFC = 13/barrel$$

$$X = 20 \rightarrow AFC = 6.8/barrel$$

Exam format

- Approximately 10 multiple choice questions
- 1 numerical question
- 1 “business” question related to a case/news article
- 1 question that varies

Midpoint method for elasticity

Midpoint method for elasticity

Given two price-quantity points on a demand curve the demand elasticity can be approximated with midpoint method (arc elasticity)

$$\varepsilon = -\frac{\left(q^{new} - q^{old}\right)/\left(q^{new} + q^{old}\right)}{\left(p^{new} - p^{old}\right)/\left(p^{new} + p^{old}\right)}$$

Here, it is important that we calculating the elasticity for the same demand curves, and not different demand curves.
The price-quantity combinations should be on the same demand curves.

Chapter 4 – Competition, equilibrium, and efficiency

4.1 Perfect competition

The "perfectly" competitive industry, an industry with no barriers to competition, is a useful benchmark to consider. It is also a reasonable approximation to many industries, including many sectors of agriculture, some parts of the labor market, and reasonably heavily traded financial securities.

Main features of a competitive market

- **Atomistic firms.** There are many competitors, all small relative to the market and unable to affect the market price through their actions.
- **Homogeneous product.** Competitors produce exactly the same product (and therefore compete head to head on price, the only relevant variable)
- **Perfect innovation.** Everyone (firms and consumers) knows about price and product characteristics.
- **Free entry** and free access to technology. Other than the "normal" entry costs, there are no barriers to the establishment of a new firm. Imitation is possible: other can enter the business if they wish; and if they do, they incur the same costs as the incumbents do.

If a firm has a sustainable competitive advantage, that advantage must lie in one of the violations mentioned above.

In a competitive market, the usual assumption that MR=MC maximizes profits can be simplified to:

$$MC(q) = p$$

Market equilibrium

The point where demand and supply cross each other.
Often denoted by p^*, q^*

The tendency of price to move in the direction of equilibrium price – also known as market-clearing price – is frequently referred to as **the law of supply and demand.**

Comparative statics

The term is used to describe the exercise of looking at what happens to equilibrium if an exogenous factor changes. This could be represented by moving the supply or demand curves and noting the change in the equilibrium price and quantity.
Basic concepts:

1. A rightward shift of the demand curve leads to an increase in quantity and an increase in price.
2. A rightward shift of the she supply curve leads to an increase in quantity and a decrease in price.

In the long-run equilibrium under perfect competition firms produce at the minimum average cost and make zero profits

If different firms have different cost structures, then in a long run competitive equilibrium (with many price-taking firm that are small relative to the overall market), the marginal firm will be one for which p=MC=AC.

4.2 Competitive selection

The long-run equilibrium under perfect competition is a limit point that industries converge to by means of successive entry and exit.
In the long-run equilibrium, price equals long-run average cost.

- **Profits in the long run.** Evidence suggests that profit rates are persistent in the long run, contrary to the implication of perfect competition.
- **Productivity.** Even though firms have the same input, firms in the 90^{th} percentile are almost twice as productive as firms in the 10^{th} percentile. In countries like China and India, the ratio is even bigger almost hitting 5:1.
- **Entry and exit rates.** In any competitive market there will be entries (when the other firms in the markets are earning high profits) and exits (when a firm is making losses)
- **Size, growth and survival.** Evidence suggests that the average firm that leaves the market is smaller than the average market firm. Furthermore, it is suggested that the growth rate for a firm declines when the firm gets bigger and older – hence, small firms grow the fastest.
- **Firm size distribution.** The model of perfect competition suggests that all firms are of the same size (assuming U-shaped cost curves) or that almost any size distribution is consistent with the model (assuming constant returns to scale). However, the data implies that this isn't the case, and that there's a rather big difference between firms, especially in terms of size and impact.

A model of competitive selection

We still assume that firms have the three first perfect competitive assumptions, but now also assume that firms must pay a sunk cost to enter the market, and not all firms have access to the same technology ⍰ they have different productivity levels and marginal cost schedules.

Furthermore, some firms might don't even know their true productivity, which leads to an estimate ⍰ therefore the firms set the price in relation to an estimated marginal cost

$$p = MC_{estimate}$$

Given these elements, a series of bad signals (high production cost) make firms become gradually more "pessimistic" about their overall efficiency.

