EFR summary

Macroeconomics, FEB11002X

2024-2025

Lectures 1 to 12

Weeks 1 to 5

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Details

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Macroeconomics - IBEB
Lecture 1 - Week 1

What is macroeconomics?

Macroeconomics is the study of **aggregated behaviour**.
Macroeconomics focuses on **consumers, business, the government & foreign countries**. It also focuses on markets where demand and supply plays a role. These are markets of goods, markets of labour and financial markets.
In this course we are gonna look for an **macro-economic equilibrium.** The government always wants to move towards an equilibrium. They can do this with policy.

Government Policy:

- Demand Policy
    - Budgettair policy
    - Monetary policy
- Supply Policy

Gross Domestic Product

The gross domestic product (GDP) is the most common measure of an economies output/production and income.
This is an **indicator for all the final goods and services produced in 1 country in the timespan of 1 year.**
You can measure GDP in **nominal terms** (current prices) or **real terms** (constant prices, volume)

The observation for most countries of GDP is that:

1. There is constant growth of the real GDP in the long-run (rising trend)
2. There are significant and returning fluctuations of the real GDP around this trend.

Since big countries often have a higher GDP it is hard to compare smaller to bigger countries. Although there is a way: **Gross domestic product per capita**: This is the gross domestic product divided by the amount of residents in a country.

Unemployment

The **unemployment rate** is the ratio of the amount of unemployed on the labour force.

- Unemployment rate = $\frac{unemployed}{labour\ force}$

The labour force = working people + unemployed

Where unemployed people are people who are actively looking for a job. Therefore young people, retirees and people who don't want to work aren't part of the labour force.

A property of unemployment is that it is countercyclical. That means when economic activity (production) is rising, the inflation will decrease.

Production Factors

Output is the result of the combination of inputs.
In this course we only take two inputs into account: labour and capital. Other inputs (land, energy, …) are also relevant although out of the scope of this course.

Inflation

Inflation is the **growth rate of the general price level in the economy** (in %).
Deflation is in question when there is negative inflation
Hyperinflation is in question when the inflation is greater than 50% on a monthly basis.

A property of inflation is that it is procyclical. That means when economic activity (production) is rising, the inflation will also rise.

Financial markets vs. the real economy

Financial/monetary economy is a part of the economy where there is trade in financial or monetary assets like obligations, shares, valuta, etc…

Real economy is a part of the economy where there is production and consumption of goods and services and incomes out of productive activities.

The financial/monetary economy and the real economy intersect partly. For example physical investments by businesses and consumer expenditure of households are influenced by the financial markets.

Openness of the economy

The **openness of the economy** is measured via international trade. Which is export and import.

$$Openness\ ratio\ = \frac{import + export}{BBP}$$

Because of globalization the openness of countries has increased. Smaller countries are often more open than bigger countries.

Countries are influenced by events in other countries. This is called **contagion**.

Long run and short run

In order to understand how **key economic variables** (GDP, inflation…) evolve, we need to distinguish between **short-run changes** (cycles) versus l**ong-run evolution** (trend). Macroeconomics tries to explain deviations (a short-run pattern) from the trend value, and how to smooth these fluctuations.

Short run	Long run
Fixed prices	Flexible prices
Consists of business cycles	Consists of a trend line
Has bigger fluctuations	Is smooth

In case of a shock the supply side usually has to adjudge	The economy's capacity to supply enough for the population matters in the long run.

Macroeconomic accounts

There are a few accounts which need to be studied in order to move on to more complex subjects.

The three definitions of Gross Domestic Product

First we need to distinguish between stock and flow variables. Flow variables are variables which are constantly changing like a river. Stock variables are variables which are measured at a specific point of time.

The gross domestic product is a flow variable, so it is constantly changing.

1. GDP = Sum of final sales within a geographic location during a period of time, usually a year.
   Keep in mind that intermediate sales (resales) are not taken into account with this.
2. GDP = Sum of value added occurring within a given geographic location during a period of time.
3. GDP = Sum of incomes earned from economic activities within a geographic location during a period of time.

There are also a few problems with the gross domestic product:

- Comparison over time can be hard. The GDP can increase for different reasons:
  - More real economic activity
  - Higher prices for the same economic activity
- Comparison across countries
  - Exchange rates are quite volatile
- Small countries hyave small GDPs
  - Solution: GDP per capita.

Nominal GDP = $P^x Q^x + P^Y Q^Y$ in an economy with 2 products, x and y.
However prices change, therefore we also have the

Real GDP = $P_0^X Q^X_T + P_0^Y Q_T^Y$. So this takes account for price changes by comparing the GDP by setting constant prices to for example the time period where they started measuring.

Measuring price level: GDP deflator = $\frac{nominal\ GDP}{real\ GDP}$.

The circular flow diagram

The circular flow diagram illustrates how factors in an economy work together. In the book which is used in the course, macroeconomics, a European text eighth edition (Burda & Wyplosz), on page 39 (fig 2.3) there is a very good illustration of this flow diagram. It is very useful to study this illustration.

We can conclude a few basic assumptions out of this diagram:

- Y = GDP, C = consumption of households, I = investments of firms, G = government spending, X = export, Z = import
- **T = net taxes** = taxes - transfers
- **Private income (households and firms)** = Y - T
- **Net private saving** = S - I
- **Total domestic spending (absorption)** = C + I + G
- **Net exports** = X - Z
- **GDP** = Y = C + I + G +X - Z (See definition 1 of GDP)
- **GDP** = Y = C + S + T (See definition 3 of GDP)
- Out of this follows C + S + T = C + I + G + X - Z which can be rewritten as **(S-I)+(T-G)=(X-Z)**

The **Gross National Income (GNI)** is the total amount of money earned by a nation's people and businesses.
The **Net National Income** is obtained by adding the money earned by people of a country living abroad and subtracting the money earned in your country by residents of another country. (Adding the **primary international income)**
The **Gross Disposable National Income (GDNI)** is obtained by adding the secondary international income (for example money earned by shares or obligations) to the Net national income.
The **Net domestic product (NDP)** is obtained by subtracting depreciation from the GDP.
Current account balance = X - Z = Y - (C + I + G) = Y(GDP) - A(**Absorption)**
Absorption = C + I + G

Macroeconomics - IBEB
Lecture 2 - Week 1

Growth theory

There are four main growth factors in the economy. These are:

- Capital (K) (This follows out of savings, which are used for investments).
- Growth of the labour force (L)
- Technological progress (A)
- Other factors which are out of the scope of this course.

The first three of these factors (K, L, A) are in the **Solow model**.

Just like in the microeconomics course there is a production function. Although this one is for the entire economy. See the summary of the microeconomics course for the basic information on production functions.

The **general production function** is written as: $Y = F(K_+, L_+)$. The plus signs mean that output will grow when these inputs grow.
The **Cobb-Douglas function** is written as $Y = K^a L^{1-a}$ with a in $0<a<1$. a is the elasticity of capital.

Just like in microeconomics, we have **Marginal productivity of capital and labour** in macroeconomics. These are found by taking the partial derivative of the production function. This works for both the Cobb-Douglas function as the general production function.

The law of diminishing returns (See micro) is also in question for the production functions.

The Cobb-Douglas function has the property of **Constant Returns To Scale (CRTS**, See micro). Other functions might have increasing or decreasing returns to scale.

We can obtain the **intensive form of the production function** if the production function has constant returns to scale. Below i will illustrate how you will have to do it. Make sure that you see the difference between K, k, Y, and y.

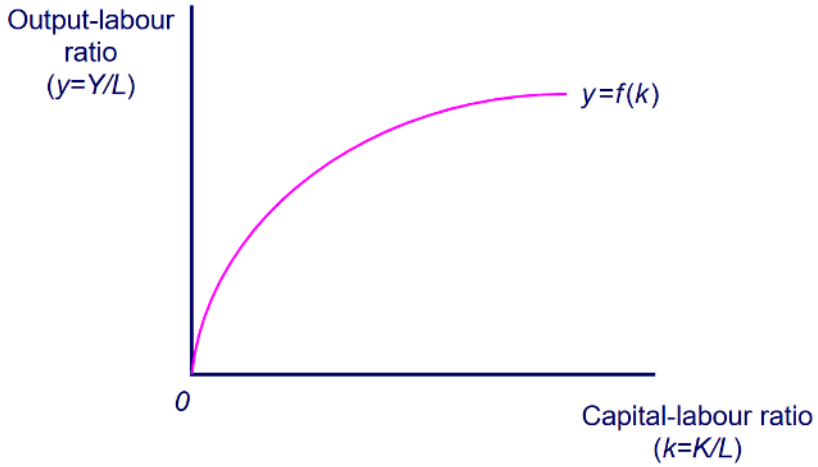
For constant returns to scale:

$cY = F(cK, cL)\ with\ c = \frac{1}{L}$

$\frac{Y}{L} = F(\frac{K}{L}, 1)$

$y = f(k)\ with\ y = \frac{Y}{L}, k = \frac{K}{L}.$

It is also possible to do this with the Cobb-Douglas function. I will challenge you to try it yourself. Below is illustrated how this works. It only works because we see L (labour) as a constant.



