

# Macroeconomics

short run      middle run      long run

## IMPORTANT WORDS

aggregate output = GDP  
The unemployment rate  
The inflation rate  
Okuns Law & Phillips Curve

## BASIC S

Intermediate good  
→ zwischen Produkt

The measure of aggregate output is called gross domestic product (GDP).  
GDP is the value of final goods and services produced in the economy during a given period.  
GDP is the sum of value added in the economy during a given period.  
GDP is the value of incomes in the economy during a given period.

We only count the final goods  
→ Finales Produkt  
Production side  
→ Income side  
] always equal  
PS = IS

## NOMINAL & REAL GDP

Nominal GDP is the sum of the quantities of final goods produced times their current price ( $Q \cdot P = N$ )

Real GDP is the sum of the quantities of final goods times constant prices. (→ Basisjahr)

$\gamma Y = \text{Real GDP}$     $t = \text{Zeitpunkt}$

$\epsilon Y = \text{Nominal GDP}$

- Can increase for two reasons:
  - Production of goods increases
  - price of goods increases

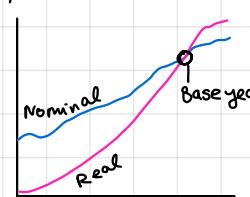
Real GDP in chained prices reflects relative prices that change over time.

Example:

t	Stk.	P	N-GDP	R-GDP	(→ 2009)
2008	10	20	200	240	10 · 24
2009	12	24	288	288	12 · 24
2010	13	26	338	312	13 · 24

Nominal GDP is also called GDP at current prices / euros.

Real GDP is also called GDP in terms of goods / in constant euros / adjustet for inflation / in (base year) prices.



Hedonic Pricing  
→ Bewertungsmethode in case of changing quality. Example:  
Quality increase of 18% } 25%  
Price decrease of 7% }  
Quality-adjusted price has fallen by about 25%

## UNEMPLOYMENT RATE

Labour Force = employment + unemployment

Unemployment is the number of people who do not have a job, but are looking for one

Not in the labour force: Mothers at home, kids, retired people, injured, etc

The unemployment rate is the ratio of the number of people who are unemployed to the number of people in the labour force.  $u = U/L$   
unemployment rate = unemployment / labour force

Discouraged workers are those, who give up looking for a job and so no longer counted as unemployed.

The participation rate is the ratio of the labour force to the total population of working age.

Background + Importance

→ Effect on welfare of the unemployed

→ Signal economy is not using human resources efficiently

→ Low unemployment rate can lead to labour shortages

## INFLATION RATE

Inflation is a sustained rise in the general level of prices.

The inflation rate is the rate at which the price level increases.

Deflation is a sustained decline in the price level.

Background + Importance

→ Affects income distribution when not all prices and wages rise proportionally

→ Leads to distortions (Verzerrung) due to uncertainty, some prices that are fixed by law or regulation, and its interaction with taxation.

→ Best rate of inflation: 1-4%

Short run = movement in output driven by movement in demand

medium run = level of output determined by supply factors

long run = economy depends on ability to innovate

## GDP DEFLATOR

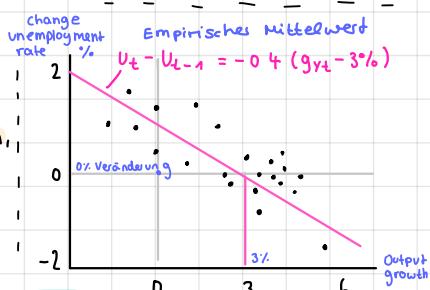
The GDP deflator in year  $t$  ( $P_t$ ) is the ratio of nominal GDP to real GDP in year  $t$ .

$$P_t = \frac{\text{Nominal GDP}_t}{\text{Real GDP}_t} = \frac{\epsilon Y_t}{Y_t}$$

→ Is called an index number

Nominal GDP is equal to the GDP deflator times real GDP.

$$\epsilon Y_t = P_t \cdot Y_t$$



OKUN'S LAW Output growth that is higher than usual is associated with a reduction in the unemployment rate. Output growth that is lower than usual is associated with an increase in the unemployment rate.