Efficient firms are firms with a low marginal cost function. Since firms equate price to the estimated marginal costs, it follows that more efficient firms sell a higher output.

Perfect competition assumptions

1. Many small independent sellers and many small independent buyers
    a. Check for the distribution of market shares – how much can one firm affect with a 10% are there many small businesses, or just a few big?
2. Homogenous product
    a. Look at the prices, quality etc. if these indicate that they're two different product, look at industry insights
3. Perfect information regarding price
    a. Sellers and buyers are price takers
    b. Analysis of market dramatically simplified
    c. "Transparency" prices should be available for everyone to see, if the market doesn't have transparency, it is not a competitive market
4. Free entry in long-run
    a. The entry cost should be small compared to the size of the market measured by the expected industry turnover over the investment's life.
5. Zero profits (for marginal firm)

Note that these are just simple indicators, and one needs to look at each industry on its own merits (more in later lectures).

You can't draw a supply function, if the market isn't perfectly competitive!!
Much of the polysilicon production capacity is in located in China. In 2017 the Chinese government introduced tighter emissions standards which effectively lead to the closure of 25 percent of the production facilities. What would be the likely effect on global polysilicon prices in the short run?
Exercise

One would think that the output would decrease, the supple curve shifts left and prices would rise. However, it is only stated that 25% of production facilities are taken away, so it could actually be the case that the facilities taken away were the ones with the oldest technology or not even producing.

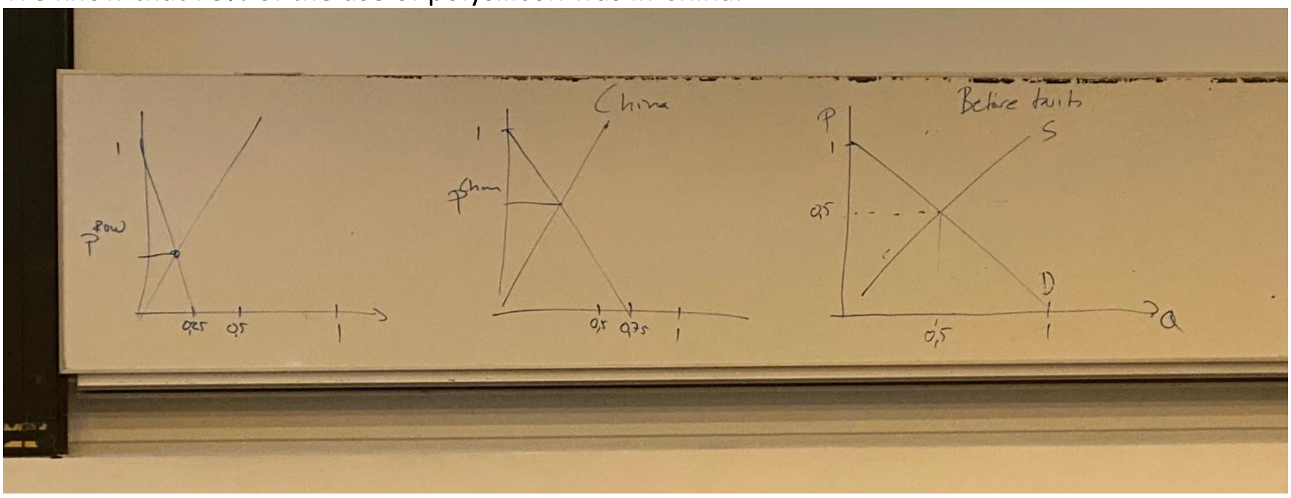
The supply function is directly related to the industry efficiency of the firms.

Polysilicon exercise – tariffs

Polysilicon

Assume that the market for polysilicon was initially perfectly competitive and global but that the Chinese government imposes import tariffs that are so high that it becomes uneconomical to import polysilicon into China and that none of the polysilicon produced in China is exported. Explain verbally (with references to the information provided) why polysilicon prices in China increased and polysilicon prices outside decreased (and not vice versa!) following the introduction of the import tariff. Provide a graphical illustration for why the price in China is higher than outside China. Be careful to state the assumptions you make. Hint: Before the tariff, 75 percent of the use of polysilicon was in China.

