Summary

-Microeconomics-

Table of Contents

Other chapters mentioned in the Syllabus should be studied apart from this summary.

Chapter 1

Microeconomics is the study of how individuals and firms make themselves as well off as possible in a world of scarcity, and the consequences of those individual decisions for markets and the entire economy.

Trade-off:

1. Which good/service to produce
2. How to produce
3. Who gets the good/service

Depends on how much it cost to produce and how much people are willing to pay for it.

Market: interaction between people and firms. (no market → no market price → serious problems)
Model: a description of the relationship between two or more variables.
Models to predict and describe how a change in 1 variable would affect another variable. If we model and lose important details, our predictions may be inaccurate. (use until better model is developed)

Theory is the development and use of a model to test hypotheses, which are predictions about cause and effect.

Consumers buy only if they cannot get more utility from goods with the same price.
Utility is explained is chapter 3.

Positive statement = testable hypothesis about cause and effect. Positive does not mean that we are certain about the truth of our statement (what will happen)
Normative statement = a conclusion as to whether something is good or bad (believe what should happen)

Micro-economics helps to make choices.

Chapter 2

Supply-and-demand model describes how consumers and suppliers interact to determine the price & quantity of a good or service.
Supply and demand model works well in markets that have many buyers and sellers.

Demand: Quantity demand (amount of a good that consumers are willing to buy at a given price during a specified period), is not the same as quantity actually sold.

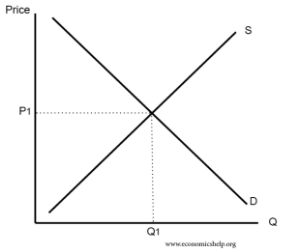
How much of a good or service to buy depends on:

1. Price of the good
2. Income
3. Tastes
4. Information
5. Price of other goods (complement or substitute)

6. Government rules and regulation

Substitude: good/service that may be consume instead of another good/service.
Complement: good/service that are jointly consumed with another good/service.

Demand function shows correspondence between quantity demanded and factors that influence purchases. Factors that are not listed are irrelevant or holding constant.



Vertical axis is price, horizontal axis is quantity demanded.

Law of demand: Consumers demand more of the good the lower its price, holding constant tastes, the prices of other goods, and other factors that influence the amount they consume.

Change in price of the good causes a movement along the demand curve

Derivative is a constant. Has the same effect when there is a large price increase or a small increase.
$\frac{\Delta p}{\Delta Q}$ tells us how much the price must fall to sell one more unit.
Change in one of the other factors creates a shift OF the curve.

Supply: Quantity supplied (amount of a good that firms are willing to sell)
Movement along the supply curve if the price changes. What happens to the quantity supplied?
$\frac{\Delta Q}{\Delta p}$ tells us how much the quantity supplied changes if the price increases with $1
Market supply curve does not have a particular form, because there is no Law of supply.
Computing change OF the curve by multiply the derivative by the price change.

Quota = limit that he government sets on the quantity of a foreign-produced good that may be imported.

Market equilibrium: equilibrium = situation in which all traders are able to buy and sellers are able to sell as much as they want, a situation in which no participant want to change its behavior.
Equilibrium if you can buy as much as you want.
Market clearing price = equilibrium price = no frustrated buyers/producers

Excess demand is the amount by which the quantity demanded exceeds the quantity supplied at a specified price

Excess supply is the amount by which the quantity supplied exceeds the quantity demanded at a specified price.

Shocking the equilibrium: comparative statistics:
If variables, held constant, change and the curve shifts. Method to analyse how variables controlled by consumers and firms, here price and quantity, react to a change in environmental variables/exogenous variables.

How does an environmental variable effect the equilibrium price and quantity that are determined by the intersection of the supply and demand curves?

1. $186 - 20p = 178 + 40p - 60p_h$
   $p = 1.8 + p_h$
   $\frac{dp}{dp_h} = 1$
   So if the price p increases with $1, the equilibrium price op ph increases with $1
2. $D = 286 - 20p(p_h)$
   $\frac{dD}{dp}\frac{dp}{dp_h} = -20 \times 1 = -20$
   So if ph increases with $1, he equilibrium quantity falls by 20 units.

Effect of a shift in the supply curve depends on the shape of the demand curve:

- If the Demand curve is flat (almost horizontal), a shift of the supply curve results in a great effect on quantity and a little effect on price.
- If the Demand curve is vertical, a shift of the supply curve results in no change in quantity and a great effect on price.

Elasticities:
An elasticity is a percentage change in one variable in response to a given percentage change in another variable, holding other variables constant.
Say, z is the quantity demand or supply, x is the price of the good and y is another variable, holding constant:

1. E = (% change in z) / (% change in x)
   $E = \frac{\frac{\partial z}{z}}{\frac{\partial x}{x}} = \frac{\partial z}{\partial x}\frac{x}{z}$
2. ε = elasticity of demand
   $\varepsilon = \frac{\partial Q}{\partial p}\frac{p}{Q} = -b\frac{P}{Q}$

On demand curves: the elasticity of demand is more negative the higher the price.
If elasticity is zero: demand curve is perfectly inelastic. (quantity does not response in price changes.)
Inelastic = 0 > e > -1
Elasticity of 1 or -1 is called unitary elasticity.
Elastic = e < -1
Perfect elastic = e = -∞
Constant-elasticity demand curve: $Q = Ap^{\varepsilon}$
Rewritten as a log-linear demand curve: $lnQ = lnA + \varepsilon \ln \quad p$
If this 2 equations exist, how to show that the elasticity of demand is a constant ε:

1. Differentiate (dq/dp) the first one, multiply by P/Q and solve the equation: answer is ε
2. Differentiate (d(Ln)q/d(Ln)p) the second one, solve it: answer is ε

Vertical demand curve for essential goods (goods people feel they must have, and will pay anything to get it)

Other elasticities:

1. Income elasticity of demand: $\xi = \frac{\partial Q}{\partial Y}\frac{Y}{Q}$
   Necessitive goods: elasticity is zero
   Luxurious goods: elasticity is greater than one
2. Cross-price elasticity of demand: Change in quantity demanded in change in the price of another good. Negative elasticity: goods are complements, positive: goods are substitutes.
   $\frac{\partial Q}{\partial p_1}\frac{p_1}{Q}$

Price elasticity of supply is percentage of change in quantity supplied in response to a given percentage change in the price: $\eta = \frac{\partial Q}{\partial p}\frac{p}{Q}$

Q is the quantity supplied.
η = 0 → perfectly inelastic
η = 0 – 1 → inelastic
η = 1 or more → elastic
η = infinite → perfectly elastic

2 factors that determine whether short run elasticity is lower or higher that long run:

1. Ease of substitution
2. Storage opportunities (better storage: more sensitive to price changes is short run than long run)

Effects on sales tax:
α = ad valorem tax rate (fraction of every dollar spent)
τ = specific tax / unit tax

The specific tax causes the equilibrium price consumers pay to rise, the equilibrium quantity to fall, and the tax revenue to rise.
New equilibrium at: $D(p) = S(p - \tau)$
Effect of a small tax on price: $\frac{dS}{dp}(\frac{dp}{d\tau} - 1)$
So change in price that the consumers pay with respect to the change in tax: $\frac{dp}{d\tau} = \frac{\eta}{\eta - \varepsilon}$
So the higher the tax, the greater the price consumers pay.