The rate of change = rate of inflation

$$\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

GDP Deflator       $P_{t-1}$  Previous year

## Example:

Real GDP  $Y_{2020} = 1000$

Nominal GDP  $\epsilon Y_{2020} = 1100$

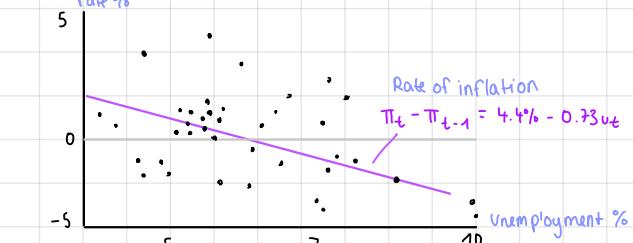
GDP Deflator  $P_{2019} = 1$

$$\pi_{2020} = \frac{1100}{1000} = 1,1 \rightarrow \text{GDP Deflator}$$

$$\pi_{2020} = \frac{(1,1 - 1)}{1} = 0,1 = 10\% \text{ rate of inflation}$$

Rate of growth of nominal GDP is equal to the rate of inflation plus the rate of growth of real GDP.

Change in the inflation rate %



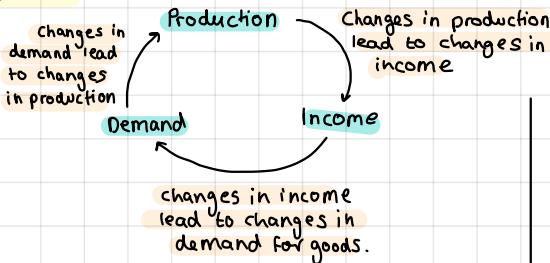
PHILLIPS CURVE A low unemployment rate leads to an increase in the inflation rate. A high unemployment rate leads to a decrease in the inflation rate.

# Macroeconomics

## THE GOODS MARKET

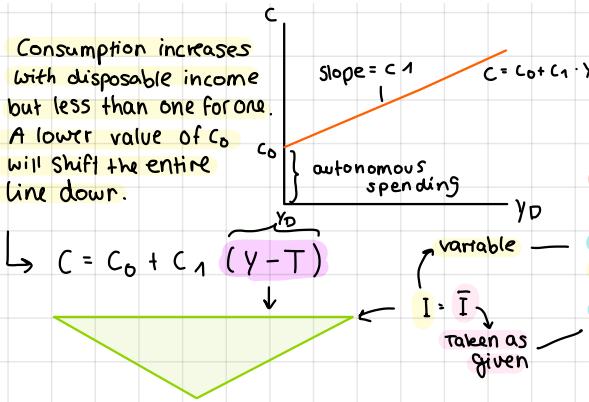
### THE SHORT RUN

Year-to-year movements focus is on production, income and demand:



### Composition of GDP example:

	Billions of euros	Per cent of GDP
GDP (Y)	13,958	100
1 Consumption (C)	7,696	55
2 Investment (I)	2,707	19
3 Government spending (G)	2,920	21
4 Net exports	338	2.5
Exports (X)	6,019	43
Imports (M)	5,681	40
5 Inventory investment	12	0.1



### DETERMINATION OF EQUILIBRIUM OUTPUT

Assume  $X = IM = 0$  (closed economy), so  $Z \equiv C + I + G$ :

Replacing  $C$  and  $I$  from previous equations

$$Z \equiv C_0 + C_1(Y - T) + \bar{I} + G$$

↑  
income  
↓  
= production  
↓  
= demand

Equilibrium in the goods market requires  $Y = Z$   
This is an equilibrium condition.

Rewrite equation:  
 characterises equilibrium output in algebra

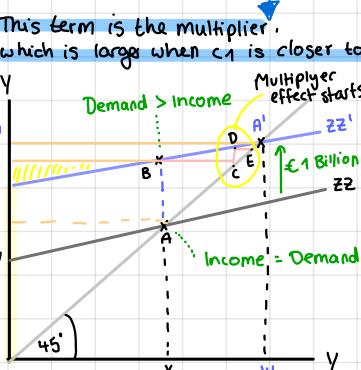
$$Y = C_0 + C_1 \cdot Y - C_1 \cdot T + \bar{I} + G$$

Reorganise the equation:  
 Divide both sides by  $(1 - C_1)$

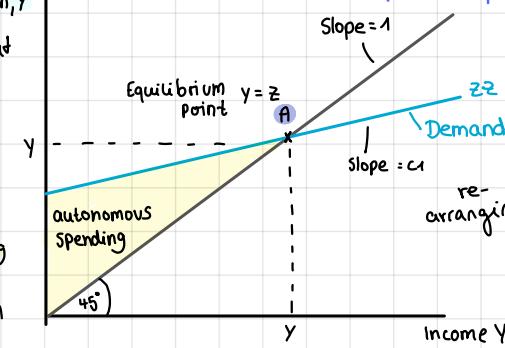
$$(1 - C_1) \cdot Y = C_0 + \bar{I} + G - C_1 T$$

$$Y = \frac{1}{1 - C_1} [C_0 + \bar{I} + G - C_1 T]$$

More income → more consumption → higher equilibrium  
 autonomous spending (doesn't depend on income)



Equilibrium output is determined by the condition that production is equal to demand.  
 An increase in autonomous spending has a more than one-for-one effect on equilibrium output.