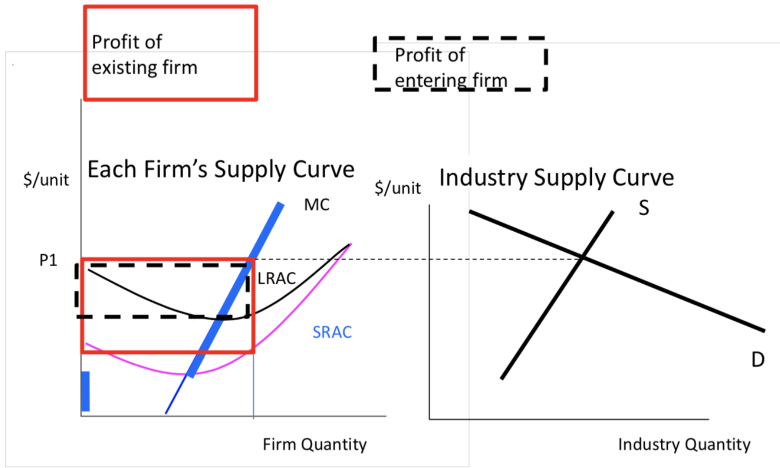
We assume that the supply of polysilicon is evenly split between Chinese and other producers. We know that 75% of the use of polysilicon was in China.



On these graphs it can be seen that China profit from these changes and the other countries actually loose.

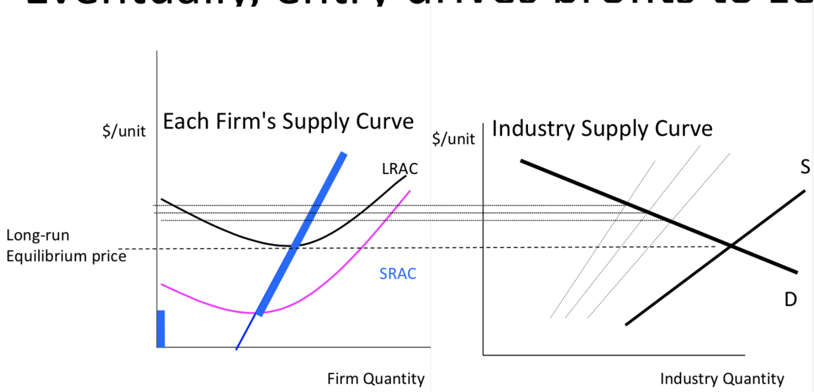
Market forces – long run & short run

Industry with initial profits: Polysilicon in 2006
Profit of existing firm vs profit of entrant



Positive profits as P>min(LRAC) → more firms willing to enter

Eventually, entry drives profits to zero



All firms earn zero profits in the long run.
No incentives to enter as price is equal to lowest long run average cost

In the long run, no firms will earn profits

Polysilicon – calculate long-run price

Polysilicon

> In late 2017, it was believed that the use of solar power would continue to grow and sales of solar panels would double in the coming decade. It was also believed that a new polysilicon production facility, employing the most modern technology, could have average operating costs of \$6.80 per kilo. Such production facility would cost approximately \$1.4billion in investment cost to construct and it would have an output of 70000 metric ton (equal to 70 million kilo) per year and an expected operating life of 10 years, and would take two years to build. Use this information to provide an estimate of the price of polysilicon in 2027. Hint: You can ignore discounting.

We assume that the technology won't change and input prices stay equal

We calculate long-run average cost
Cost of operation: 6.80
Investment of 1.4 bn

$$6.80 + \frac{1400\ mio}{70\ mio * 10}$$

$$\rightarrow 6.8 + 2.0 = 8.8$$

With our assumptions made, the price would be 8.80 USD in 2027

Market forces 101

Assuming equal technology and input prices

$\boxed{\text{Enter if economic profit > 0}}$

↓

$\boxed{\text{P > min(LRAC)} \rightarrow \text{Economic profit > 0}}$

↓

$\boxed{\text{Firms enter until P = min(LRAC)}}$

Monopolistic market profit maximization

$$\pi = p * q - VC(q) - F(1500 - 3Q) * Q - 300Q - 200001500Q - 3Q^2 - 300Q - 20000$$

