Zusammenfassung WS1617 Principles of Economics

Principles of Economics (Technische Universität München)

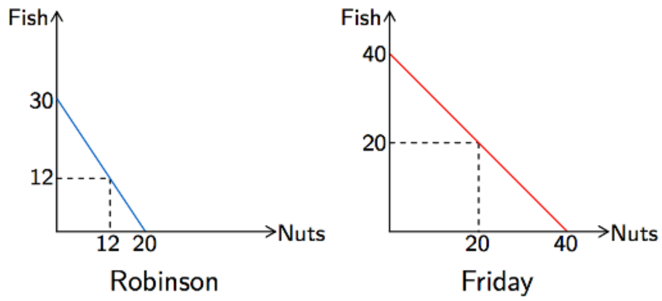
1. Introduction

1.1 Scarcity and Choice (Knappheit und Entscheidungsprobleme)

Economics is a calculus of **pleasure and pain**. A study of **mankind in the ordinary business of life**. The science which studies **human behavior** as a relationship between **ends and scarce means** which have alternative uses.
Microeconomics: Analysis of **individual choices** and their **interaction on markets** (Consumption and Demand, Production and Supply, Perfect Competition, Market Failure)
Macroeconomics: Analysis of the **economy as a whole** (Macroeconomic Indicators, Economic Growth, Economic Fluctuations)
Fundamental Problem: There is no such thing as a **free lunch**. -> nothing is free, weil man auf was anderes Verzichten muss, **Opportunitätskosten / Verzichtskosten**
Scarce Resources: Human wants exceed the resources available to satisfy them.
Scarcity implies trade-offs: The **opportunity cost** of a choice is the best forgone alternative.
Optimization: Rational individuals **maximize utility** (satisfaction) from a given set of resources & **minimize resource use** to obtain a given utility level -> dual problem
Fundamental Concepts:
Equilibrium: A situation where **individual choices are optimal** in the sense that no agent has an incentive to change behavior and mutually compatible and hence feasible.
Efficiency: An allocation of resources is called **Pareto efficient** if no Pareto improvement is possible. A Pareto improvement is a **reallocation that makes at least one agent better off without making any other agent worse off**.
Production: Transformation of **inputs into outputs**: **Efficient production implies a trade-off**: Producing more of one good implies producing less of another good.
Transformation Curve: Graphical representation of a **production trade-off given fixed resources**: All combinations of goods on and below the transformation curve are feasible, but only those on the curve are efficient. The **slope** of the transformation curve measures **opportunity cost**, i.e. the marginal cost of producing one good expressed in units of another.

1.2 Specialization and Trade

Gains from Trade: The end of all commerce is to increase production. (Ricardo, 1817)
Absolute Advantage: An agent's ability to produce a certain good using less resources than other agents
Comparative Advantage: An agent's ability to produce a certain good at lower opportunity costs than other agents



- Friday has an absolute advantage in the production of fish and coconuts.

Minutes per unit		
	Fish	Nuts
Robinson	20	30
Friday	15	15

Absolute Advantage

Opportunity costs per unit		
	Fish	Nuts
Robinson	2/3	3/2
Friday	1	1

Comparative Advantage

- Robinson has a comparative advantage in the production of fish, while Friday has a comparative advantage in the production of coconuts.
- Specialization according to comparative advantages and trade allow Robinson and Friday to consume more of each good.

Production & Consumption		
	Fish	Nuts
Robinson	12	12
Friday	20	20
	32	32

Autarky

Production (Consumption)		
	Fish	Nuts
Robinson	30 (14)	0 (14)
Friday	5 (21)	35 (21)

Specialization & Trade

example:

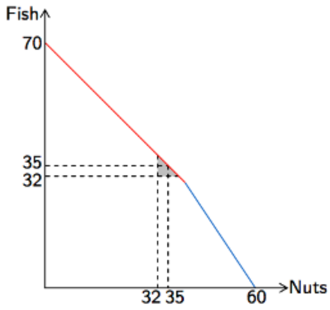
Robinson
1h more for fish prod.
15 fish
10 nuts

Friday
30 min more for nut prod.
18 fish
22 nuts

32 nuts & 33 fish
⇒ 1 fish more than before

- Here, one fish is traded for 7/8 coconuts (one coconut is traded for 8/7 fish).

The allocation under autarky allows a Pareto improvement.
The allocation after specialization and trade is Pareto efficient.



Robinson & Friday

They can realize mutual gains from trade if they agree on terms of trade between their respective opportunity costs.

Principle of Comparative Advantage: Specialization according to comparative advantages facilitates **mutual gains from trade**. This is true whether or not one of the trading partners has absolute advantages in the production of every good. The **terms of trade** must be set between the **opportunity costs of the trading partners**.

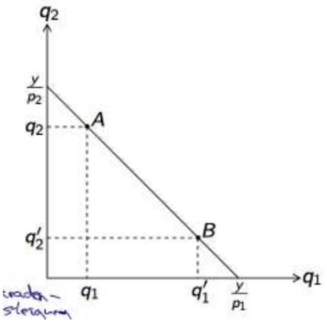
2. Consumption and Demand

2.1 Optimal Consumption

Model: Framework: Consider a representative individual.
The individual derives **utility** from the **consumption of two goods**; q1 and q2 denote the quantities of the two goods available to the individual. The individual's preferences are represented by a **utility function** U(q1,q2) which is **increasing and concave** (rechtsgekrümt, Nutzenzuwachs wird immer kleiner) in both goods. The individual is a **price taker**: She considers the prices p1 and p2 of the two goods as given. The individual's **budget** (initial resource endowment) $\mathbf{y = p_1q_1 + p_2q_2}$ is given.

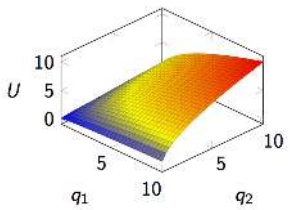
Budget Line: Locus of **all consumption bundles (q1,q2)** which the individual can obtain spending her entire budget; **Price Ratio:** Rate at which the individual can substitute one good for another at constant expenses (Geradensteigung)

$$q_2 = \frac{y}{p_2} - \frac{p_1}{p_2} q_1$$

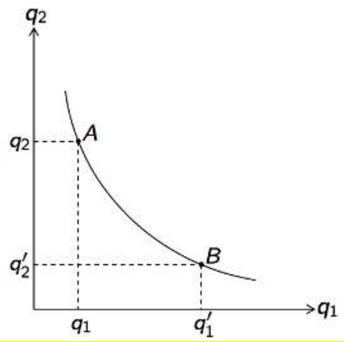


Utility Function: The function U(q1,q2) represents the utility the individual derives from any consumption bundle (q1,q2).

$U(q_1, q_2) = (q_1 \cdot q_2)^{\frac{1}{2}}$



Indifference Curve: Locus of **all consumption bundles (q1,q2)** from which the individual derives the **same level of utility** U(q1,q2). **Marginal Rate (Grenzrate) of Substitution (MRS):** Rate at which the individual can substitute one good for another at constant utility



$$\mathrm{MRS}_{1,2} = \frac{\partial U / \partial q_1}{\partial U / \partial q_2}$$

<u>Assumptions on Preferences:</u>

Completeness: The individual can compare any two consumption bundles A and B. Every consumption bundle is located on an indifference curve.