Incidence of a tax on consumers = share of the tax that fall on consumers ($\frac{dp}{d\tau}$)
Incidence of a tax on firms = $1 - \frac{dp}{d\tau}$
Price that consumers pay = $\frac{\eta}{\eta - \varepsilon}\Delta\tau$ (So firms buy 1- (n/n-e), multiplied by change in tax.)
For equilibrium, it doesn't matter who pays the tax.

Incidence of ad valorem tax that falls on consumers = $\frac{\Delta p}{\alpha p_2}$

Quantity supplied need not equal quantity demanded:
Demand equals supply if there is no government regulation.
Government regulations can shift equilibrium, or cause a gap.

1. Price ceiling: setting the price lower than the equilibrium price: more quantity demanded. This cause a shortage. But this is still called an equilibrium because firms and consumers do not want to change their behaviour.
2. Price floor: supply exceeds demand.

When to use the supply-and-demand model
Model is applicable in markets in which: (perfectly competitive markets)

1. Everyone is a price taker: no market participant can affect the market price
2. The market has many small buyers and sellers
3. Firms sell identical products
4. Everyone has full information about the rice and quality of goods
5. Transaction costs are negligible
6. Costs of trading are low, firms can easily enter and exit the market

Transaction costs: the expenses over and above the price of the product, of finding a trading partner and making a trade for the product

Chapter 3

Preferences:
5 assumptions about the properties of consumers' preferences:

1. Completeness
   Bundles a&b can be ranked by consumers, a>b
2. Transitivity (preferences are consistent)
   Consumers' rankings of bundles are logically consistent, a>b, b>c -> a>c
3. More is better
   More of a commodity is better than less of it
4. Continuity
5. Strict convexity

Indifference curve = the set of all bundles of goods that a consumer views as being equal desirable.
Indifference curves:

- Farther from the origin are preferred to those on those closer to the origin (more is better)
- Every bundle lies on a n indifference curve
- Cannot cross (transitivity)
- Slope downward (more is better)
- Cannot be thick (more is better)

Utility:

Utility = numerical set of values that reflect the relative rankings of various bundles of goods.
Utility function is relationship between utility measures and every possible bundle of goods.

Utility is an ordinal measure: tells us the relative ranking of two things but does not tell us how much more one rank is valued than another.
Carinal measure: absolute comparisons between ranks may be made
Utility function is unique only up to a positive monotonic transformation.

An indifference curve consists of all those bundles that correspond to a particular utility measure (for example all bundles where utility is 8).

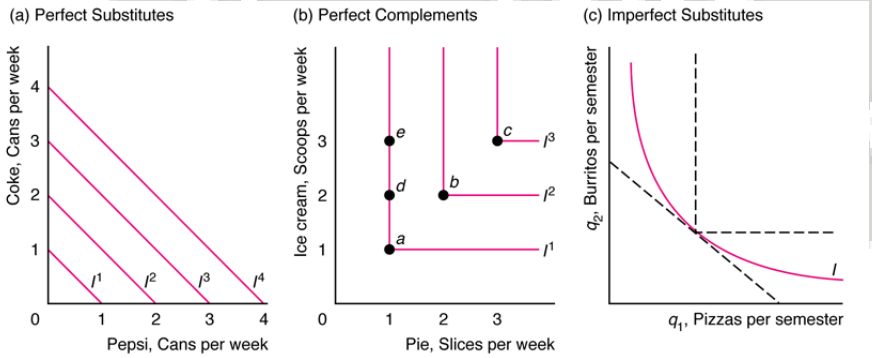
Marginal rate of substitution = the slope at a point of an indifference curve (is the maximum amount that a consumer will sacrifice(trade) to obtain one more unit of another good.

Marginal utility = the extra utility a consumer gets from consuming a little more of the good.

- Marginal utility = $\frac{\partial U}{\partial q_1} = U_1$
- Marginal rate of substitution = $MRS = -\frac{U1}{U2}$
- Expressing marginal rate of substitution in terms of her marginal utilities: $-\frac{a}{1-a}\frac{q_2}{q_1}$

Diminishing marginal rate of substitution: the MRS approaches zero (becomes flatter) as we move down and to the right along an indifference curve.

Perfect substitutes: straight, parallel lines, with a slope of -1 (MRS) or another constant rate
Perfect complements: consume in equal quantities, goods consumed only in fixed proportions
Imperfect substitution: Curve lies between perfect substitutes and perfect complements. Convex indifference curve show that a consumer views two goods as imperfect substitutes.



Budget constraint
Budget constraint/budget line = bundles of goods that can be bought if the entire budget is spent on those goods at given price.

Area under the budget line is the opportunity set: consists of all the bundles a consumer can buy, including all the bundles inside the budget constraint and on the budget constraint.

Marginal rate of transformation = slope of the budget line, the amount of one good the consumer must give up to obtain more of the other good. If q1 is on the x-axis and q2 is on the y-axis: $MRT = -\frac{p_1}{p_2}$

Constrained consumer choice
Bundle that gives the highest pleasure in point where indifference curve touches the budget constraint and does not cross it! This point is consumer's optimum (in which no incentive to change behaviour)

Interior solution: indifference curve touches budget constraint in the middle, an optimal bundle that has positive quantities of both goods. Optimum in point in which: $MRS = MRT$
Or: $\frac{U_1}{p_1} = \frac{U_2}{p_2}$
Two equivalent conditions to find the interior solution:

1. Highest indifference curve rule
2. Tangency rule: MRS = MRT

Corner solution: indifference curve touches budget constraint at one end or the other, the consumer only buys one of the goods.
Consumers with straight-line indifference curves buy only the cheapest goods. Thus if consumers buy more than a single good, indifference curves must have convex sections.