### THE COMPOSITION OF GDP

Consumption ( $C$ ): goods and services purchased by consumers (total demand).

Investment ( $I$ ) or fixed investment: The sum of nonresidential investment and residential investment.

Government spending ( $G$ ): Purchases of goods and services by the federal, state and local governments; excluding government transfers.

Exports ( $X$ ): Purchases of domestic goods and services by foreigners.

Imports ( $M$ ): Purchases of foreign goods and services by domestic consumers, domestic firms and the domestic governments.

Net exports or trade balance

$$= X - M$$

$X > M = \text{trade surplus}$

$$M > X = \text{trade deficit}$$

Inventory investment:

Difference between production and sales.  
 → Produced but not sold → Investment

### DEMAND FOR GOODS

Consumption ( $C$ ) is a function of disposable income ( $Y_D$ ).

$Y_D = \text{Income after Government transfers and paying taxes. } Y_D = Y - T$

Consumption function:  $C = C_0 + C_1 \cdot (Y_D)$

↳ behavioural equation

Higher income → Higher Consumption

Endogenous variables: Depending on other variables.

Exogenous variables: Not explained and taken as given to solve a model.

open economy

Total demand

$$Z \equiv C + I + G + X - M$$

closed economy

$$Z \equiv C + I + G$$

what people consume

propensity (Neigung) to consume

Autonomous consumption

$T$  (taxes) and  $G$  (government spending) describe the fiscal policy and are independent → exogenous

### IS-RELATION

Private saving → public saving

Private saving ( $S$ )

$$S = Y_D - C$$

$$S = Y - T - C$$

Public saving =  $T - G$

Budget surplus  $> 0$  < Budget deficit

(Herleitung:)

In equilibrium:  $Y = C + I + G$

$$Y - T - C = I + G - T$$

$$S = I + G - T$$

$I = S + (T - G)$  umgeschrieben

This is the IS relation

= Investment equals Saving

Production = Demand  
 Investment = Saving

Equilibrium behaviour:

$$S = Y - T - C$$

$$= Y - T - C_0 - C_1 \cdot (Y - T)$$

$$\text{rearranging} \rightarrow S = -C_0 + (1 - C_1) \cdot (Y - T)$$

propensity to save between 0 and 1.

# Macroeconomics

## Financial Markets

### BASICS

- Money attribute
- Medium of exchange
- Store of value
- Unit of a count
- money = + transactions  
- no interest
- currency (cash)
- deposit (bank account)
- bonds = + positive interest rate i  
- no transactions

Bond = Anleihe

Investor  
loan → borrower (Government)  
... after time ...  
Investor ← € + interest rate

### DEFINITIONS

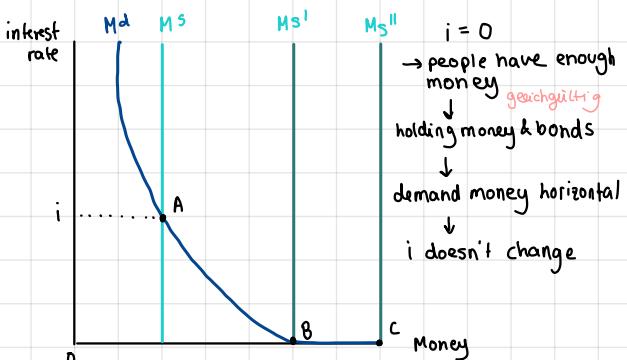
- money = pay for transactions  
income = what you earn (flow)  
saving = value of accumulation over time  
financial wealth = value of financial assets minus financial liabilities → stock variable  
investment = purchase of a new capital good  
financial investment = purchase of shares  
investment = or other financial assets

The liabilities of the central bank are the money it has issued, called central bank money.

### LIQUIDITY TRAP

Zero lower bound: The interest rate cannot go below zero.

Economy is in a liquidity trap when the interest rate is down to zero, monetary policy cannot decrease it further.