Transitivity: Consider any three consumption bundles A, B, and C. If the individual prefers A to B and B to C, she also prefers A to C. Equally, if the individual is indifferent between A and B as well as B and C, she is also indifferent between A and C. Indifference curves do not cross.

Monotonicity: If the consumption bundle A contains a larger quantity of each good than the consumption bundle B, the individual prefers A to B. Indifference curves for two goods are negatively sloped.

Convexity: If the individual is indifferent between two consumption bundles A and B, then any weighted average of A and B is at least as good as A or B. Indifference curves are convex.

<u>Extreme Cases of Preferences:</u>

Perfect Substitutes: Two goods the individual is willing to substitute for one another at a constant rate -> Linear indifference curves

Perfect Complements: Two goods the individual wants to consume in fixed proportions -> Orthogonal indifference curves (z.B. rechter und linker Schuh)

Utility Maximum:

Optimization Problem: The individual maximizes utility with respect to the consumption of the two goods subject to the budget constraint. **max(q1,q2) U(q1, q2) s.t. y >= q1p1 + q2p2**

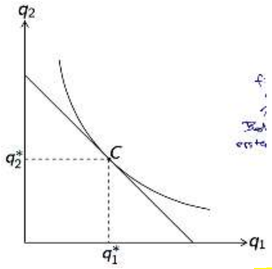
Any interior solution of the maximization problem must satisfy the following conditions:

$$y = p_1 q_1 + p_2 q_2,$$

$$\mathrm{MRS}_{1,2} = \frac{\partial U/\partial q_1}{\partial U/\partial q_2} = \frac{p_1}{p_2}.$$

Interior Solution: The rate at which the individual is willing to substitute good 1 for good 2 must equal the rate at which she can substitute good 1 for good 2.

In the optimal consumption bundle, the slope of the indifference curve equals the slope of the budget line.



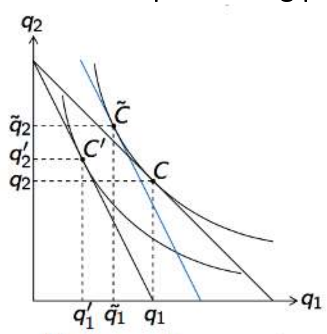
Change in Income: **Normal Good:** A good for which an **increase in income causes an increase in consumption** and vice versa; dqi/dy > 0**; Inferior Good:** A good for which an **increase in income causes a decrease in consumption** and vice versa; dqi/dy < 0 (Brot, Karto., öff. Nahv.)

Change in Prices:

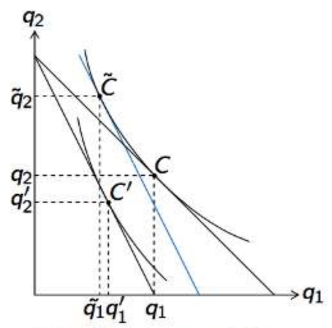
Substitution Effect: Ceteris paribus, a change of the price ratio induces the individual to substitute the good which has become relatively more expensive with the other good which has become relatively less expensive.

Income Effect: Ceteris paribus, an increase in prices decreases the individual's purchasing power and vice versa. Ceteris paribus, a decrease in purchasing power induces the individual to consume less of normal and more of inferior goods and vice versa.

Example: Total effect of an increase in the price of good 1 on the optimal consumption bundle; C -> C'; **Substitution Effect:** Change of consumption resulting from a change in the price ratio; C -> C~; **Income Effect:** Change of consumption resulting from a change in the individual's purchasing power; C~-> C' (both goods ordinary, inferior only for income effect)



Both goods normal



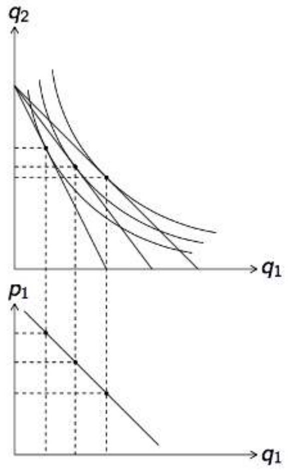
Good 1 inferior, good 2 normal

Ordinary Good: A good for which a **price increase causes a decrease in consumption** and vice versa; dqi/dpi < 0. If the ordinary good is normal, substitution and income effects work

in the same direction. If the ordinary good is inferior, substitution and income effects work in opposite directions while the former prevails.
Giffen Good: A good for which a **price increase causes an increase in consumption** and vice versa; dqi/dpi > 0. A Giffen good must be inferior, so that substitution and income effects work in opposite directions while the latter prevails. (Kartoffeln werden teurer und Rindfleisch nicht mehr leistbar -> kauft mehr Kartoffeln)
Substitutes: Two goods for which a **price increase of the first causes an increase in consumption of the second** and vice versa; dqj/dpi > 0. If the substitute good is normal, substitution and income effects work in opposite directions with the former prevailing. If the substitute good is inferior, substitution and income effects work in the same direction. (Olivenöl und Magarine)
Complements: Two goods for which a price **increase of the first causes a decrease in consumption of the second** and vice versa; dqj/dpi < 0. A complementary good must be normal, so that substitution and income effects work in opposite directions with the latter prevailing. (Ski und Skistöcke)

2.2 Individual Demand

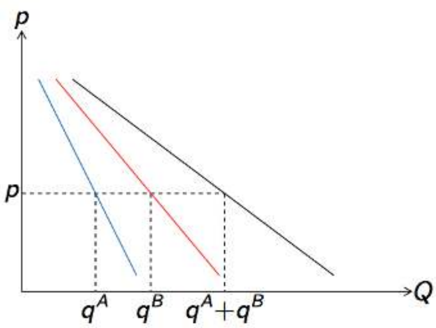
Individual Demand Curve: Ordinary Good: Downward sloping individual demand curve; dqi/dpi < 0



Optimal Consumption & Individual Demand Curve

2.3 Market Demand

Market Demand Curve:
Market Demand: Sum of individual demands for a good; Q = sum over q
Law of Demand: Empirical observation that, ceteris paribus, the market demand for a good decreases when its price increases; dQ/dp < 0 (only for ordinary good, for Giffen good: Giffen paradoxon)



3. Production and Supply

3.1 Cost Minimization

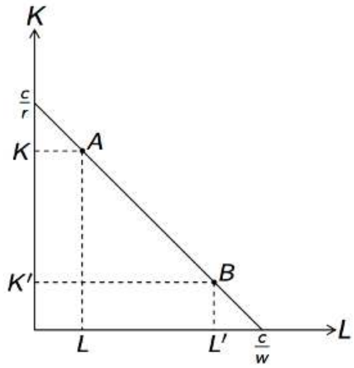
Model: Framework: Consider a representative firm. The firm produces **q units** of a particular good (output) employing two factors of production (inputs); **L** denotes the quantity of **labor**, while **K** denotes the quantity of **capital**. The firm's production technology is represented by a **production function F(L,K)** which is **increasing and concave** in both inputs. The firm is a **price taker**: It considers the output price **p** as well as the input prices **w** for labor and **r** for capital as **given**. The firm's **input costs** are **c = wL + rK**. The firm's **revenue** is **R(q) = pq.**