We do not observe consumer optima at bundles where indifference curves are concave or consumers are satiated. Thus we can safely assume that indifference curves are convex and that consumers prefer more to less in the ranges of goods that we actually observe.

Maximizing utility subject to a constraint using calculus:

1. Substitution method: substitute the budget constraint into the utility function. Derivate the function and equal to zero, or: MRS = MRT
2. Lagrangian method: λ = lagrangian multiplier.
   $L = U(q_1, q_2) + \lambda(Y - p_1 q_1 - p_2 q_2)$
   $\lambda = \frac{U_1}{p_1} = \frac{U_2}{p_2}$

How to make the lowest possible expenditure to maintain the utility at a particular level:
Expenditure function: relationship between the minimal expenditures necessary to achieve a specific utility level for a given set of prices.
Expenditure function:

1. Show lagrangian function and derive first order conditions
2. Set them to 0
3. Solve the three first-order equations for q1 and q2
   $E = p_1 q_1 + p_2 q_2$
   $q_1 = a\frac{E}{p_1}$

$$q_2 = (1-a)\frac{E}{p_2}$$
$$E = \bar{U}\left(\frac{P_1}{a}\right)^a \left(\frac{p_2}{a}\right)^{1-a}$$

Behavioural economics: adds insight from psychology and empirical research on human cognition and emotional biases to the rational economic model to better predict economic decision making.
Three applications of behavioural economics:

- Transitivity
- Endowment Effect: occurs when people place a higher value on a good if they own it than they do if they are considering buying it.
- Salience: awareness of things like the awareness of tax
    - Bounded rationality: people have a limited capacity to anticipate, solve complex problems, or enumerate all options.

Chapter 4

Deriving demand curves:
Cobb-Douglas functions has the unusual property that the demand for each good depends only on its own price and not the price of the substitute good:

$$U = {q_1}^a {q_2}^{(1-a)}$$
$$q_1 = a\frac{Y}{p_1}$$
$$q_2 = (1-a)\frac{Y}{p_2}$$

Price-consumption curve is a line through the equilibrium bundles (where indifference curve = budget constraint). With the same budget and constant price of good B, but with different prices of good A you can calculate the demand curve.

Effects of an increase in income:
An increase in an individual's income, holding tastes and prices constant, causes a shift of the demand curve.
Income-consumption curve is draw as follows: Draw a line through optimal situation points in different budget constraints and set those points horizontal, in line with the rice of the good, where those are the demand of. This are the demand curves at different budgets.
If you hold these points (the x coordinates) and write the different budgets on the Y axis, you get the Engel curve (relation between quantity demanded of a single good and income, holding prices constant)

Income elasticity of demand (income elasticity) is the percentage change in the quantity demanded of a product in response to a given percentage change in income, Y.
Shape of the Engel curve or shape of the income-consumption curve:

$$\xi = \frac{\partial Q}{\partial Y}\frac{Y}{Q}$$

ξ < 0 → inferior good (less of it is demanded if income rises)

ξ ≥ 0 → Normal good

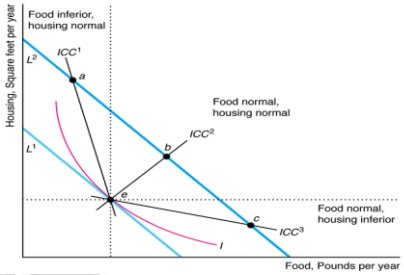
ξ > 1 → Luxury good

Slope of the income-consumption curve:

If slope is positive: both goods are normal

If the slope is negative: good X is inferior, good Y is normal

If the slope is between -1 and 0: good X is normal, good Y is inferior



A good may be normal at some income levels and inferior at others, but all goods cannot be inferior.

The weighted sum of consumer's income elasticity equals 1. With this we can make predictions:

- Budget share of good i: $\theta_i = \frac{p_i q_i}{Y}$
- Income elasticity of good i: $\xi_i = \frac{dq_i}{dY}\frac{Y}{q_i}$
- Weighted income elasticity of good i: $\theta_i \xi_i$
  Sum of those weighted income elasticity equals 1

Effects of a price increase:

An increase in a price of a good has two effects on an individual's demand:

1. Substitution effect: Change in quantity demanded when good's price rises, holding other prices and the consumer's utility constant. If price rises, consumer substitute for another, now relatively cheaper good for that one.
2. Income effect: Change in quantity demanded when income changes, holding prices constant. Decrease in income reduces buying power and causing the consumer to buy less of at least some goods.

Total change in quantity purchased is the sum of substitution effect and income effect. Necessary to evaluate the effect of policies.

Substitution effect is the change in the quantity demanded from a compensated change in the price of good 1, which occurs when we increase income by enough to offset the rise in the price of good 1 so that the utility stays constant.

Indifference curve is convex: substitution effect is unambiguous. Substitute the expensive good for a less expensive one, holding the utility constant. So the substitution effect causes a movement along the indifference curve.

With normal goods, substitution effect and income effect go in the same direction. Total effect must be negative.

With inferior goods, income effect goes in the opposite direction from the substitution effect. Income effect is mostly smaller, so total change goes in the direction from the substitution effect, but the total effect is smaller.
Giffen good: quantity demanded falls if its price decreases, because the income effect more than offsets the substitution effect. (This function is upward sloping!)

2 reasons why a demand curve do not have to be downward sloping:

1. Law of demand is an empirical regularity, not a theoretical necessity.
2. Law of demand must hold theoretically for compensated demand curves.

Compensated demand curve = how changes the quantity demanded as the price rises, holding utility constant. So reflects only pure substitution effects.

Shephard's lemma: $\frac{\partial E}{\partial p_1} = H\left(p_1, p_2, \overline{U}\right) = q_1$

Slope of budget lines given by (if q1 is on X and q2 is on Y) = $-\frac{p_1}{p_2}$

Uncompensated demand and compensated demand must cross at the original price, because they have there and only there the same budget line.

Compensated demand curve only reflects the substitution effect, not the income effect.
There is pure substitution effect if we hold utility constant.