Differentiate this

$$1500 - 6Q - 300 \rightarrow 1200 - 6Q$$

$$Q^* = \frac{1200}{6} = 200P^* = 1500 - 3 * 200 = 900$$
$$\pi = (1500 - 3 * 200) * 200 - 300 * 200 - 20000$$

$$\pi^* = 100{,}000$$

Inverse elasticity rule

Recall: Inverse elasticity rule

$$MR(q) = \frac{\partial p(q)}{\partial q} q + p(q) =$$
$$\frac{\partial p(q)}{\partial q} \frac{q}{p(q)} p(q) + p(q) = p(q)\left(1 - \frac{1}{\varepsilon}\right) = \frac{\partial c(q)}{\partial q} = MC(q)$$

$$\boxed{\frac{p - MC}{p} = \frac{1}{\varepsilon}}$$

Price cost margin inversely proportional to
elasticity of demand i.e. high mark-ups for inelastic demand curves

Price cost margin ("Lerner Index") is inversely proportional to elasticity of demand, i.e. high margins for inelastic demand curves.

If the firms has an inelastic demand, it should actually increase its prices, because the elasticity should be greater than 1 to maximize profits/revenue.
So, if a firm says "we have an inelastic demand, their prices aren't high enough".

This tool can also be used to measure a firm's market power.

Chapter 6 – Price Discrimination
The practice of setting different prices for the same good, whereby the relevant price in each case depends on the quantity purchased, on the buyer's characteristics, or on various sale clauses, is known as price discrimination.

Why price discriminate?
Optimal pricing is a balancing act: by setting a higher price, the seller would receive a greater margin, $p - c$, per unit sold: but by setting a higher price, the seller would also sell fewer units.

The goal of price discrimination is pretty simple;
Getting a slice of this untapped revenue source: selling for a higher price to consumers whose willingness to pay is higher and selling for a lower price to consumers whose willingness to pay is lower.

Customer markets
Markets where sales terms are tailored to each individual customer.

The situation when the seller has perfect information about each buyer's willingness to pay is called **perfect price discrimination**.
Under the assumptions of perfect price discrimination, the optimal policy is to sell at a price equal to the willingness to pay by each consumer whose valuation is greater than the seller's marginal cost.

Arbitrage and price discrimination
When segmenting a market and setting different prices to different segments, one must beware of the possibility of resale.

Moreover, in a perfectly competitive market, the law of one price must prevail ⍰ one price for the same product.
Thus, in order to prevail in equilibrium, there must be some market friction:

1. Physical impossibility of resale
2. Transaction costs
3. Imperfect information
4. Legal restrictions

Price discrimination allows the seller to create additional consumer surplus and to capture existing consumer surplus. Its success requires that resale is expensive or impossible.

Cost differences and price discrimination
An alternative test for price discrimination is that the ratio of prices across markets is different from the ratio of marginal costs.

Types of price discrimination

Selection by indicators segmentation of target audiences, i.e. students get a discount but have to show their ID when entering the theater.
Self-selection an example of this is cheap airfares with no flexibility, which are for leisure travelers, where the premium and more flexible fares are for business travelers this is called "self-selection".

Thus, sellers can price discriminate either based on observable buyer characteristics or by inducing buyers to self-selection among different product offerings.

6.1 Selection by indicators

Selection by indicators corresponds to the situation when the seller divides the buyers into groups, setting a different price for each group. this practice is also known as market segmentation. Furthermore, you can use market segmentation by looking at demographic criteria or even people's annual income.

The simplest model of market segmentation consists of a monopolist selling to two separate markets. The seller's profit function is then given by:

$$\pi(p_1, p_2) = p_1 D_1(p_1) + p_2 D_2(p_2) - C\big(D_1(p_1) + D_2(p_2)\big)$$

This implies the well-known elasticity rule:

$$p_1\left(1 + \frac{1}{\epsilon_1}\right) = p_2\left(1 + \frac{1}{\epsilon_2}\right) = MC$$

Under discrimination by market segmentation, a seller should charge a lower price in those market segments with greater price elasticity.

The limits of market segmentation

It is shown that it in many cases can maximize profits even further by using market segmentation. However, it can also be dangerous to split markets into too many small segments, as they would start to begin to look like each other;

1. The elasticity in in each submarket is very similar to that of the neighboring submarkets, in which case you don't get much out of market segmentation
2. Elasticities vary a lot across neighboring, in which case you fall prey to the resale or arbitrage problem.

Now, in the era of the internet it is possible for the seller to segment markets in a whole new way then they could before. For example, if you log on some website from a Mac computer, the seller assumes that the consumer is more wealthy than a Windows user.