Gewinn = revenue-costs

Input Costs:

Isocost Line: Locus of all input bundles (L,K) causing identical input costs K=c/r – w/r * L

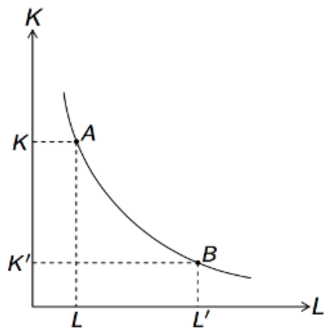
Input Price Ratio: Rate at which the firm can substitute one input for another at constant input costs



Production:

Production Function: The function F(L,K) represents the output q the firm can produce employing the input bundle (L,K). Example: q=F(L,K)=(L·K)^0.5

Isoquant: Locus of all input bundles (L,K) that yield the same output q = F(L,K)



Marginal Rate of Technical Substitution: Rate at which the firm can substitute one input for another at constant output

$$\mathrm{MRTS}_{L,K} = \frac{\partial F/\partial L}{\partial F/\partial K}$$

Strictly convex isoquants? Nicht partielle Ableitung von MRTS nach L sondern: Vollständige Ableitung da man auf Isoquante bleiben will -> K auch nach L ableiten!

Assumptions on Technology:

Monotonicity: If the input bundle A contains a larger quantity of each input than the input bundle B, A yields a larger output than B. Isoquants are negatively sloped.

Convexity: If the input bundles A and B yield the same output, then any weighted average of A and B yields at least as much output as A or B. Isoquants are convex.

Extreme Cases of Technology:

Perfect Substitutes: Two inputs that can be substituted for one another at a constant rate while output remains constant → Linear isoquants

Perfect Complements: Two inputs that should be employed in fixed proportions → Orthogonal isoquants

Ab hier nicht mehr analog zu consumption & demand:

Proportional Change in Inputs: Returns to Scale: Effect of a proportional change in all inputs on output. If all inputs are multiplied by a constant $\lambda > 0$, the output is multiplied by a power α of λ. → F(λL, λK) = λ^α*q; The production function is said to exhibit increasing returns to scale for $\alpha > 1$, constant returns to scale for $\alpha = 1$, and decreasing returns to scale for $\alpha < 1$.

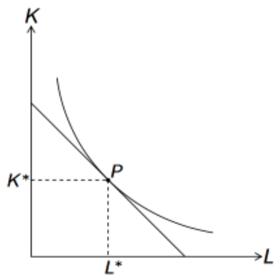
Cost minimum:

Optimization Problem: The firm **minimizes input costs** with respect to input employment subject to a given output. **min(L,K) c = wL+rK s.t. q = F(L,K)**

Any interior solution of the minimization problem must satisfy the following conditions:

q = F (L, K), $\mathrm{MRTS}_{L,K} = \frac{\partial F/\partial L}{\partial F/\partial K} = \frac{w}{r}$.

Interior Solution: The rate at which the firm can substitute labor for capital at **constant output** must equal the rate at which it can substitute labor for capital at **constant input costs**. In the optimal input bundle, the slope of the isoquant equals the slope of the isocost line.



Change in Output: Effect on Input Costs: An increase in output always results in an increase in input costs and vice versa; dc/dq > 0.

In order to increase output, more of at least one input must be employed.

Production Costs:

Total Costs: Sum of fixed and variable costs; Fixed costs c^f are independent of output. Variable costs c(q) represent minimum input costs as a function of output. C(q)=c^f +c(q)

Average Costs: Costs per unit of output; Let AC(q) denote average total costs, and let ac(q) denote average variable costs.

$$AC(q) = \frac{C(q)}{q} = \frac{c^f}{q} + \underbrace{\frac{c(q)}{q}}_{ac(q)}$$

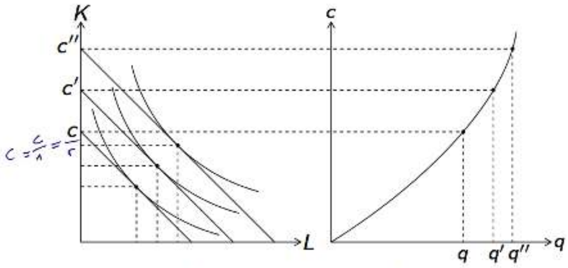
Short-Run Total Costs: In the short run, fixed costs are sunk costs. **Sunk Costs:** Incurred costs that cannot be recovered C(q)=c^f +c(q), q>=0

Long-Run Total Costs: In the long run, non-variable costs must be quasi-fixed costs. **Quasi-Fixed Costs:** Costs that arise if the firm starts production but do not vary as output increases

$$C(q) = \begin{cases} c^f + c(q), & q > 0 \\ 0, & q = 0 \end{cases}$$

Variable Costs: Upward sloping variable cost curve; dc/dq > 0

Assume that the price of capital is normalized to r = 1.



Cost Minimization & Variable Costs

3.2 Profit Maximization

Marginal Effects of Production:

Marginal Costs: Change in total costs resulting from a marginal change in output

MC(q) = dC(q)/dq

Marginal Revenue: Change in revenue resulting from a marginal change in output

MR(q) = dR(q)/dq

Profit Maximum:

Optimization Problem: The firm maximizes its profit π(q) with respect to output q.

max(q) π(q) = R(q) - C(q) -> dπ/dq = MR(q) - MC(q) = 0

Any interior solution of the maximization problem must satisfy the following condition:

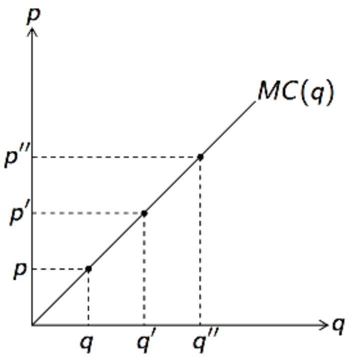
MR(q) = MC(q).

For a **price-taking firm**, marginal revenue equals the output price, so that profit maximization requires **p = MC(q).**

Strictly Convex Costs: Increasing marginal costs; dMC(q)/dq > 0

An increase in the output price increases the profit maximizing output; dq/dp > 0.

Linear steigend wenn strikt konvexe Gesamtkostenfunktion



Profit Maximizing Output

3.3 Individual Supply

Individual Supply Curve:

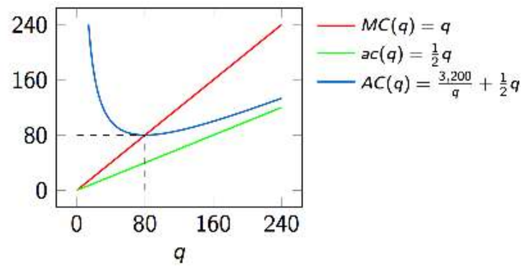
Optimal Production: The firm supplies either the output q > 0 satisfying the condition p = MC(q) or the output q = 0. In the **short run**, the firm supplies q > 0 if and only if

R(q) >= c(q) <-> p >= ac(q).