Elasticities:

$$\text{total effect} = \text{substitution effect} + \text{income effect}$$

Sluktsky equation: $\varepsilon = \varepsilon^* + (-\theta\xi)$

ε = elasticity, total effect of price change, change along an uncompensated demand curve
ε*= substitution elasticity of demand (substitution effect), change in percentage of quantity demanded if price increases and we compensate income to hold utility constant, change along compensated demand curve.
ξ = income elasticity, multiplied by θ (money spend on a certain good) gives the substitution effect.
So: ε = ε* + ξ θ

For a Giffen good, ε must be positive -> upward-sloping demand curve -> - ξ θ must be positive and large relative to the substitution effect. When a good is very inferior, the income effect is more positive.
ε* is always negative, consumers buy less of a good when its prices increases, holding utility constant

Inflation: the increase in the overall price level
Nominal price: the actual price of a good
Real price: the price adjusted for inflation

Chapter 5

Consumer welfare

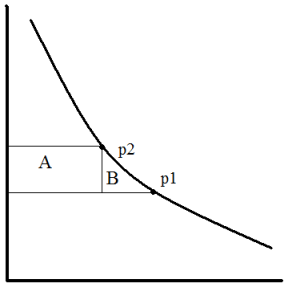
Measuring impact of a tax in terms of the change in the utility level by comparing old and new utility levels, but that is not easy. So it is measured with consumer welfare, in terms of dollars.

Consumer welfare = benefit a consumer gets from consuming that good in excess of the cost of the good. If you are indifferent to that product, you are indifferent to pay the price or not to pay the price.

An inverse demand curve reflects a consumer's marginal willingness to pay: the maximum amount a consumer will spend for an extra unit, the marginal value the consumer places on buying one more unit.

Consumer Surplus = Monetary difference between the maximum amount that a consumer is willing to pay for the utility of the good purchased and what the good actually costs.
An individual's consumer surplus is the area under the inverse demand curve and above the market price up to the quantity the consumer buys.
Market consumer surplus is the area under the market inverse demand curve and above the market price up to the quantity consumers buys.

If the price of a good rises, purchasers of that good lose consumer surplus.



$U = {q_1}^{0.6}{q_2}^{0.4}$
$Y = 300$
$p_1 = \$15 \rightarrow \$20$
$q_1 = \frac{0.6Y}{p_1}$ so $q_1 = 12 \rightarrow 9$
$A + B = -(0.60Y)(\ln \quad p_2 - \ln \quad p_1) \approx -51.79$ is total fall of CS
$A = (20 - 25) \times 9 = 45$
$B = 51.79 - 45 = 6.79$

But this is an inexact measure of consumer surplus with the uncompensated demand curve.

Expenditure function and consumer welfare.
CS is extra income we would have to provide so that the consumer's utility did not change.

Expenditure functiorn gives the minimal expenditure necessary to achieve a special utility level for a given set of prices.Difference in expenditure with old price and new price is the welfare change. An increae in the price leads to a drop in welfare.

We can use 2 different utility levels:

1. Companesating variation (CV): it is a compensation to keep the consumer on the original indifference curve.
   New income with which utility remains constant = Y + CV
   Comensating variation measure is the income (CV) involved in the income effect.

2. Equivalent variation (EV): it is the same as the price increase. It moves the consumer to the new indifference curve (from the new price). Amount of income that would lower utility by the same amount as the price increase.

Three measures of consumer welfare harmof price increase.
Whicht welfare measure is larger?

- Normal good: $CV > \Delta CS > EV$
- Inferior good: $CV < \Delta CS < EV$

Three can differ, but mostly they are the same. The smaller income elasticity or budget share, the closer is substitution elasticity to total elasticity, and the closer are compensated and uncompensated demand curve.

Market consumer surplus
Market consumer surplus is sum of each individual's consumer surplus.
As the price increases, consumer surplus falls more the greater the initial revenues (price times quantity) spent on the good and the less elastic the demand curve.

If we hold revenue constant, consumer surplus loss from an increase in price is larger as the demand curve becomes less elastic.

Effect of governmet policies on consumer welfare
Quota reduces number of units that a consumer buys, or provides a consumer with a certain amount of a good (food), the government creates a kink in the consumer's budget constraint. A quota shifts the indifference curve below the original indifference curve. A quota causes a rotation or a parallel shift of the budget line. We can calculate the equivalent variation to determine the harm.
Calculation of EV:

1. Draw a budget line below original indifference curve, tangent to first budget line.
2. Determine expenditure function
3. Determine utility function by new situation
4. Old expenditure – new expenditure is EV

Cash is preferred to food stamps because with the same value cash can increase the opportunity set by more than the food stamps can. But if she only buys food, she is indifferent between cash or food stamps. With cash people will have more choices than those who receive a comparable amount of food stamps. With cash, they could buy either food or other goods, nog just food like food stamps can.

Deriving labor supply curves
$Total\ income = wage \times hours\ worked + unearned\ income \rightarrow Y = wH + Y^*$
Leisure (all the time spent not working for pay) time cost you the wage you would have earned if you worked = N
The number of hour someone works per day, H, equals 24 – the hours someone spends on leisure:
$H = 24 - N$

A person maximizes his utility given the time constraint and the income constraint.
Given te utility function, what is the labor supplyfunction?

1. Set the derivative of utility function with respect to H equal to zero.
2. Fill in a given a, 1/3 for example. This is the hours a person works, indifferent with the wage.

Chapter 6

The ownership and management of firms
A firm is an organization that converts inputs into outputs.
Private sector consists of firms owned by individuals or other nongovernmental entities whose owners try to earn a profit

- Sole proprietorship: firms owned by an individual who is personally liable for the firm's debts
- General partnerships: businesses jointly owned and controlled by 2+ people who are liable for debts
- Coporations: are owned by shareholders in proportion to the number of shares/amout of stock they hold. Have limited liability: the personal assests of corporate owners cannot be taken to pay a corporation's debts even if it goes into banktuptcy.

Public sector consists of firms and organizations that are owned by governement or government agencies.

$Profit\ (\pi) = R\ (revenue) - C(cost)$
$R = pq$
Efficient production (achieves technological efficiency): if a firm cannot produce its current level of output with fewer inputs, and no more output can be produced using existing technology.
Efficient production is a necessary condition for profit maximization, but it doesn't ensure that a firm's profit is maximized. So profit maximization does imply Efficient Production, but not the other way around.

Production
Input is Capital (K), Labor (L) and materials (M).
Production function: is relationship between the quantities of inputs used and the maximum quantity of output that can be produced given the current knowledge about technology and organization.
$q = f(L, K)$ is the form of a production function.

Fixed input can not vary practically in the short run, a variable input can. In the long run, all inpus are variable.