Kaldor's stylized facts

Kaldor's stylized facts are important features of long-term economic growth in reality. A theory therefore has to explain these facts.

1. Y/L and K/L keep increasing.
2. K/Y doesn't show a systematic trend
3. Y/L keeps rising, which means that labour becomes more productive and therefore the wages keep rising.
4. Y/K doesn't show any trend, which means that capital doesn't become more productive and profit doesn't have a trend.
5. The shares of labour and capital in the gross domestic product stay relatively constant.

Growth theory deals with where the long-term equilibrium lies. Even though it doesn't work the same as in microeconomics it is similar in some ways. We are looking for the **steady state** = state in which variables grow with constant rates or the variables are constant (growth rate = 0).

Solow's basic growth model

First we need to define all ingredients of this model:

- The production function is Y = F(K, L)
- K = capital, L = labour
- F(,.) is a constant returns to scale function
- The endogenous variables are Y and K
- The exogenous variables are L
- The growth of L is the growth of the labour force which is for this lecture 0.
- Capital depreciates with a constant rate: δ.

Saving and investing

S = I, because this is a closed economy. Therefore all savings are invested by companies.

S = sY (in which s is fraction of the income)

I = sY

$\frac{I}{L} = s \cdot \frac{Y}{L} = s \cdot y$

Capital accumulation with depreciation:

$dK = I - \delta K$

$\frac{dK}{L} = \frac{I}{L} - \frac{\delta K}{L}$

$dk = \frac{I}{L} - \delta k$

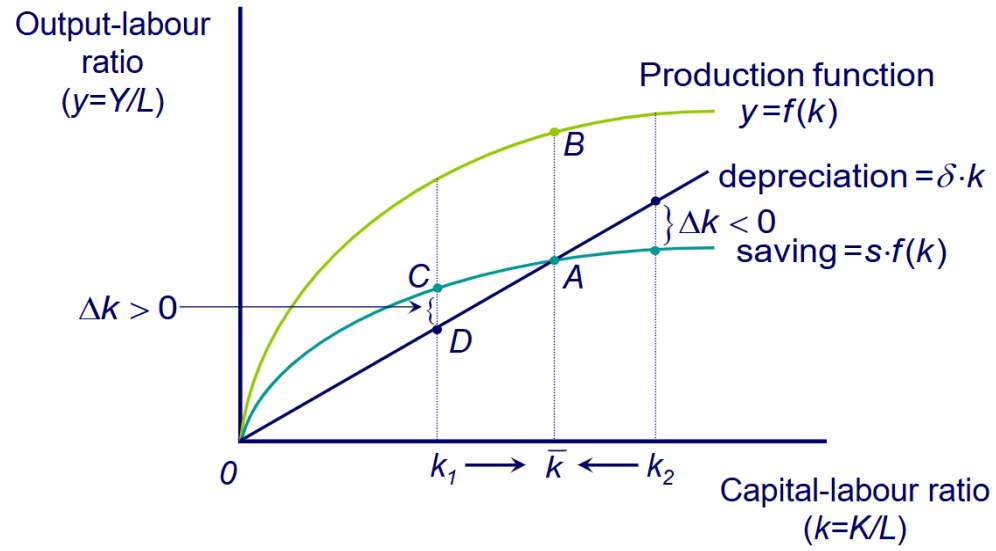
The full model can be summarised with 3 formulas:

- $y = f(k)$
- $\frac{I}{L} = s \cdot y$
- $dk = \frac{I}{L} - \delta k$

This can be summarised in the following function. $dk = sf(k) - \delta k$.

Now we want to know where this steady state is. This is where the quantity of capital doesn't change. In short where: $dk = 0 \Leftrightarrow sf(k) = \delta k$

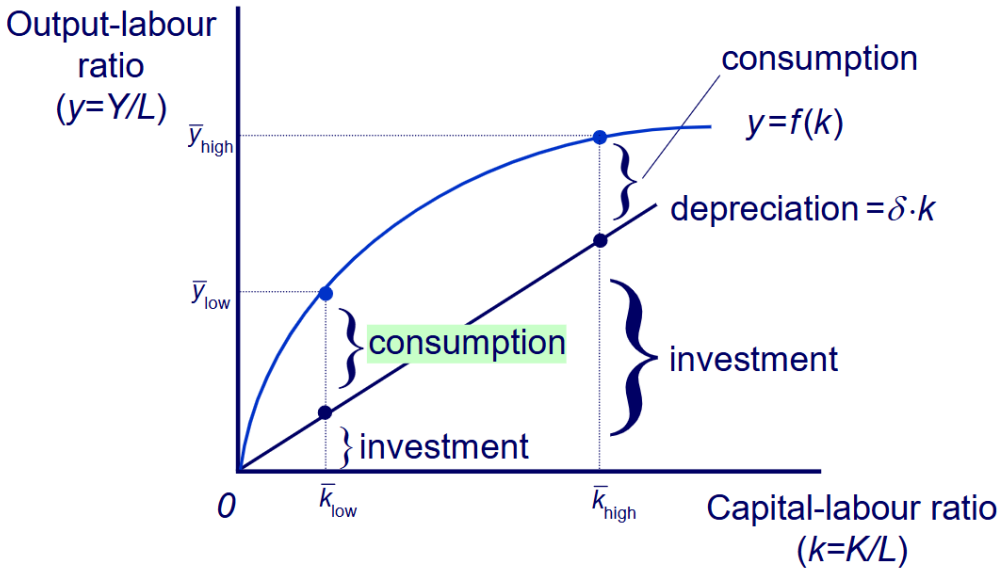
Below this steady state is illustrated with point A:



The "Golden Rule"

You might think that saving a lot might help for increasing the GDP. Although this isn't true. Saving money is a sacrifice, because you are delaying consumption. Consumption is essential for welfare.

The **Golden Rule** describes that maximising welfare is equal to maximising consumption per capita in the steady state. This can be mathematically written as: $c = y - sy = f(k) - \delta k$. When you maximise this formula you find the maximum of consumption - depreciation. This is illustrated below:



When you solve the maximising problem you will find that $MPK = \delta$. Where the slope coefficient of the production function is equal to the depreciation the income (Y/GDP) is at its maximum.

Below are a few exercises on the Solow model.
Give the intensive form of the production function:

$Y=K^{0,5}L^{0,5}$

A) Calculate the values for k, y and i in the steady state (use Question A):

With $s = \delta = 0,1 \,\&\, n = a = 0$

B) What is the golden rule value of S if:

$Y=K^{0,5}L^{0,5}$

$\delta = 0,1$

$n = a = 0$

The solution are given below:

A) $\frac{Y}{L} = \frac{K^{0,5}}{L^{0,5}} \Leftrightarrow \frac{Y}{L} = (\frac{K}{L})^{0,5} \Leftrightarrow y = k^{0,5}$