6.2 Self-selection

There are many examples in which the seller knows that the population of potential consumer is divided into groups, but cannot identify which groups each consumer belongs to.

One extreme case where firms are price discriminating is when firms produce goods that are **damaged** on purpose.
This phenomena is also described as **versioning**.
 Economy, business and first class.
One thing that is rather important here is that the sellers doesn't set prices for the high-end products so high that the premium segment will by the cheaper products instead.

Incentive constraint

 the high-end consumer should have no incentive to go for one of the cheaper products
(Type x prefers plan x to plan y)

Participation constraint

 When a product is intended for the low-end consumer, the price cannot be greater than the low-end consumer's willingness to pay.
(Each consumer prefers some plan vis-à-vis no plan at all)

Bundling

"If you want to buy a good good, you will also have to buy the bad good." this is often the case in movie theatres.

1. Tie-in-sales
2. Pure bundling
3. Mixed bundling

Intertemporal price discrimination

Pricing **durable goods** involves another important element of price discrimination time
This means, that a monopolist will be able to engage in price skimming: to sell both to high-valuation buyers at a high price and to low-valuation buyers at a low price.
This is referred to as the: "high price today and low price tomorrow"-strategy.

When selling a durable good, sellers may prefer to commit not to price discriminate over time. In fact, due to "strategic" purchase delays, profits may be lower under price discrimination.

A durable good can become a non-durable good if you lease it out instead of selling it.

6.3 Non-linear pricing

If a company sells 1 scoop of ice-cream for 2 USD and 2 scoops for 3 USD, then 1 scoop will cost respectively 2 USD and 1.50 USD This is called non-linear pricing

Linear pricing doesn’t take how much consumers want to consume into account, which means that it will “leave money on the table” loose potential revenue
However, when introducing the concept of non-linear pricing, this will potentially eliminate the revenue loss and take the quantity of consumption of consumers into account.
 This also gives the seller the opportunity to charge different prices per unit that the consumer buys.

If the seller can set a two-part tariff (fixed price and variable price; think of annual membership and green-fee) and all consumers have identical demands, then the (variable) price that maximizes total profits is the same that maximizes total surplus, that is, a price equal to marginal cost.

A monopolist’s optimal two-part tariff consists of a positive fixed fee and a variable fee that is lower than the monopoly price. Total surplus is therefore greater than under uniform pricing.

Chapter 7 – Games and Strategies

Interdependent decision making: Warner Bros' payoff depends not only on its own decision but also on the decision of another player, Fox.
A game is a stylized model that depicts situations of strategic behavior, where the payoff of one agent depends on its own actions as well as on the actions of other agents.

Payoff interdependence introduces a host of possibilities for strategic behavior – the object of game theory.

Simultaneous vs. sequential decisions

Both players choose their strategy simultaneously.
However, this isn't always the case in the real word they specific decisions are maybe taken at separate times, but before the other player knows this decisions it will be as if the decisions were taken simultaneously.

7.1 Nash Equilibrium

There are several ways of "solving" a game we often look at dominant and dominated strategies.

A dominant strategy yields a player the highest payoff regardless of the other players' choice.

A dominated strategy yields a payoff which is lower than that of a different strategy, regardless of what the other players do.

Prisoner's dilemma

Depicts the conflict between individual incentives and joint incentives.

When analyzing games, it is not only important whether players are rational: it is also important whether players believe the other players are rational.

Nash-Equilibrium

A pair of strategies constitutes a Nash equilibrium if no player can unilaterally change its strategy in a way that improves it payoff.

(When using the Aspiri method, you'll find the Nash-Equilibrium as soon as you hit the same payoff twice in a row.)

A good way to determine a Nash-Equilibrium is by looking at the other player's best response.

7.2 Sequential Games

7.3 Repeated games

Chapter 8 – Oligopoly

Pricing is the most basic strategy that firms must decide on. The demand received by each firm depends on the price it sets.

8.1 Bertrand Model

The model consists of two firms in a market for a homogenous product and the assumption that firms simultaneously set price.
Furthermore, we assume that both firms have the same constant marginal cost.

Under price competition with homogenous product and constant, symmetric marginal cost (Bertrand competition), firms price at the level of marginal cost .