Short-run production: one variable and one fixed input
Capital is fixed and labor is variable.
$MP_L = marginal\ product\ of\ labor = \frac{\partial q}{\partial L}$ is the change in total output by using 1 extra unit of labor, holding other factors like capital constant
$AP_L = \frac{q}{L}$ Average product of labor: ratio of output to the number of workers used to produce that output

Law of dimishing marginal returns: if a firm keeps increasing an input, holding all other inputs and technology constant, the corresponding increases in output will eventually become smaller. This is when second partial derivative of production function with respect to labor is smaller that 0.

Misinterpretendings of the law:

1. Dimishing marginal return is NOT dimishing return.
2. No focus on other inputs or technology.

Long-run production: two variable inputs
In the long-run, a firm can use as much capital and labor as wanted.

Isoquant: is a curve that shows the efficient combinations of labor and capital that can produce the same level of output. They look like indifference curves, but they hold quantity constant, whereas indifference curves hold utility constant!

- The farter an isoquant is from the origin, the greater the level of output
- Isoquants do not cross
- Isoquants slope downwards
- Isoquants must be thin

If the inputs are perfect substitutes, isoquant is a straight line: $q = x + y$
Fixed-proportion function: inputs are complements: $q = \min(g, b)$

Marginal rate of technological substitution = ability of a firm to replace one input (K) with another (L) while holidng output constant: $MRTS = \frac{dK}{dL} = -\frac{MP_L}{MP_K}$ where MP are partial derivatives. Because isoquants slope downward, the MRTS is negative.
General form MRTS for a Cobb-Douglas function: $MRTS = -\frac{a}{(1-a)} \times \frac{K}{L}$

If you chose a point on the isoquant more to the right, the slope becomes flatter. This reflects the dimishing marginal rate of technical substitution. The more labor the firm has, the harder it is to replace the remaining capital with labor, so the MRTS falls as the isoquant becomes flatter.

Elasticity of substitution: $\sigma = \frac{d(\frac{K}{L})}{dMRTS} \times \frac{MRTS}{K/L}$
It tells us how the input factor ratio changes as the slope of the isoquant changes. If elasticity is large, the isoquant is relatively flat. If elasticity falls, the isoquant become more curved.

Elaticity of substitution varies along the isoquant, except for constant elasticity of substitution (CES):
$q = (aL^{\rho} + bK^{\rho})^{\frac{d}{\rho}}$
P<1 is a constant
ρ = 1: Lineair production function (σ = 1/0), two inputs are perfect substitutes
ρ = 0: Cobb-Dougles production function (σ = 1/1)

ρ = negative infinity: fixed-proportion production function (σ = $\lim_{n\to-\infty} \frac{1}{n} = 0$), elasticity approaaches zero, substituion between inputs is impossible.

Returns to scale
Production function is constant returns to scale (CRS) if output increases with the same proportion as the input is increased. With increasing returns to scale (IRS), the output increases proportionally more than the input. Decreasing returns to scale (DRS) if output increases proportionally less than increase in input.
Show that if we double input production function is constant returns to scale:

1. $q_1 = AL^aK^b$
2. $q^2 = A(2L)^a(2K)^b = 2^{a+b}AL^aK^b$
3. $\frac{q_2}{q_1} = 2^{a+b} \equiv 2^\gamma \; where \; \gamma = a + b$
4. $\gamma = 1 \; so \; constant \; returns \; to \; skill \; (\gamma > 1 \; IRS)(\gamma < 1 \; DRS)$

Productivity and technical change
Relative productivity is a firm's actual output expressed as a percentage of the output that the most productive firm in the industry (which has a relative productivity of 100%) could have produced from the same amount of inputs.

Technical progress is an advance in knowledge that allows more output to be produced with the same level of inputs.
With technological innovation a firm can produce more output with the same inputs (neutral technical change). Nonneutral technical changes the proportions in which the inputs are used.

Chapter 7

Measuring costs
Explicit costs = direct out-of-the-pocket payments for inputs to its production process within a given period.
Implicit costs = value of time and value of other recourses used but nog purchased.
Opportunity costs/economic costs is where the capital could be sell for today, the value of the best alternative use of that resource.

Allocating capital costs is different for blokkeepers and economists. Blokkeepers exense the cost for full amount or amortize it by spreading it over the life. Economists use the opportunity costs.
Sunk cost = expenditure made in the past, which cannot be recovered. So economists use opportunity costs and ignore the historical price.

Short-run costs
Fixed costs (F) do not vary with output. This costs can not practically be adjust in the short-run.
Variable costs (VC) vary with output, the production expense that changes with the quantity of output produced.
So total costs (C) also vary with output. $C = VC + F$

Marginal costs (MC) is amount by which a firm's cost changes if the firm produces one more unit of output.
Average costs (AC) is cost per unit produced $AC = C/q$.

- Average fixed cost (AFC) = $AFC = F/q$
- Average variable cost (AVC) = $AVC = \frac{VC}{q}$

Marginal cost curve cuts the average cost and the average variable cost curves at their minimum.
Variable cost function is the inverse function of the short-run production.
Because K is fixed in the short-run, only variable in production function is L

Shape of marginal cost curve = $MC = \frac{w}{MP_L}$
Shape of average cost curve = $AVC = \frac{w}{AP_L}$

Taxes shift the average and marginal cost curves.

Short-run cost summary:

1. Some input costs are fixed (capital) and some input costs are variable (labour)
2. Constant input prices can determine shapes of VC, MC, AC with production function.
3. Marginal costs curve cuts average cost curve and average variable cost curve in their minimum. The AC-curve and AVC-curve fall at quantities where the marginal cost curve is below them and rise where the marginal cost is above them. That's why the MC-curve cuts the curves at their minimum points.

Long-run costs
Fixed costs are no sunk costs, but they are avoidable. As a result, long run total costs equal long run variable costs.

Isoquants give outputs which a firm can choose. With these combinations of efficient input bundles, a firm wants to choose the bundle with the lowest costs.

Isocost line (straight line) indicates combinations of input that require the same total expenditure.
w=wage, r=rental rate

1. $\bar{C} = wL + rK$
2. $K = \frac{\bar{C}}{r} - \frac{w}{r}L$

With this we can derive 3 properties of isocost lines:

1. Isocost line intersects axis when firm only uses Labour or capital
2. Isocost further from the origin have higher costs than isocosts closer to the origin.
3. Slope of each isocost is the same $-\frac{w}{r} = \frac{dK}{dL}$

Looks like the budget constraint but people have 1 budget constraint and firms have many isocost lines.