B) $dk = sy - \delta k = 0$

$sk^{0,5} = \delta k$

$k = (\frac{s}{\delta})^2 = (0.1/0.1)^2 = 1$

$y = k^{0,5} = 1$

$i = sy = 0.1$

C) $MPK = \delta$

$0.5k^{-0,5} = 0.1 \Rightarrow k = (0.5/0.1)^2 = 25$

$y = 25^{0.5} = 5$

$sy = \delta k \Rightarrow s = \frac{\delta k}{y} = 0.1 * 25/5 = 0.5$

Macroeconomics - IBEB

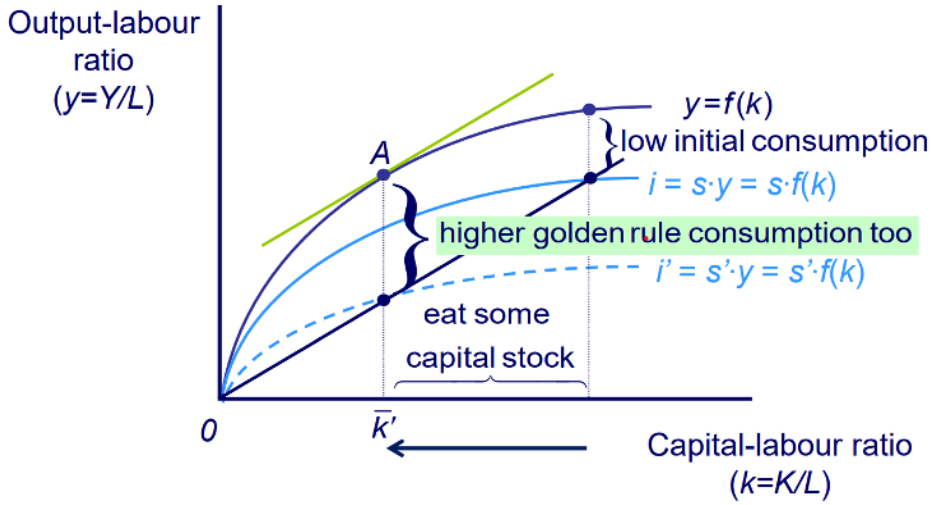
Lecture 3 - Week 1

The transition to the Golden Rule steady state

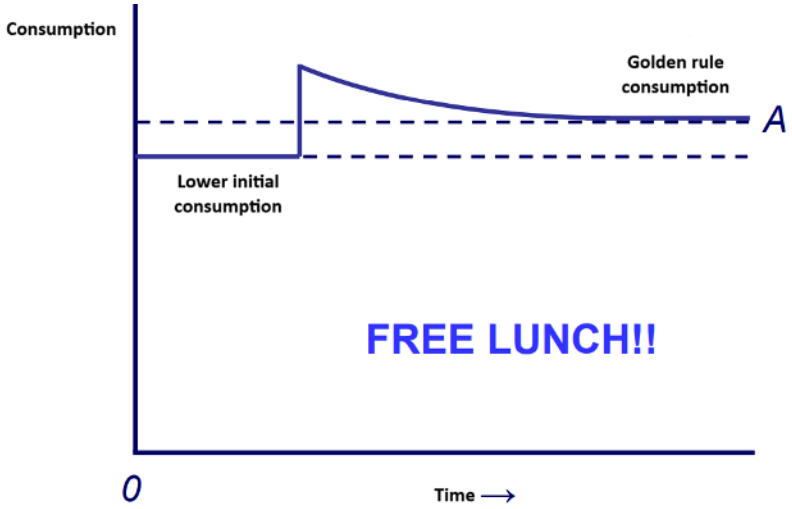
In the summary of the last lecture we have learned how to calculate the Golden Rule steady state savings growth rate. The economy won't move by itself to the Golden

Rule steady state. If the policymakers want to reach the Golden Rule steady state they shall have to change the savings growth rate. This change will lead to a new steady state with a higher consumption.

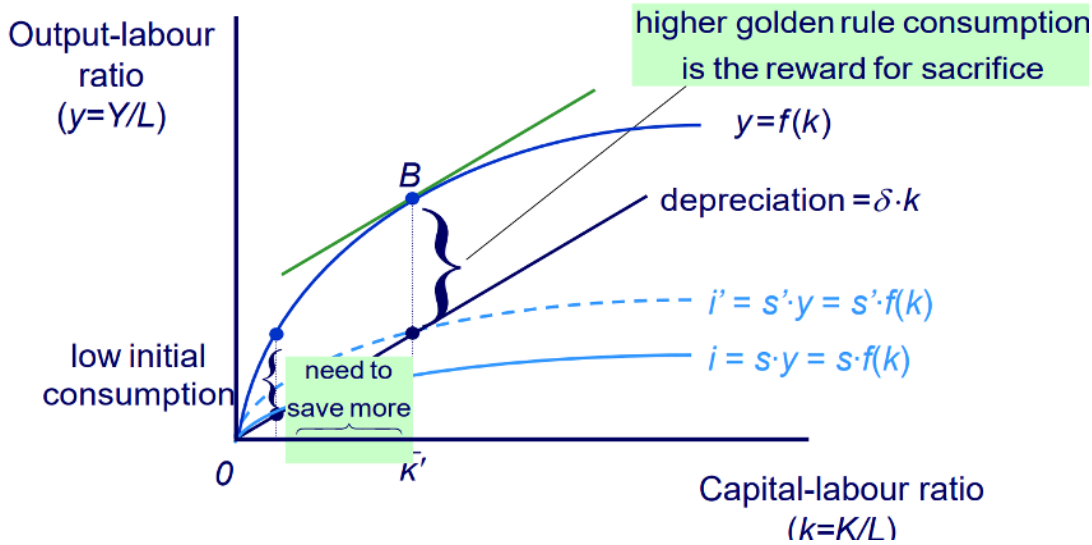
An economy is **dynamically inefficient** if it's possible to raise the consumption of all generations (possibly to the golden rule consumption) by lowering the savings. In short: there is too much capital.



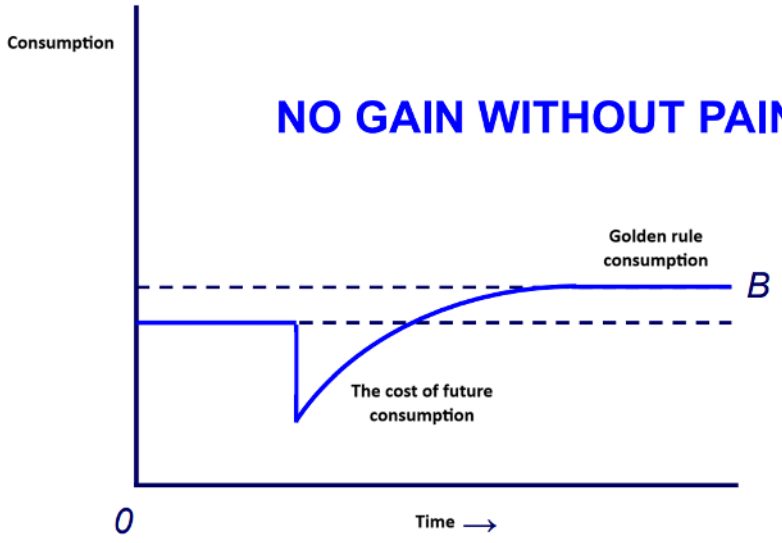
In the illustration above, we can see that by lowering the savings, which can be done by changing the investments to i' with savings growth rate of s', the golden rule consumption can be reached and it is also possible to first eat some capital stock. Which gives even more short-term consumption. In the end of course the amount produced isn't the goal but the amount of consumption is the goal. In the illustration below, you can see that by lowering the savings it will be possible to in the short-run get even more consumption, and in the long-run move to the golden rule amount of consumption.



An economy is **dynamically efficient** if it's possible to raise the consumption of future generations (possibly to the golden rule consumption) by raising the savings in the short-run. In short: Too little capital.



In the illustration above, we can see that by raising the savings, which can be done by changing the investments to i' with savings growth rate of s', the golden rule consumption can be reached. This comes at the cost of sacrifice of consumption in the short-run. In the long-run the golden rule of consumption will be reached. This is illustrated below.



The expansion of the basic Solow-model

A problem with the basic Solow-model is that with capital accumulation there isn't any permanent growth in the steady state of the base model. Therefore we will expand the model with **growth of population, =n, and technological progress, =a.**

First, we will look at the steady state with growth of population:
Let's say L grows with n, then we can conclude that:

- L_T=x*(1+n)^t

Let's say that capital-labour ratio and the output-labour ratio are constant and L grows with n, then the output Y and the capital goods stock K will also grow with n.

- $\Delta k = sf(k) - (\delta + n)k$

The capital accumulation has changed to the above formula. Let's look at the steady state:
$\Delta \bar{k} = 0 \Rightarrow sf(\bar{k}) = (\delta + n)\,\bar{k}$

So far k=K/L and y=Y/L are still constant. Although now L grows with factor n and therefore K and Y will also grow with factor n. ALthough the data shows that K/L and Y/L will keep growing on the long-run. The model doesn't explain that correctly at this point.