In the **long run**, the firm supplies q > 0 if and only if R(q) >= C(q) <-> p >= AC(q).

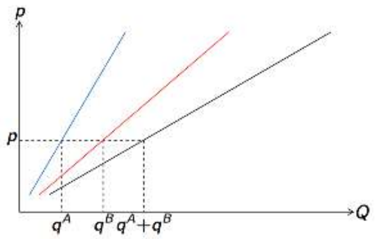
Individual Supply Curve: The short run (long run), individual supply curve corresponds to the segment of the marginal cost curve which runs above the average variable (average total) cost curve.

Example: Consider a firm with total costs C(q)=3,200+1/2*q^2 → Short run individual supply: q =p; Long run individual supply: $q = \begin{cases} p, & p \geq 80 \\ 0, & p < 80 \end{cases}$



3.4 Market Supply

Market Supply: Sum of individual supply quantities of a good; Q = sum over q



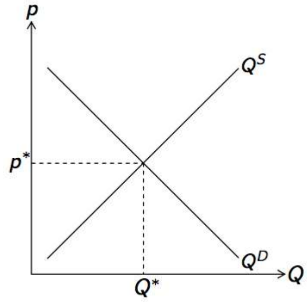
Individual & Market Supply Curves

Law of Supply: Empirical observation that, ceteris paribus, the market supply of a good increases when its price increases; dQ/dp > 0

4. Perfect Competition

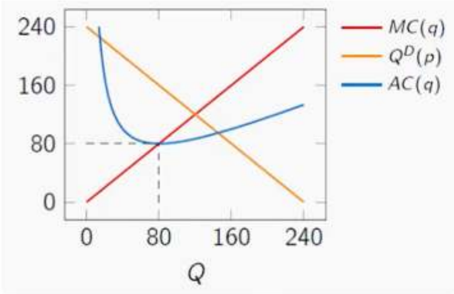
4.1 Equilibrium

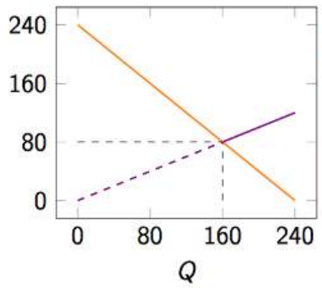
Model: Framework: Consider a market where an ordinary good is supplied by n (element of natural numbers) identical firms producing at increasing marginal costs.
Perfect Competition: All producers and all consumers are **price takers**. No barriers to entry or exit exist. (Preisnehmer passen Mengen optimal für sich an den gegebenen Preis an)
Complete Market: Decisions of individual producers or consumers have no external, i.e. uncompensated, effects on others.
Perfect Information: All producers and all consumers have equal access to any relevant information. (es gibt weder Unsicherheit noch Informationsassymetrie)
Markt: Institution bei welcher Angebot und Nachfrage zusammentreffen, bei dem Handel stattfindet & in einem Markt sind alle Güter homogen n; Gewöhnliches Gut: Marktnachfragefunktion sinkt mit steigendem Preis; Steigende Grenzkosten: Gesamtkosten strikt konvex
Competitive Equilibrium: Market Equilibrium: A market is in equilibrium if for a given price p, **market demand Q^D equals market supply Q^S.**
Let p* and Q* denote price and quantity, respectively, in the competitive equilibrium.
Q^D(p*) = Q^S(p*) = Q*



Market Imbalance: A market is imbalanced if for a given price p, market demand Q^D differs from market supply Q^S.

Excess Demand: If p' < p*, then Q^D > Q^S and Q'=Q^S < Q*.
Excess Supply: If p' > p*, then Q^D < Q^S and Q'=Q^D < Q*.
<u>Comparative Statics:</u>
Change in Market Demand: Ceteris paribus, if market demand …increases, equilibrium price and quantity increase. …decreases, equilibrium price and quantity decrease.
Change in Market Supply: Ceteris paribus, if market supply …increases, equilibrium price decreases, and equilibrium quantity increases. …decreases, equilibrium price increases, and equilibrium quantity decreases.
Number of Firms: Short Run: The number of firms in the market is fixed.
Long Run: The number of firms in the market may change because of entry and exit of firms. Additional firms enter the market if this yields non-negative profits. Incumbent firms exit the market if they make losses. The equilibrium number of firms in the market is the maximum number of firms that can make non-negative profits.
Long-Run Equilibrium: Example: Consider a competitive market with market demand Q^D(p)=240-p served by n identical firms, each of which has total costs C(q)=3,200+1/2*q^2 so that long-run market supply is $Q^S(p) = \begin{cases} np, & p \geq 80 \\ 0, & p < 80. \end{cases}$ (MC = AC → Q^S(80) = Q^D(80) → n=2)

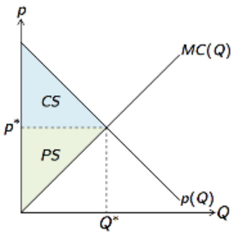




Individual Maximization: Given the equilibrium price p*, …
… utility maximization implies that consumers' reservation price, i.e. inverse market demand, must equal equilibrium price p(Q*) = p*, because Q^D(p)^-1 = p(Q).
… profit maximization implies that producers' reservation price, i.e. marginal costs, must equal equilibrium price MC(Q*) = p*, because Q^S(p)^-1 = MC(Q).
Competitive Equilibrium: At the equilibrium quantity Q*, the reservation prices of consumers and producers must be equal. p(Q*) = MC(Q*) because Q^D = Q^S.
Zahlungsbereitschaft der Nachfrage = Grenzkosten der Anbieter

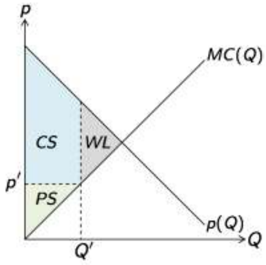
<u>4.2 Welfare</u>

<u>Consumer and Producer Surplus</u> (Rente / Rendite / Überschuss)
Total Surplus: Sum of consumer and producer surplus; TS = CS + PS
Consumer Surplus: Aggregated differences between consumers' reservation price and market price; $CS = \int_0^{Q(\bar{p})} (p(Q) - \bar{p})\, dQ$
Producer Surplus: Aggregated differences between market price and producers' reservation price; $PS = \int_0^{Q(\bar{p})} (\bar{p} - MC(Q))\, dQ$
Welfare Maximum: In the competitive equilibrium, total surplus is maximized. The competitive equilibrium is Pareto efficient as all potential gains from trade are realized.

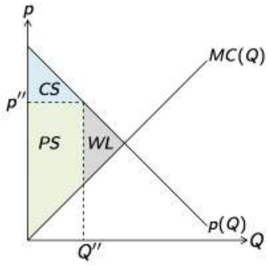


Short-Run Welfare Loss:

Welfare Loss: WL is the loss in total surplus compared to competitive equilibrium if the reservation prices of consumers and producers differ. A price ceiling at p' < p* implies Q' < Q* and p(Q') > MC(Q'). A price floor at p'' > p* implies Q'' < Q* and p(Q'') > MC(Q'').