3 approaches to minimize costs:

1. Lowest-isocost rule: pick bundle of inputs where the lowest isocost line touches the isoquant.
2. Tangency rule: pick bundle of inputs where isoquant is tangent to the isocost line. In this point of tangency the slope of the isocost curve and the slope of the isoquant is equal: $MRTS = -\frac{w}{r}$ or $\frac{MP_L}{w} = \frac{MP_K}{r}$
3. Last-dollar rule: pick bundle of inputs where the last dollar spent on one input gives as much extra output as the last dollar spent on any other input.

If we use calculus to calculate the minimum costs, use Lagrange!
If we want to know the maximum output by a given level of costs also use Lagrange.

If wage costs fall and interest rate stays constant, the firm will use more wage, which is relative cheaper.

Maximizing output:
$\max L = f(L,K) + \lambda(\bar{C}) - wL - rK$

If a firm calculates the cost-minimizing output for any given level of output, it can calculate how costs varies with output. Curve through the tangency point in the long-run is the expansion path.
Formula for expansion path: $K = \frac{(1-a)}{a}\frac{w}{r}L$
Slope of the expansion path is the same as for the Long-run cost curve.

Solved problem pg. 226
Long-run marginal cost curve cuts the long-run average cost curve in its minimum.
Cost function exhibits economies of scales if average cost of production falls as output expands, which we expect as production function returns to scale.
Diseconomies of scale if average cost rises when output increases.

A firm can also minimize costs by substitute one production unit for another production unit (labour by materials etc.) because it waists less in the new situation.

Lower costs in the long-run
Short-run costs are at least as high as long-run costs because in the long-run a firm is flexible and it is higher if the wrong level of capital is used in the short-run.
Long-run average costs is equal to or below the short-term average costs. The LRAC includes some point of every short-run average cost curve, but this point is not necessary the minimum of the SRAC.

Doubling output increases short-term costs by factor 2.3 and long run costs by factor 2.
Reasons why LRC < SRC Long-run cost is lower than short-run cost:

1. Firm is flexible in the long-run.
2. Technological system may lower cost over time
3. Benefits of learning by doing (more experience)

Firms have an incentive to produce more in the short-run than they otherwise would to lower their costs in the future.

Cost of producing multiple goods
Economies of scope if it is less expensive to produce two products together than separately.
If SC is positive: produce together, if SC is negative: produce separately:

$$SC = \frac{C(produce\ only\ good\ 1) + C(produce\ only\ good\ 2) - C(produce\ good\ 1\ and\ 2)}{C(producing\ good\ 1\ and\ 2)}$$

Production possibility frontier = maximum amount of outputs that can be produced from a fixed amount of input.

Chapter 8

Competition
A market is perfectly competitive if each firm in the market is a price taker that cannot significantly affect the market price for its output or the prices at which it buys inputs. Demand curve is horizontal at the market price. It can sell at much as it wants, price is unchanged. If price rises, demand falls to zero.
Market structure: the number of firms in the market, the ease with which firms can enter and leave the market, and the ability of firms to differentiate their products from those of their rivals.

Price takers:

1. The market consist of many small buyers and sellers
2. Sell identical/homogeneous products
3. Firms can easily enter and exit the market
4. Buyers and sellers have full information about price and product characteristics
5. Transaction costs are negligible

Transaction costs are low because buyers and sellers do not need to spend money or time to find each other.
This are conditions for a perfectly competitive market. The demand curve of firms in a perfectly competitive market is essentially horizontal as long as there are many firms in the market.

The demand curve that an individual firm faces is called the residual demand curve.
Residual demand = the market demand that is not met by other sellers at any given price = demand – supply of other firms. This all is a function of the given price. $D^r = D(p) - S^o(p)$
S^o= supply curve of the other firms

Elasticity of market demand < elasticity of residual demand:
Elasticity of firm A = (amount of identical firms x market elasticity of demand) – (amount of identical firms – 1) x elasticity of supply of each of the other firms: $\varepsilon = n\varepsilon - (n-1)\eta$

Perfectly competitive markets are important because:

1. Many firms are perfectly competitive → Make predictions about tax effects etc.

2. It has many desirable properties

Profit maximization

Economic profit π is revenues R– economic costs C. Economic profit < business profit.

$$\pi = R - C$$

We always refer to profit/economic profit as revenue – opportunity cost

2 decisions in maximizing profit:

1. Output decision: what output of level maximizes the profit or minimizes the losses?
2. Shutdown decision: is it more profitable to produce or to shut down.

Output rules:

1. The firm sets its output where its profit is maximized.
    - Marginal profit: the change in the profit the firm gets from selling one more unit of output: dπ(q)/dq
2. A firm sets its output where its marginal profit is zero (use first order condition for a profit maximum)
    - Marginal revenue: MR, is the change in revenue it gains from selling one more unit of output: dR/dq
3. A firm sets its output where its marginal revenue equals its marginal costs. (slope of the marginal revenue curve must be less than the slope of the marginal cost curve.)

Shutdown rule:

1. The firm shuts down only if it can reduces its loses by doing so. (revenues and variable costs are compared. Fixed costs are sunk so they are irrelevant to the decision)
2. The firm shuts down only if its revenue is less than its avoidable cost. (in short and long run)

Competition in the short-run

Firms determines first what output maximizes output, than whether to produce or to shut down.

Because the demand function is horizontal, a competitive firm can sell as much as it want at market price p.

Because MR = p, it does not vary with output. This means that the first derivative of marginal cost function is positive.

Maximum profit is downwards from equilibrium (on p curve) to AC curve: $\frac{\pi}{q} = p - AC$

How does a tax change the maximum profit of a firm, which is taxed alone?

1. Use calculus to calculate profit-maximizing output before tax:
   $\pi = pq - C(q)$ and use derivatives to calculate.
2. Use calculus to calculate profit-maximizing output after tax:
   $\bar{\pi} = pq - C(q) - \tau q$ and use derivatives to calculate.

3. Use comparative statics to determine how a change in the tax rate effects output:
$$-\frac{dMC}{dq}\frac{dq}{d\tau} - 1 = 0$$

A firm can gain by shutting down only if its revenue is less than its short-run variable cost -> $pq < VC(q)$. A competitive firm shuts down if the market price is less than the minimum of its short-run average variable cost curve.

The competitive firm's short-run supply curve is its marginal cost curve above its minimum average variable cost, because the firm will stop producing if market price is below AVC.