Therefore we will expand the Solow model with technological progress. Below is the new model illustrated:

- Y=F(K, AL) = F(K, E) [Cobb-Douglas: $Y = K^{\alpha}(AL)^{1-\alpha}$] Keep in mind that $a \neq \alpha$.
- A = The state of the technology
- $\frac{\Delta A}{A} = a$
- E=AL: Effective labour
- $y = \frac{Y}{AL}$, $k = \frac{K}{AL}$
- $\Delta K = sf(k) - (\delta + a + n)k$

In the steady state there are 3 kinds of variables:

1. Constant variables:
   $\frac{\Delta k}{k} = \frac{\Delta y}{y} = 0$
2. Variables with growth rate = a + n:
   $\frac{\Delta K}{K} = \frac{\Delta Y}{Y} = a + n$

3. Variables with growth rate = a:
   $\frac{\Delta(Y/L)}{Y/L} = \frac{\Delta Y}{Y} - \frac{\Delta L}{L} = a, \frac{\Delta(K/L)}{K/L} = \frac{\Delta K}{K} - \frac{\Delta L}{L} = a$.

Keep in mind that Kaldor's stylized facts are still relevant and especially the continued growth of Y/L and K/L are explained better now.

The contribution of the three variables to the growth

How do we measure the contribution of the 3 variables (s, n, a) to the growth. In particular, technological growth is hard to measure. This is done as a residual factor: The **Solow residual**.

But first a few **rules with growth rates** to keep in mind!

- Definition of a growth rate: $\frac{\Delta X}{X}$
- The growth rate of a product: $\frac{\Delta(xy)}{xy} \approx \frac{\Delta x}{x} + \frac{\Delta y}{y}$
- The growth rate of a ratio: $\frac{\Delta(x/y)}{x/y} \approx \frac{\Delta x}{x} - \frac{\Delta y}{y}$
- The growth rate of a power: $\frac{\Delta(x^a)}{x^a} \approx a\frac{\Delta x}{x}$

Now let's see how to find the Solow residual out of the Cobb-Douglas function, keep in mind that $\alpha \neq a$(alpha isn't a):

$Y = AK^{\alpha}L^{1-\alpha}$

$\frac{\Delta Y}{Y} = \frac{\Delta A}{A} + \alpha\frac{\Delta K}{K} + (1 - \alpha)\frac{\Delta L}{L}$

Solow residual: $\frac{\Delta A}{A} = \frac{\Delta Y}{Y} - \alpha\frac{\Delta K}{K} - (1 - \alpha)\frac{\Delta L}{L}$

There is still some criticism on the Solow model. The Solow model sees technological progress as exogenous and the savings rate also. This does a poor job at reflecting reality because it doesn't explain why these variables are what they are.

Macroeconomics - IBEB
Lecture 4 - Week 2

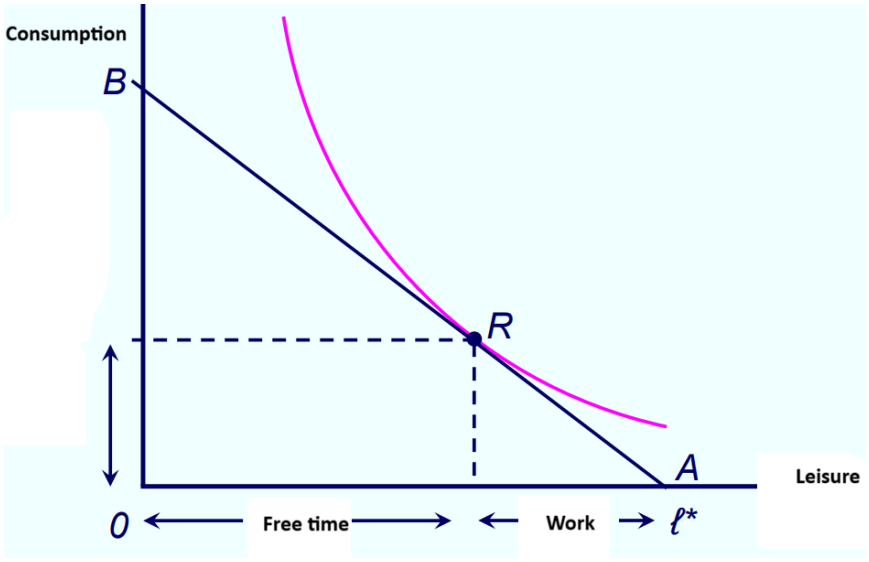
The labour market

The **supply of labour** is derived out of the utility maximization of employees. This works the same as in microeconomics. The employees consider the amount of consumption and free time they want. The **Marginal substitution ratio** between consumption and leisure is equal to the real wage rate.

The next part will be a lot like microeconomics. Therefore we use indifference curves and budget constraints. Let's first look at the supply of labour:

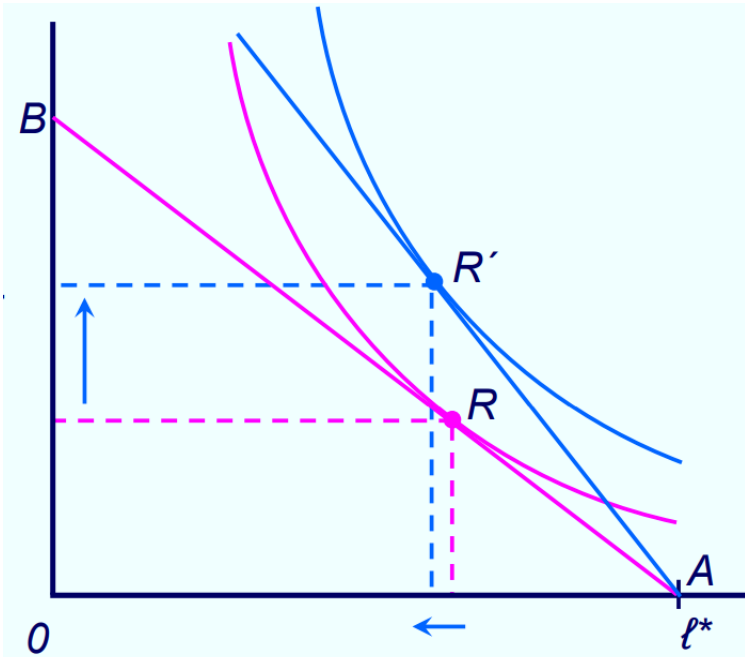
- **The budget constraint:** $C = al + b$
  With C being the real consumption. L is the free time in hours (leisure)
- The consumptive spendings being P(price) * C(consumption)
- The amount of available hours being: l^* and the hours worked being: $l^* - l$
- The income being a function of the nominal hourly wage: $W(l^* - l)$
- The slope coefficient of the budget constraint = -w with w = W/P

Together with the indifference curves, just like in micro, this is illustrated below:

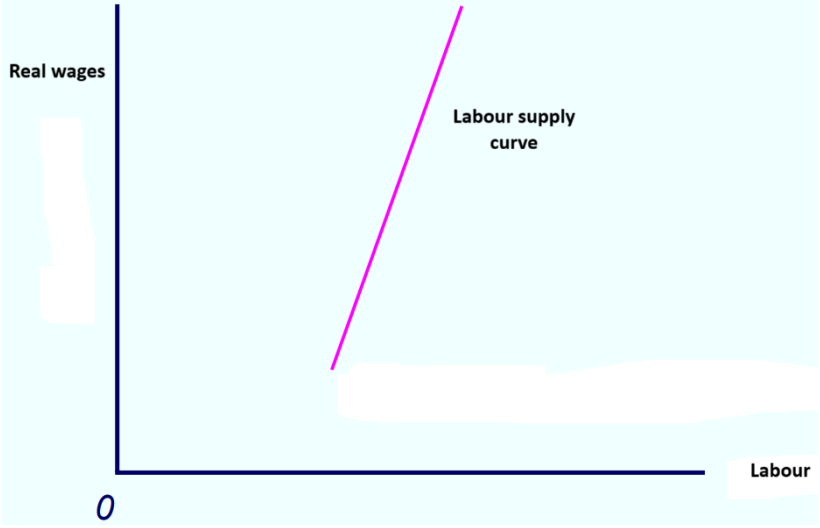


The optimum of this scenario is where the MRS is equal to the budget constriction = -w. This is done by using the same utility maximization methods as in micro: max. U(C, l) while C = al + b.