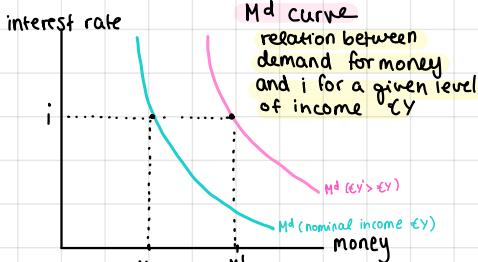
### DEMAND FOR MONEY

Demand for money Nominal income decreasing function of interest rate  $i$

$$M_d = C \cdot Y \cdot L(i)$$

(+) (-)

Increase in interest rate decreases demand for money, because more people put their wealth into bonds.



Given bond payment per year: 100 €

Price of bond today: €  $P_B$

Interest rate on bond:  $i = \frac{100 - P_B}{P_B}$

The higher the bond price, the lower the interest rate.

The higher the interest rate, the lower the price today.

### PART TWO

Financial intermediaries: Finanzielle Vermittler

→ Receive funds from people and firms and use these to buy financial assets or to make loans to other people and firms

Example: Bank (money = liabilities), keep some funds as reserves (Reserves)

### Assets Liabilities

Assets	Liabilities
Bonds	Central bank money = Reserves + Currency

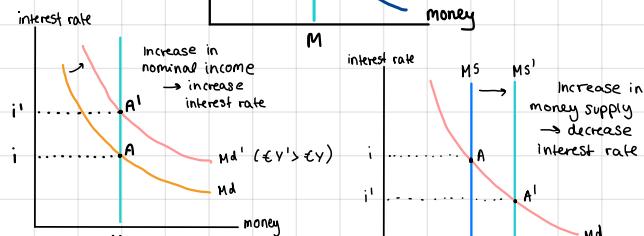
Assets	Liabilities
Reserves Loans Bonds	Deposit Accounts

### DETERMINING THE INTEREST RATE

Ausgangspunkt: Central bank supplies an amount of money equal to  $M$ : Equilibrium in financial markets requires that:  $M_s = M_d = M$

Money Supply = Money demand  
 $M = C \cdot Y \cdot L(i)$

I must be, that supply of money and i of demand for money equals each other.  
 $M_s = M_d$



Central banks change supply of money by buying or selling bonds in the bond market  
→ open market operations

Central bank expands the supply of money by buying bonds  
→ Expansionary open market operation

Central bank contracts the supply of money by selling bonds  
→ Contractionary open market operation

Assets	Liabilities
Bonds	Money

→ Expansionary open market operation ↓

Assets	Liabilities
Change bonds holdings + €1 Mio	Change money stock + €1 Mio

No currency → demand money = demand chequeable deposits

$$M_d = C \cdot Y \cdot L(i)$$

Demand reserves bank depends on amount of chequeable deposits

$$H_d = \theta \cdot M_d = \theta \cdot C \cdot Y \cdot L(i)$$

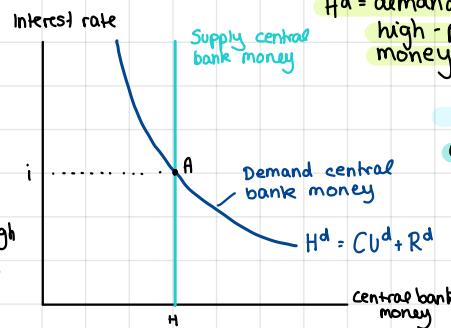
H denotes the supply of central bank money, then equilibrium condition:

$$H = H_d$$

$$H = \theta \cdot C \cdot Y \cdot L(i)$$

Increase in H → decrease i

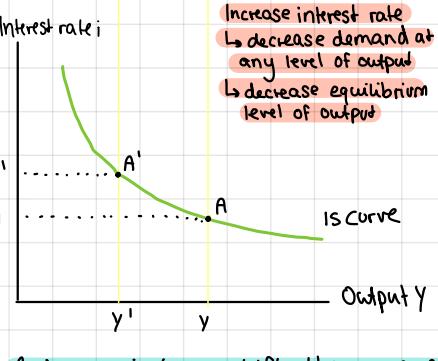
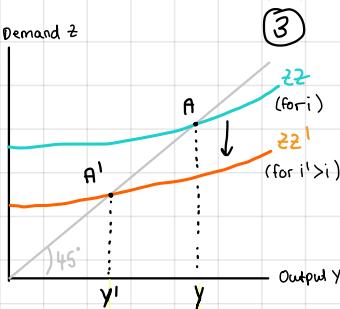
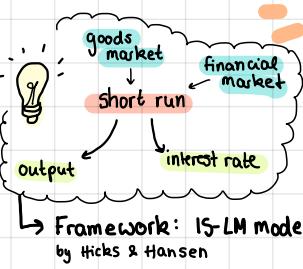
Decrease in H → increase i



Supply central bank money = demand central bank money

# Macroeconomics

## THE IS - LM MODEL



## PUTTING IS and the LM RELATIONS TOGETHER

- Equilibrium in the goods market implies that an increase in the interest rate leads to a decrease in output.
- This is represented by the IS-curve.
- Equilibrium in financial markets is represented by the horizontal LM curve.
- Only in point A, which is in both curves, are both goods and financial markets in equilibrium.