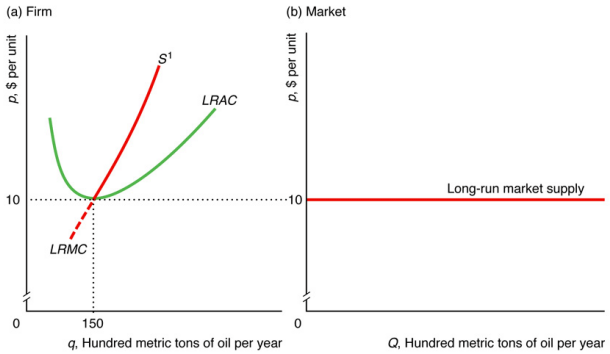
If a single factor price increases, costs rise less than in proportion.

Market supply curve is n (amount of firms n market) times individual supply curve.
For identical firms: The market supply curve flattens as the number of firms in the market increase because the market supply curve is the horizontal sum of more and more upward sloping firm supply curves → If firms want to increase their output they do not have to decrease their prices.
For different firms: the more that firms differ in costs, the steeper the market supply curve at low prices.

Short-run market supply and market demand curve given short-run competitive equilibrium.
Competition in the long-run
In the long run, there are no sunk costs. The firm produces what maximizes its profit, like in the short-run. In the long-run, all costs are variable! So firm shuts down if revenue < economis costs.

Long-run supply curve is marginal cost curve aboven the AC curve.

In the long-run, a firm shuts down if the market price is below the long-run average cost.
In a market with free entry and exit a firm enters a market if it can make a long-run profit and exits the market to avoid a long-run loss.
When the market price is above the AC, firms will entry the market, prices will drop until p = AC.
Entry and exit barriers are likely to be related.



The long-run market supply curve is flat at the minimum average long-run cost if firms can freely enter and exit the market, an unlimited number of firms have identical costs, and input prices are constant. Total output = number of firms x output per firm. So long-run supply curve is horizontal if the market has free entry and exit.

Reasons why curves can be upward sloping:
1. If numer of firms in a market is limited (sum of marginal cost curves aboven AC)
2. If firms differ (different average costs)

3. Non constant input prices (increasing-cost market: input prices rise with output). Long-run market supply curve is upward sloping in an increasing-cost market and flat in a constant cost market.

Residual supply curve = quantity that the market supplies that is not consumed by other demanders at any given price. Residual supply = world supply – other demand elsewere in the world

Elasticity of residual supply: $\eta_r = \frac{\eta}{\theta} - \frac{1-\theta}{\theta}\varepsilon_0$
η = market supply elasticity
ε = demand elasticity of other countries
θ = import of total world supply (Qr/Q)
If a country imports a small share of the world's output, then it faces a horizontal import supply curveat the world equilibrium price.

Chapter 9

Producer surplus (PS): the excess of the revenue form selling a good and the minimum amount necessary for the seller to be willing to produce the good. The minimym amount a seller must receive to be willing to produce = its variable cost. $PS = \int_0^{q^*}[p - MC(q)]dq$

The welfare of society (W) = CS+PS: implicitly weights the well-being of consumers and producers equally.
Deadweight loss (DWL): the net reduction in welfare from a loss of surplus by one group that is not offset by a gain to another group.
Market failure: inefficient production or consumption, often because a price exceeds marginal cost.

Government policy can let the suplly curve shift to the left, when this happens, consumers make fewer purchases at a higher price and welfare falls. For example by restricting the number of firms in a market or by raising the cost of entry.
A long-run barrier to entry is an explicit restriciton or a cost that applies only to potential new firms.

Welfare effects of a sales tax
A new sales tax causes the price that consumers pay to rice and the price that firms receive to fall:

$\Delta CS < 0$
$\Delta PS < 0$
Welfare, W = CS+PS+T

The government can set a price floor/a minimum price: the lowest price a consumer can legally pay for the good. If the market price is above the price floor, the support program is irrelevant.
Price ceiling: the highest price that a firm can legally charge. IF the ceiling is set below the unregulated competitive price, consumers deman more than the unregulated equilibrium quantity and firms supplu less than that quantity. PS must fall because of a price ceiling, because firms receive a lower price and sell fewer units.

Deadweight loss relfects two distortions in a market:

1. Excess prodcution: more output is produced than is consumed
2. Inefficiency in consumption: at the quantity they actually buy, consumers are willing to pay more than the marginal cost.

Chapter 11

A monepoly is the only supplier of a good for which there is no close substitute.

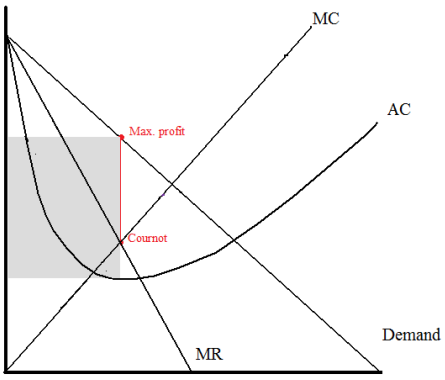
Monopoly profit maximization
A monopoly sells the entire market quantity.
Necessary condition for profit maximization:

1. $\frac{d\pi(Q)}{dQ} = 0$
2. $MR(Q) = MC(Q)$
3. $\frac{d^2\pi(Q)}{dQ^2} < 0$

A monopoly's marginal revenue curve lies below its inverse demand curve at any positive quantity.
Marginal revenue in terms of the elasticity of demand: $MR = p(1 + \frac{1}{\varepsilon})$
Marginal revenue is closer to the price as demand becomes more elastic

Because marginal profit is marginal revenue minus marginal costs, marginal profit is zero when the marginal revenue curve intersects the marginal cost curve.

A monopoly never operates in the inelastic portion of its demand curve.



Shaded area is maximum profit

Average profit is positive only if price is above the average costs. If average profit is negative, shut down.

Monopoly can set its price OR quantity (not both together), but is constraint by the market demand curve. We assume that the monopoly sets its quantity.

The monopoly's output decision depends on its marginal cost curve and its demand curve. Unlike the competitive firms, a monopoly does not have a supply curve.

If demand changes, price can change, quantity can change OR both can change. Thus a given quantity can correspond to more than one monopoly-optimal prices.

Market power

Market powers is the ability of a firm to charge a price above marginal cost to earn a positive profit

How much above its marginal cost stes a monopoly its price? It depends on:

1. Shape of the demand curve at the profit maximizing quantity. Is it elastic?
   $\frac{p}{MC} = \frac{1}{1+(\frac{1}{\varepsilon})}$
   If demand is perfectly elastic, p = MC. The more elastic the demand curve, the less a monopoly can raise its price without losing sales.
2. Lerner index (or price mark-up): (p – MC) / p, lerner index is value between 0 and 1.
   $\frac{p-MC}{p} = -\frac{1}{\varepsilon}$

All else the same, the demand curve that a firm faces becomes more elastic:

1. As better substitutes are introduced
2. More firms enter the market selling the same products
3. As firms providing the same service locat closer to the firm.