Let's say now that there is a real wage rise and therefore the optimum changes. If we do this for every possible wage and connect the points we get the **labour supply curve**. This is illustrated below in the 2 pictures:



$$w \uparrow \rightarrow (\ell^* - \ell) \uparrow$$

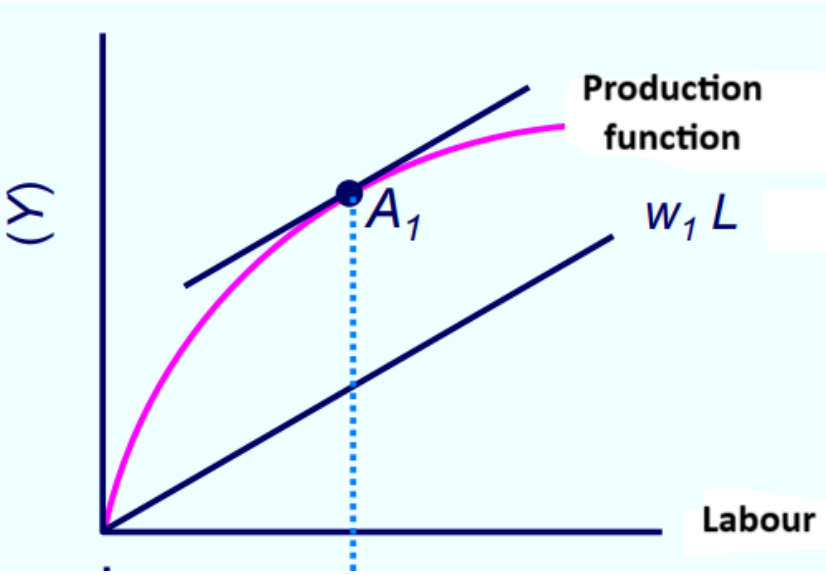


Labour demand

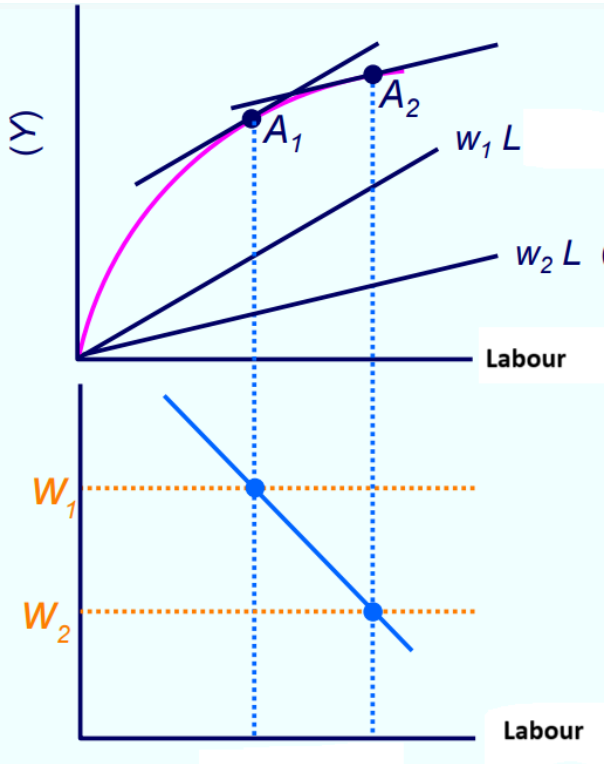
The demand of labour is derived from the winstmaximising of firms. This is at the point where marginal labour productivity equals the real wages.

The demand of labour decreases if the real wages rise and **rises because of increases in capital and technological progress.** This is a pitfall for lots of students. You might think demand for labour decreases because of technological progress, although technological progress makes labour more efficient. Therefore will the demand of labour rise.

In this case the labour will maximise the production (Y) minus the real wages (wL). This is illustrated below, and is done by taking the derivative of the production function minus the real wages and setting it to 0.



We now want to derive the **labour demand** curve. This is done by changing the wage rate (w) and taking the profit maximizing point for each rate. This is illustrated below, and can be illustrated in the demand curve.



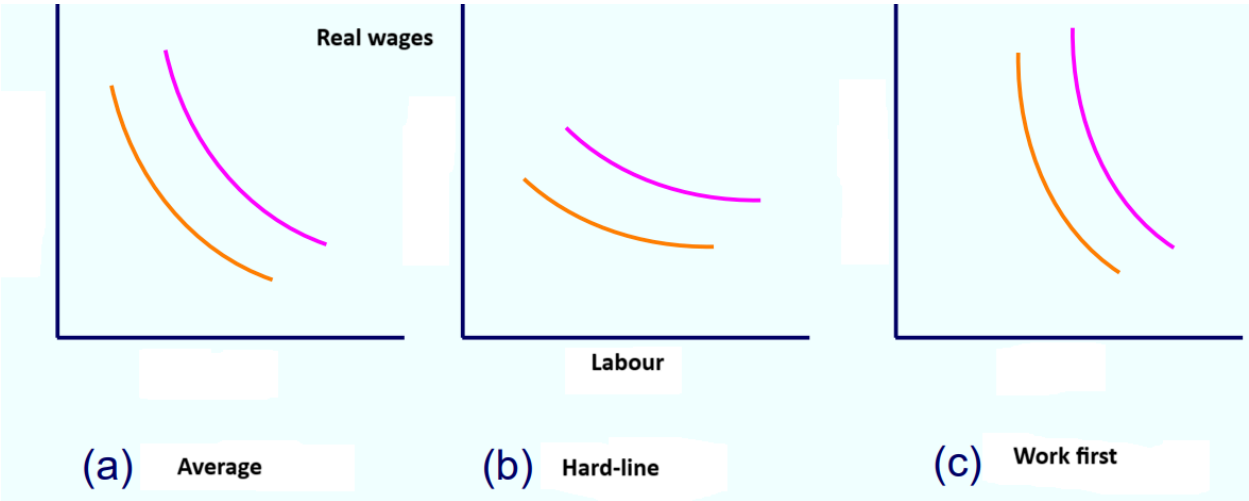
Types of unemployment

Voluntary unemployment is unemployment where people looking for work, can find it. They choose not to work however, because they find the wages too low.
Involuntary unemployment is unemployment where people are willing to do work for the prevailing wage, although that work isn't there for everyone. This unemployment is structural in its nature. This is explained by **downward real wage rigidity**. This lecture we will look at examples of this: minimum wages and labour unions.

A minimum wage is a wage higher than the equilibrium. This is regulated by law and prevents exploitation. However, firms don't hire employees with a lower labour productivity than the real wages. This leads to involuntary unemployment.
The difference between the labour force who is willing to work for the minimum wage and the labour demand at the minimum wage is the involuntary unemployment.

Labour unions represent employees and take over their indifference curves. They stand up for the interests of "**insiders":** the people who have work.
Because the labour unions represent a lot of people they can push the wages up. This also makes for a higher unemployment rate ("outsiders").

Below the indifference curves of labour unions are illustrated:



The extra power a labour union has makes for it that the collective labour supply lies higher than the household labour supply. This makes for it that the real wages are higher, but there is more unemployment.

Equilibrium unemployment: This is long-term unemployment where there is absence of cyclical effects:

- **Structural unemployment:** because of downward real wage rigidity
- **Friction unemployment:** because of a temporarily "no match" between vacancy and job seeker (for example students who graduated looking for a
- job)

Cyclical unemployment: This is short-term unemployment caused by recessions.

The model of unemployment

The model of unemployment:

- $L^S = L + U$ with
- L^S = labour force
- L = The employed
- U = The unemployed
- $\Delta U = sL - fU$
- s = the fraction of the labour force losing its job
- f = the fraction of the unemployed gaining a job

- $\Delta U = 0 \Leftrightarrow sL = fU^E \Rightarrow s(L^S - U^E) = fU^E \Rightarrow sL^S = (s + f)U^E$
- If we want to express the unemployment in a fraction of the total labour force we can set: $u^E = \frac{U^E}{L^S} = \frac{s}{s+f}$.

Macroeconomics - IBEB
Lecture 5 - Week 2

Monetary neutrality

The supply of the total amount of money is decided by the monetary authority: the central bank. In the Eurozone, this is the European Central Bank (ECB).

The **neutrality principle:** Money only influences nominal variables in the long-run. Therefore nothing changes in the real economy. One important thing to note is that because of the neutrality principle, prices have to grow with the same rate as the amount of money.
$\pi = \frac{\Delta P}{P} = \frac{\Delta M}{M}$.