**Monetary Policy:**  
Increase in M  $\Leftrightarrow$  monetary expansion  
Decrease in M  $\Leftrightarrow$  monetary contraction  
 $\Leftrightarrow$  monetary tightening

## POLICY MIX

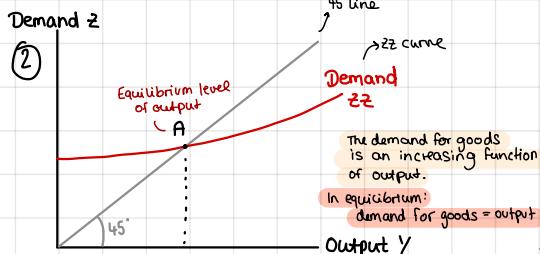
- Monetary-fiscal policy mix is the combination of monetary and fiscal policies.
- Suppose, that the economy is in a recession and output is too low.
- Both fiscal and monetary policies can be used to increase output.

### THE GOODS MARKET + IS RELATION

- Investment ( $I$ ) depends on production ( $Y$ ) and the interest rate ( $i$ ).  $I = I(Y, i)$ . So equilibrium in goods market: Investment equals savings  $\Leftrightarrow I = S$ .

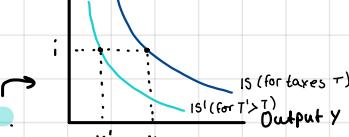
$$I = C(Y-T) + I(Y, i) + G$$

( $C$ : consumption,  $T$ : taxes,  $G$ : governmental spending)



$\rightarrow Z2$  is upward sloping because:  
interest rate  $\xrightarrow{\text{increase}}$  output  $\xrightarrow{\text{increase}}$  demand  
because of its effects on consumption and investment

$\rightarrow Z2 = \text{curve}$ ,  $Z2 \neq \text{line}$   
 $\rightarrow Z2$  is flatter than 45° line  
 $\rightarrow$  increase in output  $\rightarrow$  less than one-for-one increase in demand



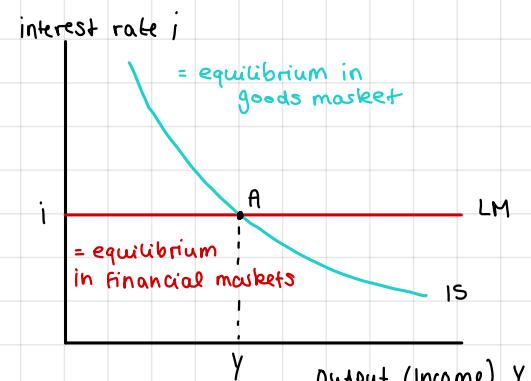
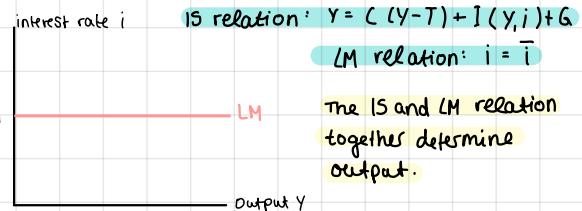
### FINANCIAL MARKETS and the LM RELATION

$$M = f(Y, L(i)) \leftarrow \text{divide by the price level}$$

$$\frac{M}{P} = Y \cdot L(i) \rightarrow LM \text{ Relation}$$

In equilibrium, real money supply equals the real money demand, which depends on real income  $Y$  and the interest rate  $i$ .

The central bank chooses the interest rate (and adjusts the money supply so as to achieve it).



### Fiscal policy:

Decrease in  $G-T$

$\rightarrow$  Fiscal contraction  $\Leftrightarrow$  fiscal consolidation

Increase in  $G-T$

$\rightarrow$  Fiscal expansion

An increase in taxes shifts the IS curve left. This leads to decrease in equilibrium level of output.

interest rate i