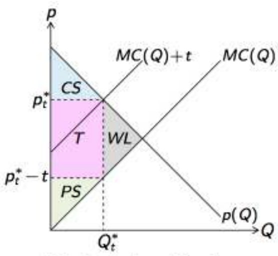


Price Ceiling

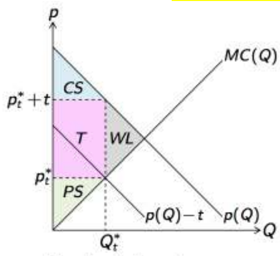


Price Floor

Taxation: Consider a tax per unit of output, where t > 0 denotes the tax rate, and T = tQ denotes tax revenue. The welfare effects of the tax are equal, whether it is levied on producers or consumers. In equilibrium, the tax drives a wedge between the reservation prices of consumers and producers; $t = p(Q_t^*) - MC(Q_t^*)$.



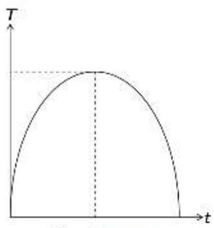
Tax Levied on Producers



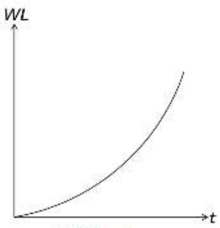
Tax Levied on Consumers

Comparative Statics: Steuersatz t -> Steueraufkommen T

Change in Taxation: If an increase in the tax rate causes a decrease in the tax base (equilibrium output), it results in an increase (decrease) in tax revenue if the tax rate is sufficiently small (large), a higher welfare loss of taxation.



Tax Revenue



Welfare Loss

5. Market Failure

5.1 Market Power

Monopoly:

Framework: Consider a monopoly market for an ordinary good.

Monopoly Market: A market served by only one firm, the monopolist. The monopolist is a **price maker**: Given inverse market demand, the monopolist's output choice determines market price. All consumers are price takers. **No price discrimination**: The monopolist charges every consumer the same price for all units of the good.

Formation of Monopolies: A monopoly may emerge because of **market size**: the market may be too small for more than one firm or **market barriers**: one firm may have exclusive access to the market. E.g. patents, exclusive ressources

Monopoly Profit:

Profit Maximization: The monopolist maximizes profit with respect to output given inverse market demand and total costs. **max(Q) π(Q) = R(Q)-C(Q), with R(Q) = p(Q)*Q**

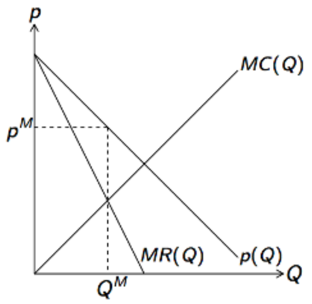
Any interior solution of the maximization problem must satisfy the following condition:

MR(Q) = p(Q) + dp(Q)/dQ * Q = dC(Q)/dQ = MC(Q)

Trade-off: A marginal increase in output has two effects on revenue. Revenue increases by the price charged for the marginal unit. Revenue decreases by the price reduction aggregated over the inframarginal units.

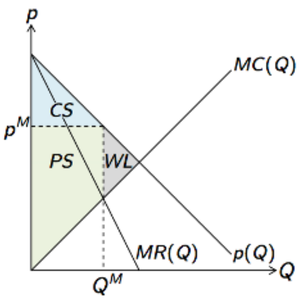
Monopoly / Market Equilibrium: The monopoly market is in equilibrium at the profit maximizing output Q^M and the corresponding price p^M, where monopoly output (price) equals (inverse) market demand.

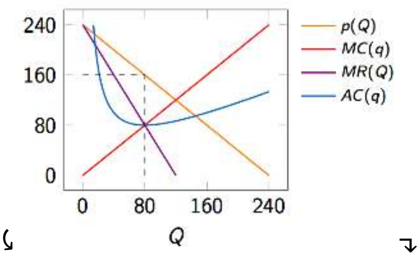
$$Q^M = Q^D(p^M) \quad \Leftrightarrow \quad p^M = p(Q^M)$$



Monopoly and Welfare:

Markup Pricing: The monopolist effectively sets the price above marginal costs, which entails a welfare loss. The monopoly equilibrium is not Pareto efficient, as not all potential gains from trade are realized.





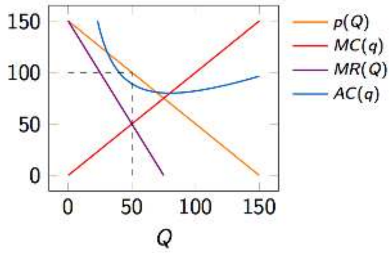
Consider a monopoly market where inverse market demand is p(Q) = 240-Q, and total costs are C(Q) = 3,200+ ½*Q^2. The profit maximizing output is Q = 80, and the corresponding price is p^M = 160. The resulting profit is π = 6, 400.

Natural Monopoly:

Subadditivity: Total costs are (locally) subadditive if a given output can be produced **less costly by a single firm rather than by more than one firm**. $C(Q) < \sum_{i=1}^{n} C(q_i), \quad \text{where} \quad Q = \sum_{i=1}^{n} q_i$

Natural Monopoly: A monopoly resulting from **subadditive total costs**. Average total costs of the monopolist are decreasing in the relevant output range. $\frac{dAC(Q)}{dQ} < 0 \quad \forall \quad Q \quad \text{s.t.} \quad p(Q) \geq MC(Q)$

Example: Consider a monopoly market where inverse market demand is p(Q) = 150-Q, and total costs are C(Q) = 3,200+ 1/2*Q^2. The profit maximizing output is Q^M = 50, and the corresponding price is p^M = 100. The resulting profit is π = 550.

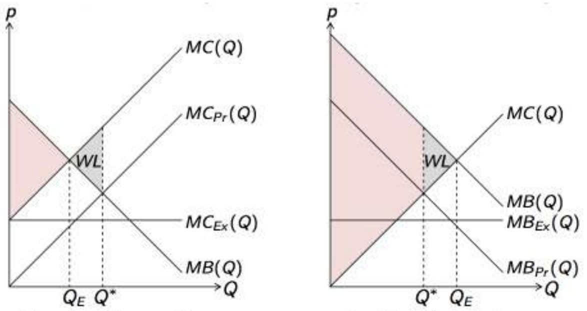


Patent Monopoly: Patent Protection: Right of an inventor to prevent others from utilizing the invention. If **fixed costs are higher for the inventor than for potential imitators**, patent protection is necessary for the inventor to make non-negative profits. Trade-off between prospective welfare (resulting from future inventions) and present welfare (resulting from existing inventions).
Monopoly Regulation: Price Regulation: A **price ceiling** that induces the monopolist to increase output **increases welfare**. The welfare maximizing price ceiling induces the monopolist to produce the output for which inverse market demand equals marginal costs; p(Q) = MC(Q). In case of a **natural monopoly**, the welfare maximizing price ceiling implies losses for the monopolist, calling for either **subsidization or nationalization.**