Transactions (T) are a primary motive for the money demanded (M). People keep a share (k) of their money to fulfill their purchases. The expenditure is equal to the amount of transactions times the average price per transaction (P*Y). Transactions (T) depend on the real GDP (Y).
From this the **Cambridge equation** of Pigou can be set up:
$M = kPT \Leftrightarrow M = kPY$

The **turnover rate**, so the amount of times M is spend per period is given by: $V = \frac{1}{k}$.

If the average prices rise it is possible to do less transactions with the given M. Therefore the real cash is relevant: $\frac{M}{P}$.
We can rewrite the to: $\frac{M}{P} = kY$.

The neutrality principle says money doesn't influence the long term growth of a country. Although the opposite isn't true. The growth of a country does influence the real cash demanded. We can see this be writing the cambridge equation in growth rates:
$\frac{\Delta M}{M} = \pi + \frac{\Delta Y}{Y}$. You can see that dY/Y, the growth rate of a country, does influence the growth rate of the money demanded. We can also rewrite this equation to get the inflation: $\pi = \frac{\Delta M}{M} - \frac{\Delta Y}{Y}$

Exchange rates

The nominal exchange rates can be written in two main ways:

1. The British definition: Amount of foreign valuta / 1 domestic valuta (S = 1,35$/1€)
2. The European definition: Amount of domestic valutas / 1 foreign valuta (X€/1$)

In this course and in the book we use the British definition. We'll define S as the nominal exchange rate. Therefore when S increases that leads to a nominal appreciation of the euro and a nominal depreciation of the dollar.

- S = nominal exchange rate british definition)
- P* = Prices of foreign goods (in $)
- P = Prices of domestic goods (in €)

The **real exchange rate** is given by: $\sigma = \frac{SP}{P^*}$.
The real exchange rate measures the amount of foreign goods you can buy with 1 unit of domestic goods. Keep in mind that if the real exchange rate increases the domestic valuta depreciates. This is the opposite with the nominal exchange rate.

Purchasing power parity (PPP)

Relative purchasing power parity gives that the real exchange rate is constant in the long-run:
$\frac{\Delta\sigma}{\sigma} = \frac{\Delta S}{S} + \pi - \pi^* = 0$
And therefore: $-\frac{\Delta S}{S} = \pi - \pi^*$
Absolute purchasing power parity (Law of One Price) gives that the real exchange rate is constant in the long-run and the real exchange rate is equal to 1:

- $\frac{\Delta\sigma}{\sigma} = \frac{\Delta S}{S} + \pi - \pi^* = 0$
- $\sigma = \frac{SP}{P^*} = 1 \Rightarrow S^{PPP} = \frac{P^*}{P}$

Macroeconomics - IBEB
Lecture 6 - Week 2

Intemporal budget constraint

Intemporal budget constraints are equations which connect the past, today and the future for different sectors.
We are gonna look different sectors:

- Consumers
- Producers
- Government
- Economies of countries as a whole

Consumers

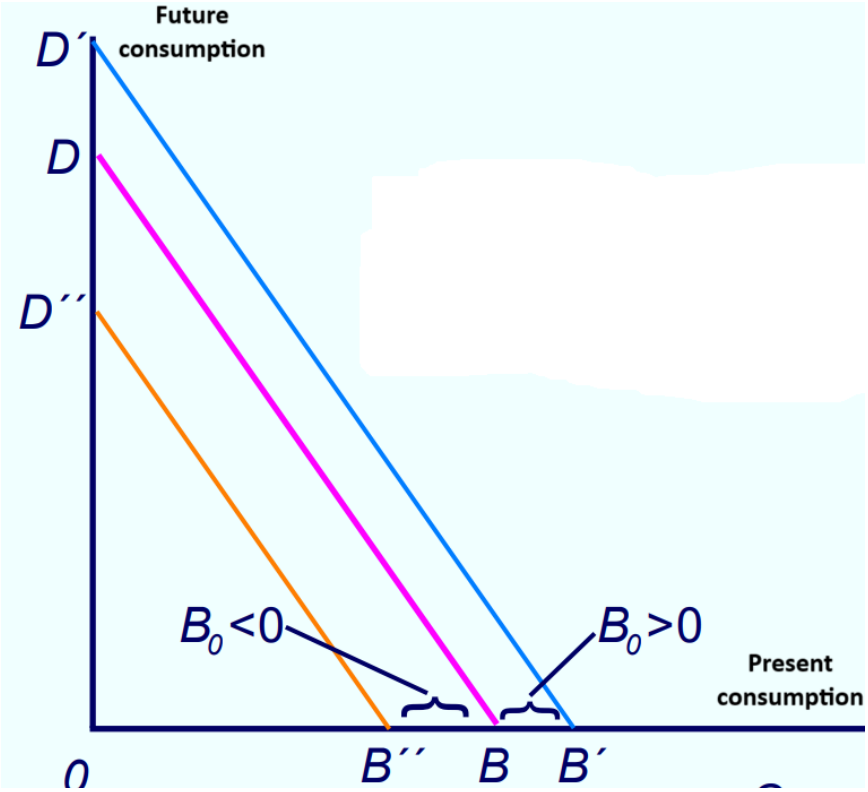
Let's start with the budget constraint for the consumer, in this case there are two periods: present and future.

- Income present/future: Y_1/Y_2
- Consumption present/future: C_1/C_2
- Real interest (debit&credit): r
- Vision from period 2: $C_1*(1+r) + C_2 = Y_1*(1+r) + Y_2$
- Vision from period 1: $C_1 + C_2 /(1+r) = Y_1 + Y_2/(1+r)$
- It is always possible to consume Y_1 in period 1 and Y_2 in period 2 ($C_1=Y_1$ & $C_2=Y_2$)

Now let's say you own a heritage since the start of period 1. We call this heritage B_0.
This changes the intemporal budget constraint to:

- $C_1*(1+r) + C_2 = (Y_1+B_0)*(1+r) + Y_2$

It is also possible that the heritage is a debt. Then B_0 will be negative.
Below is an illustration of this:



This subject is for big parts so if you find it challenging so far i suggest looking into the microeconomics summary of intertemporal budget constraints.

Producers

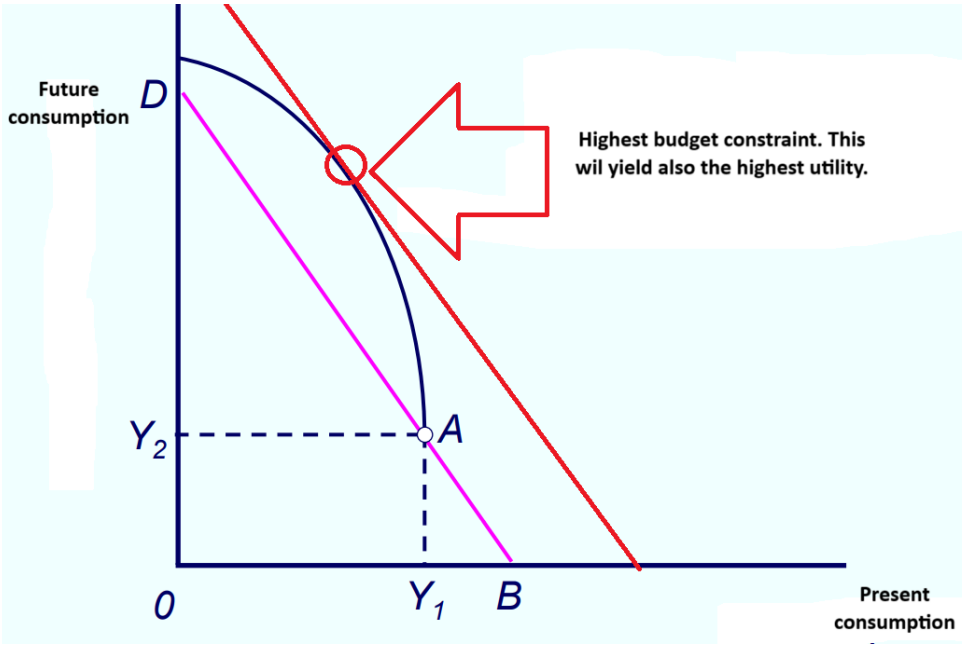
We know that the production-function is given by Y = F(L, K) although in lecture 2 & 3 of week 1 we learned how to write the production function in its intensive form: Y = F(K). We are interested in the capital because it's possible to invest in capital instead of saving money for interest.