Avoiding the Bertrand Trap (p.190)

How do you avoid the Bertrand trap?

1. Product differentiation
2. Dynamic competition
3. Asymmetric costs
4. Capacity constraints

In other words, another way out of the Bertrand trap is to be a cost leader.

Price competition with capacity constraints

If total industry capacity is low in relation to market demand, then equilibrium prices are greater than marginal cost.

8.2 Cournot Model

The game where firms simultaneously choose the quantity they want to produce is known as the Cournot model.

First, we derive each firms optimal choice.
Second, we put the firms' best response mappings together and find a mutually consistent combination of actions and conjectures.

Now, we simply set MR=MC and by assumption MC is constant and equal to 0.

Monopoly, Duopoly, and Perfect Competition

Duopoly is an intermediate market structure, between monopoly and perfect competition. When looking at a Cournot equilibrium, we can see that it lies between two lines → under Cournot total output is more than under monopoly and less than under perfect competition.

In fact, no matter what the initial situation, we can always converge to the Nash equilibrium.

8.3 Bertrand vs. Cournot

The two models of duopoly competition presented in the previous sections, though similar in assumptions, are in stark contrast when it comes to predicted behavior.

Cournot → predicts that price under duopoly is lower than monopoly price but greater than under perfect competition.

Bertrand → predicts that duopoly competition is sufficient to drive prices down to marginal cost level, that is, two firms are sufficient to bring price down to the price level under perfect competition.

Why not choose only one model?
Industries differ and the two models both have advantages and disadvantages, which makes the use of two models attractive.

IMPORTANT → if capacity and output can be adjusted easily, then the Bertrand model describes duopoly competition better. If output and capacity are difficult to adjust, then the Cournot model describes duopoly competition better.

Estimating oligopoly equilibria

More generally, while the pass through rate under Bertrand (or under perfect competition) is always 1, under Cournot or monopoly the pass through rate depends on the shape of the demand curve.

If we have information about costs, the estimation becomes a lot simpler. If the Bertrand equilibrium better describes market interaction – and if marginal costs are similar across firms – then we should observe price close to marginal cost; whereas, under Cournot competition or monopoly behavior, we should observe price greater than marginal cost. There is still an important statistical inference problem: a positive price-cost margin results from a certain degree of monopoly pricing and from a certain demand elasticity.

8.4 The models at work: comparative statics

Models are simplified descriptions of reality, a way of understanding a particular situation.
We can use the model as **counterfactual**, that is, to predict how the market changes as a function of changes in various exogenous conditions, i.e. the price of an input or of a substitute product.

Comparative statics → the meaning of the expression is that we compare two equilibria, with two sets of exogenous conditions, and predict how a shift in one variable will influence the other.

Expl: Prisoner's dilemma

Y

X

	Confess	Remain silent
Confess	-5; -5	0; -20
Remain silent	-20; 0	-1; -1

Dominant strategy Confess

Nash-Equilibrium Confess, Confess best response for both players is confessing

Firm 2

Firm 1

	Don't enter	enter
Don't enter	0; 0	0; 1
enter	1; 0	-1; -1

Dominant strategy None

Nash-Equilibrium 2 Nash equilibria, if one firm enters the other will not and visa versa