5.2 Externalities

External Effects:

Framework: Consider competitive markets where individual decisions have external effects.
External Effect: Uncompensated effect of individual decisions on others' profit or utility.
- Marginal costs comprise private and external marginal costs. **$MC(q) = MC_{Pr}(q) + MC_{Ex}(q)$**
(Bisher: sozialen Grenzkosten = privaten Gr.k.)
- Marginal benefits comprise private and external marginal benefits.
$MB(q)=MB_{Pr}(q)+MB_{Ex}(q)$ (Privater Grenzvorteil = Grenzzahlungsbereitschaft = inverse Marktnachfrage p(u) = Grenzreservationspreis; Externer Grenzvorteil = Grenzerlös)
If consumption or production decisions have external effects, the market price fails to align marginal costs and marginal benefits.
Negative Externality: External costs of a decision. Individual optimization yields a quantity that is inefficiently large. **Positive Externality:** External benefits of a decision. Individual optimization yields a quantity that is inefficiently small.

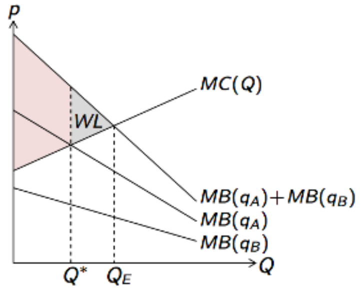


Negative Externality   Positive Externality

Remedies to External Effects:

Quantity Regulation: Decision makers can be forced to choose the efficient quantity. Requires information on marginal costs and marginal benefits
Corrective Taxation: A (Pigouvian) tax or subsidy can induce individuals to choose the efficient quantity. Requires information on external marginal costs and external marginal benefits

Bargaining: If property rights are well defined, bargaining between those affected by an externality and those causing it can induce individuals to choose the efficient quantity, irrespective of the division of property rights. (Coase Theorem)
Public Good: A good that is non-rival with respect to consumption. Consumption by one individual does not diminish the consumption possibilities of other individuals.
Provision by one individual entails a positive externality on other individuals.



Public Good

Samuelson Condition: Efficient provision of the public good. The sum of consumers' reservation prices should equal producers' reservation price. **Sum over MB(q_E) = MC(Q_E)**
Free-Rider Problem: Incentive of individuals to rely on others to provide the public good. Private provision results in an ineffciently small quantity. Public provision according to the Samuelson condition requires information on marginal benefits and marginal costs of the public good.

5.3 Asymmetric Information
Quality Differences:
Framework: Consider a continuum of goods that differ only with respect to quality. The following is common knowledge: Quality q is uniformly distributed on the interval [0, qmax]. Sellers' reservation price is q for a good of known quality and E(q) for a good of unknown quality. Buyers' reservation price is ***θ*q for a good of known quality** and ***θ*E(q) for a good of unknown quality, with *θ* > 1.**
Adverse Selection: Withdrawal of high quality goods due to asymmetric information regarding quality. If **only sellers can assess quality**, potential gains from trade might not be realized: For ***θ* element of (1, 2), trade is not feasible**
Symmetric Information: If both sellers and buyers (if neither sellers nor buyers) can assess quality, **trade is mutually beneficial since *θ* > 1.**
Asymmetric Information: If only sellers can assess quality, trade is feasible if and only if ***θ*>=2**. At any price p, sellers wish to sell all goods whose quality is q <= p. Hence, the quality of goods on offer is uniformly distributed on the interval [0, p]. At any price p, buyers know that the expected quality of goods on offer is E(q) = p. Hence, they wish to buy a good if

$$\theta E(q) \geq p \quad \Leftrightarrow \quad \theta\frac{p}{2} \geq p \quad \Leftrightarrow \quad \theta \geq 2.$$

6. Macroeconomic Indicators
6.1 Gross Domestic Product
Economic Activity:
National Accounts (Volkswirtschaftliche Gesamtrechnung): Accounting system that records the economic activity of a nation
Gross Domestic Product (Brutto Inlands Produkt (BIP): 2016 in D: 3 Billionen Euro (ungefähr gleich hoch wie Brutto National Einkommen)) **(GDP):** Measure of domestic economic activity that equivalently captures output, expenditure, and income (Inlandsprinzip: alles was im

Inland produziert wird, auch von ausländischen Firmen -> BIP**;** Inländerprinzip: Leistungen der Inländer in In- und Ausland -> Brutto National Einkommen, früher: Brutto Sozial Produkt)
Output Method (Entstehungsrechnung): GDP is the **sum of value** added at each stage of domestic production in a given period of time.
Expenditure Method (Ausgabenrechnung / -methode): GDP is the **sum of expenditures** on domestically produced final goods in a given period of time (net of expenses for intermediate goods produced abroad or in previous periods).
Income Method (Einnahmenrechnung): GDP is the **sum of incomes** from domestic production in a given period of time.
Nominal GDP: GDP at **current market prices**
Changes in nominal GDP reflect changes in output and prices.
Real GDP: GDP at **constant market prices** of a particular base period. Changes in real GDP only reflect changes in output.

6.2 Price Level

Cost of Living:

Price Index: Weighted average of the market prices of a set of goods normalized to a base period (t = 0)
Paasche Index: Price index that uses current period weights

$$P_t^P = \frac{\sum_{i=1}^n (p_{i,t} \cdot Q_{i,t})}{\sum_{i=1}^n (p_{i,0} \cdot Q_{i,t})}$$ = nominal GDP / real GDP

Laspeyres Index: Price index that uses base period weights

$$P_t^L = \frac{\sum_{i=1}^n (p_{i,t} \cdot Q_{i,0})}{\sum_{i=1}^n (p_{i,0} \cdot Q_{i,0})}$$

Inflation Rate: Relative change in the price index between two periods $(P_t-P_{t-1})/P_{t-1}$
GDP-Deflator: A Paasche Index that measures price changes of domestic output: GDP-Deflator = Nominal GDP / Real GDP
Consumer Price Index (CPI): A Laspeyres Index that measures price changes of a particular consumer basket: CPI = cost of consumer basket at current prices / cost of consumer basket at base period price (-> better because international, but no quantity changes took into account)

6.3 Unemployment

Labor Force: Total number of people who are able and willing to supply labor. The labor force L, which is a subset of the adult population N, comprises the employed E and the involuntarily unemployed U.
Unemployment Rate: Ratio of the unemployed to the labor force: $u=U/L = U/(E+U)$
Labor Force Participation Rate (Erwerbsquote)**:** Ratio of the labor force to the adult population: $e=L/N=(E+U)/N$

7. Economic Growth

7.1 Steady State

Model: Framework: Consider a closed economy in the **long run**, where **all input and output prices are flexible**. Output Y is determined by the production possibilities; the production function and the supply of inputs, i.e. the labor force L and the capital stock K → $Y = F(L,K)$
Output is used for consumption C and saving sY, where s element of [0,1] denotes the saving rate → $Y = C + sY$. Savings are invested in the capital stock.