Welfare effects of monopoly

Welfare is the sum of consumer surplus and producer surplus. It is lower under monopoly than under perfect competition, because consumers buy less in monopoly situation, so there is deadweight loss.

Taxes and monopoly

Taxes affect a monopoly differently than they affect a competitive industry in two ways:

1. Tax incidence on consumers can exceed 100% in a monopoly market but not in a competitive market
2. Government earns more with an ad valorem tax with a monopoly.

Specific tax:

After tax profit = $\frac{dR(Q)}{dQ} - \frac{dC(Q)}{dQ} - \tau = 0$

When monopoly lowers its output, it raises its price by: $\frac{dp}{dQ}\frac{dQ}{d\tau} > 0$

Solve MR=MC and fill in into the inverse demand function.

To calculte the incidence of the tax on consumers: $\frac{\Delta p}{\Delta \tau}$ = percent of tax that consumers pay

Ad valorem tax:

With ad valorem tax the government raises more revenue with monopolies.

Cost advantges that create monopolies
Cost advantage for 2 reasons:

1. The firm controls an essential facility for other firms
2. It uses a superior technology or has a better way of organizing production

Natural monopoly if it can produce with lower cost than any other firm in the market.If producing with two firms costs more than producing with one firm, the firm has a natural monopoly.
Government actions that create monopolies

1. Barriers to entry:
- Licenses to operate
- Grants of monopoly rights
- Auctions of monopoly rights
2. Patents.
- Length differ.
- It gives firms the change of developing and innovate their products

Government actions that reduce market power
To reduct the power of monopolies, the government can use several regulation. With the optimal price regulation, the government requires that the monopoly charge no more than the competitive price (eliminate deadweight loss). Firm still makes a profit if price is above AC. In this situation (competitive markets) the welfare is optimal.

If price is set below optimal price, the firm shuts down or the price is low, the output is also lower than optimal output so there is deadweight loos because less outut is sold than with optimal regulation. Is the demand curve and marginal cost curve are nog exactly known, regulation is difficult.

Regulation is inefficient if they are influenced by the firms they regulate.

Alternative for regulation is increase competition (firms may entry into the market or ban import which stimulate competition form outsiders)

Monopoly decisions over time
Network externality = one person's demand depends on the consumption of a good by others

1. Direct size effect: consumer gets direct benefits from a larger network
2. Bandwagon effect: a person places greater value on a good as more and more other people possess it
3. Snob effect: a person places greater value on a good as fewer and fewer other people possess it
4. Indirect effect: positive network externalities depend on the complementary goods that are offered

This is also an explanation for monopolies: ebay has most buyers and sellers and buyers and sellers.

Chapter 17

Externalities

An externality occures when a person's well-being or a firm's production capability is directly affected by the actions of other consumers or firms rather than indirectly through changes in prices. This externalities can be negative or positive.

Public goods

Public good = commodity or service whose consumption by one person does not preclude others from also consuming it. A public good produces a positive externality, and excluding anyone from consuming a public good is inefficient.

Demand curve for public goods is the vertical sum of individual demand curves for public goods.

Optimal provision of a public good:

Pareto superior is any reallocation that increases one person's utility while holding the other person's utility constant. Use lagrange and the first-order conditions.

The sum of the maginal rates of substitution of all members of society equals one.

Many people try to free ride: benefit from action of othrs without paying. They want to benefit from a positive externality.

Reducing free riding by:

1. Social pressure
2. Merge different stores into one store
3. Compulsion

Knowing and being able to list

To know

Hoorcollege 1:

- budget limitation and budget line
- Cobb-Douglas utility function
- complete preferences
- convex and concave
- corner solution
- "endowment effect"
- imperfect substitutes

- differential curve
- “interior solution”
- iso-utility curve
- cardinal and ordinal preferences
- linear and quasi-linear preferences
- marginal utility
- marginal substitution rate ("MRS") and marginal transformation rate ("MRT")
- utility function
- perfect substitutes
- perfect complements
- rational preferences
- "salience"
- preferences and transitivity of preferences

Hoorcollege 2:

- spending function
- Angel curve
- compensated and uncompensated demand curve
- Poison good
- Hicksian demand curve
- inferior good
- income-consumption curve
- income effect
- income elasticity of demand
- Laspeyres index / Paasche index
- normal good, luxury good, necessary good
- Marshallian demand curve
- nominal price, real price
- price-consumption curve
- “Revealed preferences”
- Shephard’s Lemma
- Slutsky comparison
- substitution effect
- substitution elasticity of demand
- actual price index ("true cost-of-living index"

Hoorcollege 3:

- Cobb-Douglas production function
- average product of labor
- isoquant
- short term and long term production function
- marginal product of labor and capital
- marginal technical substitution rate ("MRTS")
- production function
- - linear
- - fixed relationships

- scale revenues
- constant
- decreasing
- increasing
- technological change
- neutral and non-neutral
- labor saving
- capital saving
- variable input and fixed input
- law of decreasing additional income

Hoorcollege 4:

- "Economies of scope"
- average costs (- curve)
- average variable costs (- curve)
- marginal costs (- curve)
- short-term cost function
- long-term cost function
- "Learning by doing"
- opportunity costs
- scale revenues
- constant
- decreasing
- increasing
- fixed costs
- sunk costs

Hoorcollege 5:

- supply curve in the short term
- supply curve in the long term
- competitive balance
- short-term competitive balance
- long-term competitive balance
- marginal costs and marginal revenues
- marginal profit
- residual supply and demand curve
- avoidable costs
- free entry and exit
- v.v.m.
- (economic) profit
- profit maximization

Hoorcollege 6:

- compensatory variation
- consumer surplus

- deadweight loss
- equivalent variation
- (un) compensated demand function
- inverse supply function and inverse demand function
- market failure
- maximum price, minimum price
- producer surplus
- quota
- “Willingness to pay”
-

Be able to do

- Lagrange
- Cournot duopolie
- Demand supply model
- Elasticities
- Effects on sales taks
- Utility graphs and calculations
- Cobb-Douglas
- Shephard’s lemma
- Slutsky equation
- Consumer surplus
- Producer surplus
- Forms of ownership
- Difference between short-run and long-run costs
- Prof maximization
- Lerner index
- Calculate with externalities

Disclaimer