We want to invest in physical capital if this yields more than a financial investment. Formally this is written as: F(K) > K(1+r) where the yields of a financial investment are given by K(1+r).
This can be rewritten as $\frac{F(K)-K}{K} > r$. Which translates to the net return on physical investment > return on financial investment. So as long as the production function line is above the opportunity cost line of investment (K(1+R)) profits are being made.

We know that consumers have a big influence on producers. They are the producers (CEO's, investors, etc). Therefore it's possible to rewrite the intertemporal budget constraint of consumers to include the production functions.

- From the vision of period 2: $C_1*(1+r) + C_2 = (Y_1-K)(1+r) + Y_2 + F(K)$
- From the vision of period 1: $C_1 + C_2/(1+r) = Y_1 - K + (Y_2+F(K))/(1+r)$

Below is illustrated how this is visualised. Note that the production function is mirrored because if we move to the left with present consumption, more is invested. Therefor because of diminishing returns, the production function will first increase a lot after which the increases diminish. Our goal is to reach the highest budget constraint with the production function. Therefore it isn't smart to invest everything in this particular production function.

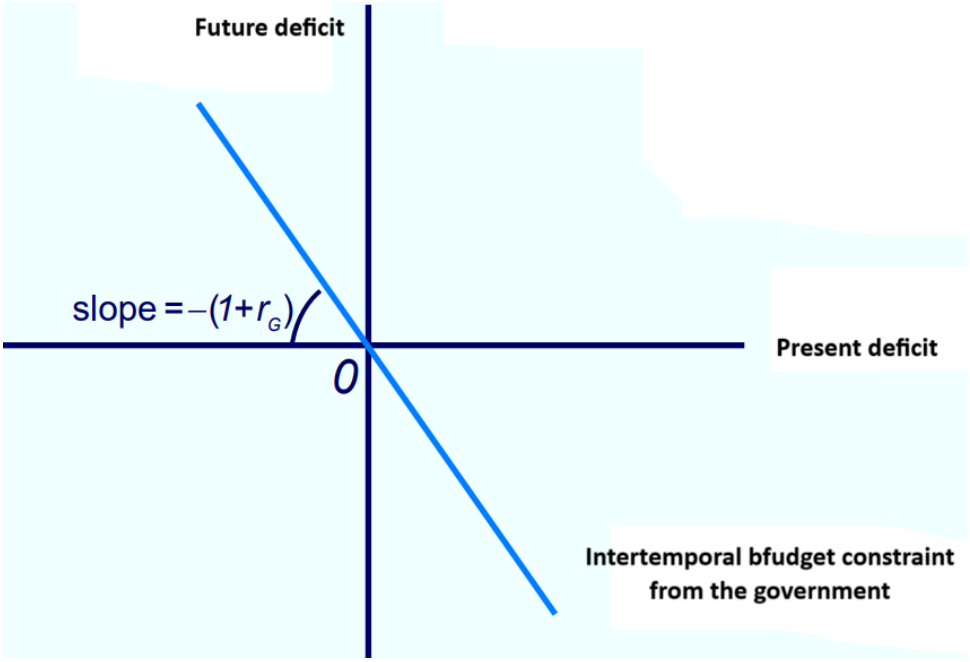


Government

The government's intertemporal budget constraint is also very relevant in macroeconomics. I will set the budget constraint up below.

- Old debt: G_1
- Government spendings in period 1/2: G_1/G_2
- Government income (tax) in period 1/2: T_1/T_2
- Government interest: r_G
- $(1+r_G)(D_1+(G_1-T_1))=T_2-G_2$

This budget constraint explains that the debts the government now makes has to be paid back in the future. Let's illustrate this without debt from the past: $D_1=0 \Rightarrow (1+r_G)(G_1-T_1)=T_2-G_2$



We can see that at points where there is a future deficit there is no present deficit and at points where there is a present deficit there is no future deficit.

Ricardian equivalence

Ricardian equivalence assumes consumers are very smart. They keep the government's budget constraint (less tax now is more future tax). We can illustrate how their budget constraint changes for Ricardian equivalence:

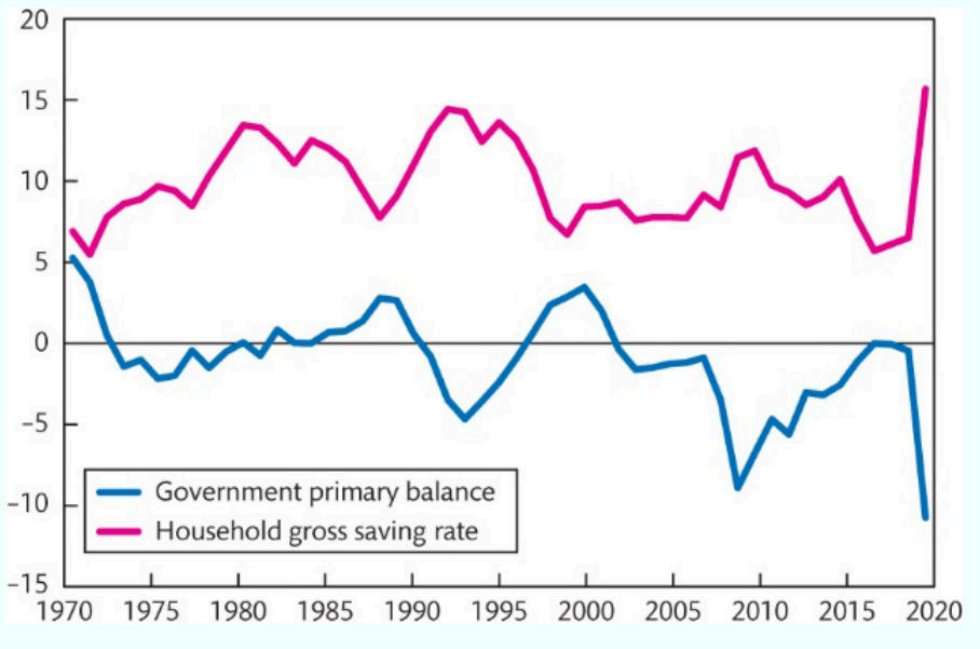
- $C_1 + C_2/(1+r)=(Y_1-T_1)+(Y_2-T_2)/(1+r)$
- $G_1 + G_2/(1+r_G)= T_1 + T_2/(1+r_G)$
- Ricardian equivalence assumes that $r_G = r$. Keep this in mind. If this isn't the case there isn't Ricardian equivalence.
- If we sum the first two equations we get: $C_1+C_2/(1+r) = (Y_1-G_1)+(Y_2-G_2)/(1+r)$

We see that in this ricardian budget constraint the consumer keep the government spending in mind. We can also see that taxing (T) has disappeared out of the constraint. Tax changes don't influence the consumption anymore.

There are a few reasons why ricardian equivalence doesn't apply:

- Keynes: "In the long run we are all dead". So basically the consumer doesn't care if there is a shortage for the government when he dies.
- The consumer doesn't get credit, for example a loan.
- The government pays a lower interest than the private sector: $r_G<r$

Below you can see an illustration in which it looks like Ricardian equivalence is relevant until 1995, because the government primary balance and household gross saving rate are inversely related.



Whole economy (country)

The current account (CA) in the balance of payments consist of:

- The primary current account (PCA = X - Z)
- + interest earnings/costs on the net assets compared to foreign countries (F)
- CA = PCA + rF
- In a model with two periods: $PCA_1+PCA_2/(1+r)>=-F_1$

Macroeconomics - IBEB
Lecture 7 - Week 3

Explaining the consumer and investment function.

In this lecture we explain the C (consumers) and I (investment) in the gross domestic product function: Y = C + I + G + X - Z.