Neoclassical Production Function: Output: The production function satisfies the following properties: **1. Constant returns to scale**: $F(\lambda L, \lambda K) = \lambda F(L,K)$ for all $\lambda > 0$; **2. Positive but decreasing marginal products in both inputs:**

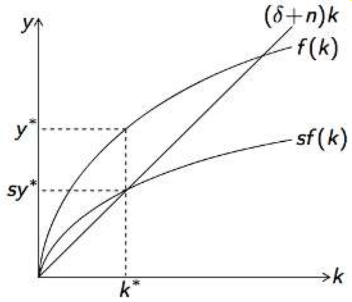
$$\frac{\partial F}{\partial L} > 0, \quad \frac{\partial^2 F}{\partial L^2} < 0$$
$$\frac{\partial F}{\partial K} > 0, \quad \frac{\partial^2 F}{\partial K^2} < 0$$

; **3. Inada-Conditions:**

$$\lim_{L\to 0}\left(\frac{\partial F}{\partial L}\right) = \lim_{K\to 0}\left(\frac{\partial F}{\partial K}\right) = \infty$$
$$\lim_{L\to \infty}\left(\frac{\partial F}{\partial L}\right) = \lim_{K\to \infty}\left(\frac{\partial F}{\partial K}\right) = 0$$

__Intensive Form:__ **Output:** The production function can be expressed in intensive form, i.e. in per-worker terms. Constant returns to scale imply $Y/L=F(K/L,1)$.
Let lower-case letters denote quantities in per-worker terms, and define $f(k)=F(k,1)$. Then output per worker is $y = f(k)$. Positive and decreasing marginal product $f'(k) > 0$, $f''(k) < 0$.
Inada-Conditions: $\lim_{k\to 0} f'(k) = \infty, \quad \lim_{k\to\infty} f'(k) = 0$

__Labor and Capital Growth:__
Population Growth: In any period t, the labor force grows at a constant rate n. $L_{t+1} =(1+n)L_t$
Capital Accumulation: In any period t, the capital stock
- decreases because capital depreciates at the rate δ element of [0, 1] (Abschreibungen)
- increases because a fraction s of output is invested in capital. $K_{t+1} =K_t - \delta K_t +sY_t$
Ceteris paribus, capital per worker increases with savings and decreases with depreciation (Wertverlust) and population growth. $(1+n)k_{t+1} =(1-\delta)k_t +sf(k_t)$
__Steady State:__
Balanced Growth: The economy is in a steady state if the capital stock per worker is constant over time; $k^* = k_t = k_{t+1}$. Break-Even Investment: In a steady state, capital investment per worker exactly offsets the decrease in capital per worker due to depreciation and population growth. $sf(k^*) = (\delta + n)k^*$



Convergence: If capital per worker in period t is below the steady-state level, $k_t < k^*$, then savings exceed break-even investment, $sf(k_t) > (\delta + n)k_t$, and capital per worker increases. If capital per worker in period t is above the steady-state level, $k_t > k^*$, then savings fall short of the break-even investment, $sf(k_t) < (\delta + n)k_t$, and capital per worker decreases.
Comparative Statics: Ceteris paribus, an **increase** in the **depreciation rate** δ implies a decrease in steady-state capital per worker. Ceteris paribus, an increase in the **rate of population growth n** implies a decrease in steady-state capital per worker. Ceteris paribus, an increase in the **saving rate s** implies an increase in steady-state capital per worker.

__7.2 Golden Rule of Capital Accumulation__
Optimization Problem: Maximize consumption per worker with respect to capital per worker in the steady state. In any period t, consumption per worker is $\mathbf{c_t =(1-s)y_t =f(k_t)-sf(k_t)}$.

Substitution yields steady-state consumption per worker, i.e. the objective function. $\mathbf{\max(k^*)\ \ c^*=f(k^*)-(\delta+n)k^*}$. Hence, the capital stock per worker which maximizes steady-state consumption per worker must satisfy $f'(k_{gold}^*) = \delta + n$.

Dynamic Inefficiency: No trade-off between present and future consumption.
If the saving rate exceeds its golden-rule level, $s > s_{gold}$, then a **decrease in the saving rate implies an immediate increase in consumption as well as an increase in steady-state consumption per worker**.
Dynamic Efficiency: Trade-off between present and future consumption.
If the saving rate falls short of its golden-rule level, $s < s_{gold}$, then an **increase in the saving rate implies an immediate decrease in consumption but an increase in steady-state consumption per worker**.

7.3 Technological Progress

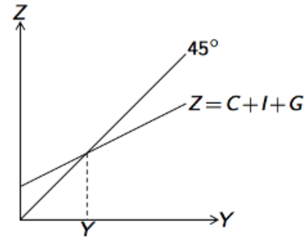
Model Extension:
Production: Output is a function of the effective **labor force E · L** and the capital stock K. The effective labor force takes into account the **number of workers L and workers' productivity E** → Y = F (E · L, K) → k_hat = K/(EL)
Labor Productivity Growth: In any period t, workers' productivity grows at the rate g. In the steady state, the capital stock per worker also grows at the rate g. → $(\delta + n + g)$k_hat

8. Economic Fluctuations

Model: Framework: Consider a closed economy in the **short run**, where **wages and goods prices are fixed**. In general equilibrium, output can fall short of the production possibilities, i.e. inputs may be unemployed. (kurzfr. Ist Nachfrage entscheidend nicht das Angebot)
General Equilibrium: Simultaneous equilibrium in the goods market and the money market. Output Y is determined in the goods market. The interest rate r is determined in the money market.

8.1 Goods Market Equilibrium

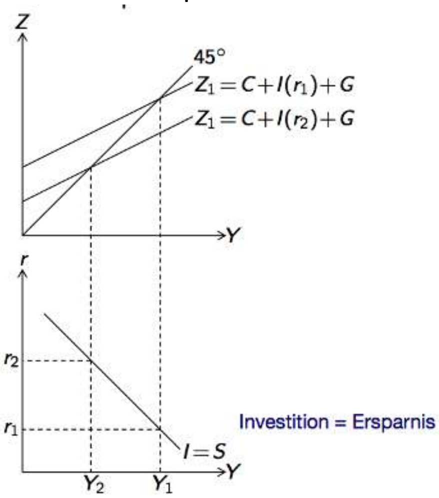
Demand: Planned expenditures (demand) Z comprise **private consumption C**, **planned investment I**, and **government consumption G**. Z =C(Y-T)+I(r)+G
Private consumption is a function of disposable income Y-T, i.e. output net of taxes, where taxes T>=0 are fixed. The marginal propensity to consume is MPC=C'(Y-T) element of (0,1).
Planned investment is a function of the interest rate r, where I'(r) < 0.
Government consumption G>=0 is fixed. (Y = Output bzw. Einkommen; T = Steuern -> Y & T exogen; Y-T = sowas wie Nettoeinkommen -> hier: verfügbares Einkommen)
Savings: Total savings S comprise private savings S_{Pr} and government savings S_G.
Total Savings: Output net of private and government consumption $S = S_{Pr} + S_G = Y - C(Y-T) - G$
Private Savings: Disposable income net of private consumption $S_{Pr} = Y – T - C(Y-T)$
Government Savings: Surplus of taxes over government consumption (Primary Surplus)
$S_G = T-G$
Equilibrium: Output equals demand, and, equivalently, planned investment equals savings.
Y = C(Y-T) + I(r) + G <-> I(r)=S



Adjustment: If demand exceeds (falls short of) output, output will increase (decrease), which in turn causes an increase (a decrease) in consumption and hence demand etc..