Birthe

Svend

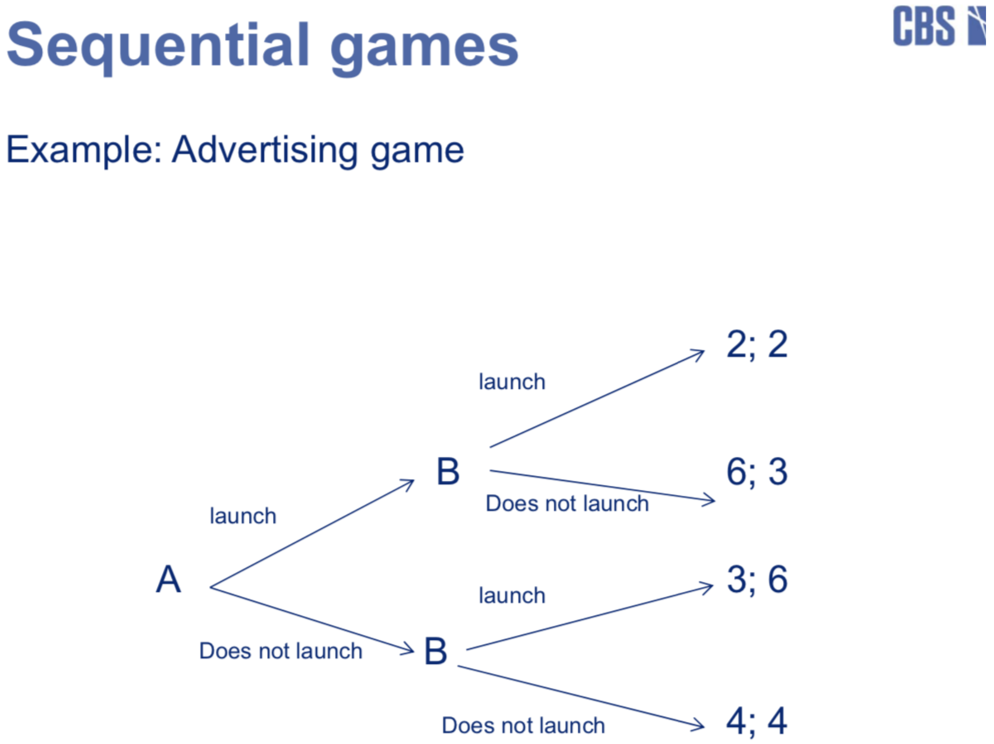
	party	club
Party	1; 3	2; 0
club	2; 2	1; 1

Dominant strategy Svend has no dominant strategy, Birthe's dominant strategy is party

Nash-Equilibrium Club, Party

Sequential games

One firm makes a decision, the other firm observes that decision and decides on its own course of action.



The game takes place in a game tree one way to find the Nash equilibrium in this game is called the **backward induction**

First we look at what firm B would do if A launches firm b would not launch. If firm A wouldn't launch, firm B would choose to launch.

 we now know what firm B will do, so we go back and see where firm A gets the highest payoff given the decisions that we know firm b will take this means that firm a chooses to launch, as firm and would obtain the highest possible payoff by doing this.

** This is called "The subgame perfect Nash-Equilibrium"**

Oligopoly overview

Model	Decision Variable	Timing	Equilibrium Concept
Bertrand	price	simultaneous decisions	Nash equilibrium
Cournot	quantity	simultaneous decisions	Nash equilibrium
Stackelberg	quantity	sequential decisions	Subgame perfect equilibrium

The Bertrand Model

- The firm's specific demand depends on the price a firm sets
- Firm's specific demand are interdependent
- Firm 1 and 2 set their prices simultaneously
- They produce homogenous products
- They have the same production technology and same constant MC
- Market demand is linear $D(p)$

Even though we only have two firms, the price competition will lead to the same market outcome as perfect competition.
⍰ This is called the **Bertrand-Paradox**

Does Price competition always lead to marginal cost pricing?

- Product Differentiation:

With differentiated products slightly undercutting one's rival does not persuade all consumers to switch supplier.

- Dynamic Competition:

With repeated interaction between the rivals they might be able to collude and to avoid marginal cost pricing.

- Capacity Constraints:

If firms are capacity constrained undercutting is not attractive if the undercutting firm cannot serve the market demand afterwards.

The Cournot Model

Demand is given by:

$$q_1 + q_2 = D(p) \rightarrow P(q_1 + q_2) = p$$

Monopoly, duopoly and perfect competition

Monopoly, duopoly and PC

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- The Cournot duopoly is an intermediate market structure between monopoly and perfect competition
- The total output produced is between the total output produced under perfect competition and under monopoly:

$$q^M < q_1^N + q_2^N < q^C$$

- The market price is correspondingly smaller than the market price under monopoly and higher than under perfect competition.

Prices under Cournot and Bertrand

Prices under Cournot and Bertrand Competition

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- The model predictions of a Bertrand model and a Cournot model strongly differ in terms of the equilibrium prices.
- Under Bertrand competition prices are equal to marginal costs as with perfect competition.
- Under Cournot competition prices are above marginal costs, but below the monopoly level

Which model should you choose?

- Depends on the industry under consideration
- If capacities and/or output are long-run decisions compared to the pricing decision, then the Cournot model should be applied
    - Here, we would look at manufacturing industries → automotive etc.
- If it is easy to adjust output, then the Bertrand competition is the adequate model
    - This could be software, online services etc.