Change in Demand: An increase (a decrease) in any component of demand causes an increase (a decrease) in output. Multiplier: The effect on output is larger than the initial change in demand. $\frac{\partial Y}{\partial X} = \frac{1}{1 - \mathrm{MPC}} > 1, \quad \text{with} \quad X \in \{C, I, G\}$

IS-Curve: Locus of all combinations of interest rate r and output Y, such that the goods market is in equilibrium



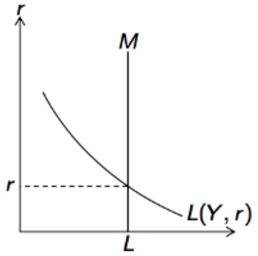
8.2 Money Market Equilibrium

Liquidity Demand: The demand for money, i.e. liquidity, L is a function of output and the interest rate. L = L(Y , r)

An increase in output increases the volume of market transactions and hence liquidity demand. $\frac{\partial L(Y,r)}{\partial Y} > 0$ An increase in the interest rate increases the opportunity cost of holding money and hence decreases liquidity demand. $\frac{\partial L(Y,r)}{\partial r} < 0$

Money Supply: The amount of money M>=0 is fixed.

Equilibrium: Liquidity demand equals money supply. L(Y,r) = M

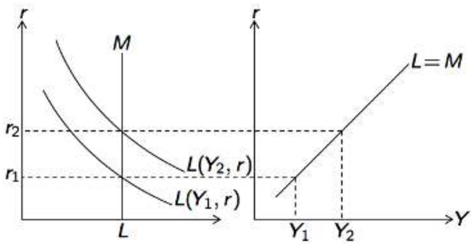


Adjustment: The interest rate adjusts liquidity demand to money supply.

Change in Money Supply: An increase (a decrease) in money supply causes a decrease (an increase) in the interest rate.

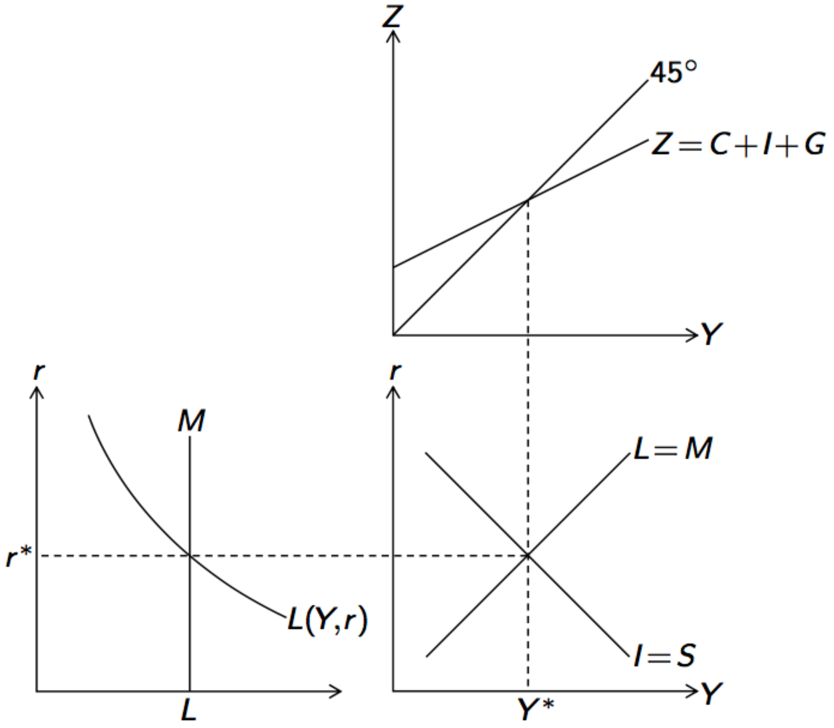
Change in Output: An increase (a decrease) in output causes an increase (a decrease) in liquidity demand and hence in the interest rate.

LM-Curve: Locus of all combinations of output Y and interest rate r, such that the money market is in equilibrium

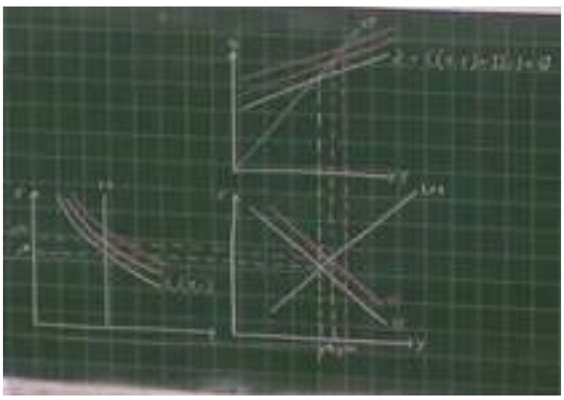


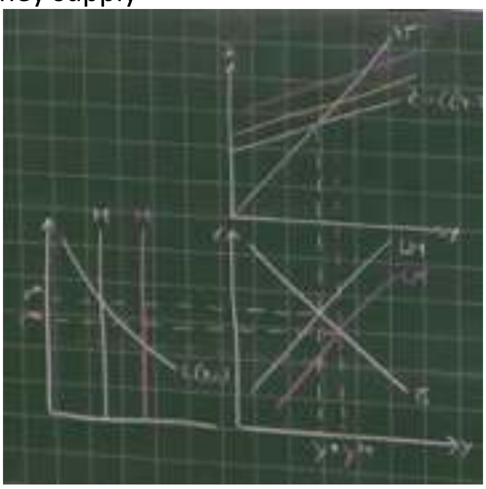
8.3 General Equilibrium

General Equilibrium: Combination of output and interest rate, such that both the goods market and the money market are in equilibrium



Fiscal Policy: Ceteris paribus, expansionary (contractionary) fiscal policy causes an increase (a decrease) in output and interest rate.
Expansionary Fiscal Policy: Increase in government purchases or decrease in taxes -> 1.
Contractionary Fiscal Policy: Decrease in government purchases or increase in taxes
Monetary Policy: Ceteris paribus, expansionary (contractionary) monetary policy causes a decrease (an increase) in interest rate and an increase (a decrease) in output.
Expansionary Monetary Policy: Increase in money supply (EZB druckt Geld) -> 2.
Contractionary Monetary Policy: Decrease in money supply

1. 

2. 

change in money supply M necessary to offset the effect of a marginal increase in government consumption G on the general- equilibrium interest rate r*:

Applying the implicit function theorem yields: $$\frac{dM}{dG} = -\frac{\frac{\partial F}{\partial G}}{\frac{\partial F}{\partial M}} = 4.$$