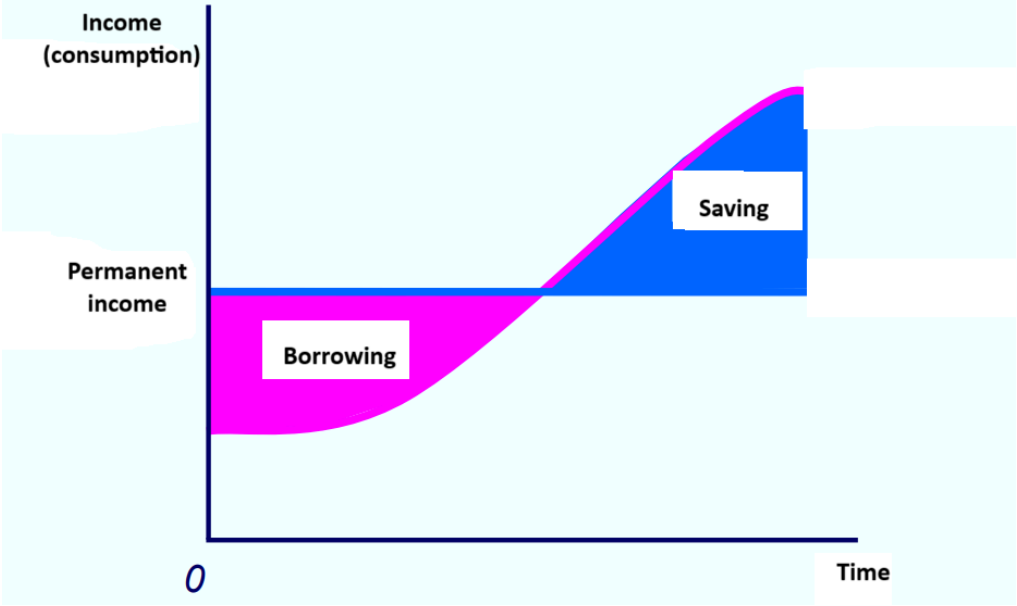
- $C = C(\Omega, Y^d)$
- Ω = Wealth (+)
- Y^d = available income (+)
- $I = I(r, q, \Delta Y)$
- r = real interest (-)
- q = Tobin's q (+)
- ΔY = Accelerator (+)

Let's first start with the consumer function. Last lecture and in microeconomics we learned how to maximise utility curves in the form $U(C_1, C_2)$ while under the budget constraint.
This is done in the following steps

- Max: $U=C_1^A*C_2^{(1-a)}$ while $C_1 + C_2/(1+r) = Y_1 + Y_2/(1+r) = \Omega$
- $C_2 = (1+r)(\Omega-C_1)$
- Now we can maximize the utility function by substituting C_2 and taking dU/dC_1 and setting it to zero.
- When solving this it will give $C_1=a\Omega$ in which $\Omega = Y_1 + Y_2 / (1 + r)$
- $C_2 = (1-a)((1+r)Y_1 + Y_2)$

We see that we can calculate the amount of consumption in a specific period very easily, by multiplying the power of the specific period with the max income in that period.

The permanent income hypothesis (Also known as Life-cycle consumption) is a hypothesis in which a consumer spreads out its income over his lifetime. This is called consumption smoothing. See the illustration below for further explanation.



The permanent-income is calculated by setting Ω (present value of current and future incomes) equal to the present value of a permanent income. This is mathematically illustrated below:
$\Omega = Y_1 + Y_2/(1 + r)$

Exercise:
Y_1=100000, Y_2=200000, r=0.05
Calculate the permanent income.

Answer:
$\Omega = 100000 + 200000/1.05 = 290476$
$290476 = Y_P + Y_P/1.05 \Leftrightarrow Y_P = 148780$

Let's return to the consumption function. What is the more important determinant, the permanent income or the disposable income? According to the permanent incomehypothesis and the life-cycle consumption is wealth (or permanent income) the most important determinant. According to the Keynesians is the disposable income the most important determinant.
The answer depends on the case, in case of credit restrictions for consumers the Keynesians might be more right, because it's not possible to create a permanent income. This is because it is not possible to take loans.

So in conclusion the consumption function is given by $C = C(\Omega, Y^d)$. The influence of real interest is negative via Ω. Consumption is not very volatile if only the permanent income (Ω) has influence on C. Take in mind that this consumption function is simplified and in Ω financial assets and house prices should be added.

The production function

In the previous lecture we learned that producers will invest if $\Pi(profit) > 0$. This is also written as $F(K) > (1 + r)K$. If we want to optimize this the following principle will show up: $MPK = 1 + r$. When the interest (r) goes up the amount of capital invested will go down. Therefore the interest has a negative impact on L.

A share in a listed company is a propertytitle. You are entitled for a share of the present and future profit of a company. The rate of the share is given by the markets expected and discounted value of future profit streams of the firm.

The market value of a firm = The rate of shares * total amount of shares. This doesn't have to be the same as the replacement value of the installed capital.
Tobin's q = Market Value / Replacement Value

The q theory of investments: links investments to Tobin's q.

If Tobin's q > 1: there are positive investments. An example of this is if the purchase of capital of 100, increases the market value with 120.

If Tobin's q<1: Negative investments, they will sell capital for the replacement value.

If the real interest increases, the present value of the expected future profits of the company will decrease. This will lower the marketvalue and therefore indirectly lower the investments.
Expectations over the performance of the firm, the sector or macro-economic conditions will influence q and therefore the investments. Since expectations are often volatile this will lead to volatile investments. We often see that investments are way more volatile than consumption.

Kaldor's stylized facts: The capital-output ratio K/Y is stable in the long-run. We have learned this in the first week of this course. This stylized facts we will explain with the **accelerator,** ΔY**.**
We will write the optimal capital as K = vY with v>0 and constant. An increase in Y requires an increase in K. If so then $I = \Delta K = v\Delta Y$. Investments are constant when the output rises. Investment rise when the output accelerates.

This will give the investment function $I = I(r, q, \Delta Y)$

Macroeconomics - IBEB
Lecture 8 - Week 3

Money and monetary policy

The functions of money are:

- Medium of exchange

- Unit of account
- Purchasing power reserve

You can use goods as money: “commodity money” <-> fiduciary money (“fiat money”, intrinsically useless).

Types of money:

- M0 (“monetary basis”):
  -Chartal money: banknotes and coins (C)
  -Reserves of commercial banks (R)
- M1:
  -Chartal money (C)
  -Cashless money: Deposits at commercial banks (D)
- M2:
  -M1
  -Saving accounts
- M3:
  -M2
  -Other short-term papers

Money-making institutions

- The central bank (ECB)
  -Brings banknotes and coins in circulation (C)
  -Reserves of commercial banks (R)
  -This is the monetary basis (M0)
- The commercial banks
  -Create cashless credits (D)
  -By lending credit (L)

Knowing how the balances of the banks are structured is very important to understand monetary policy.
The **Central Bank:**

Assets	**Liabilities**
Foreign reserves	Money in circulation

Loans to commercial banks	Cash and reserves of commercial banks
Investments	Credits of the government
	Net assets

The **Central Bank:**

Assets	**Liabilities**
Cash and reserves at the central bank	Liabilities to the central bank
Investments	Credits of the private sector
Loans	Net assets

Banks create money by lending. Of all deposits a certain share is lent out and a share is in the reserves (voluntary or obligatory)
Reserveratio rr: rr% of the deposits goes into the reserves. This is to make sure that banks can meet possible requests

Let's say Mr. A. deposits 1000 euro into the bank and the reserveratio is rr=0.1. 900 will be lent out and 100 will go to the reserves. The 900 euro lent out will eventually be deposited into the bank again. This process continues until the 1000 euro is in the reserves. The total money "created" is 1000/0.1=10000, of which 9000 are lent out and 1000 are in the reserves.

R = rr*D
D = 1/rr * R
So when the reserves go up with 100 the transfer credits will go up with 100 * 1/rr.
This process is called money multiplying. Combining the functions below will lead to the money multiplier (5)

1. $M0 = C + R$
2. $M = C + D$
3. $C = cc * M$
4. $R = rr * D$
5. $M = \frac{1}{cc+rr(1-cc)} M0$

The money-market

The demand for money is given by: $M^d = kPY$
Although keep in mind that the nominal interest rate (i) also influences the demand for money: $i = r + \pi$.
We can rewrite the demand for money by: $M^d = k(i)PY$

The demand for money implies an indirect demand for monetary basis by the banks. Banks with too much or too little reserves can go to the **interbank market**. There they can lend and borrow among themselves for interbank interest. **Interbank interest in the eurozone is the ESTR** (European Short Term Rate, before it was called the EONIA).

The supply of money is controlled by the central bank (ECB - European Central Bank). If the banks would like more reserves then the central bank can create them via:

- Loans to the banks
- Via purchases of short-term assets of the banks.

In short: The monetary basis is controlled by the central bank. If the bank doesn't react to a rise in the demand for money the interbank interest will rise. If the central bank would like to keep the interbank interest constant they should supply more money to the monetary basis. The central bank can choose every combination of monetary basis money and interest rate along the demand curve.

The central bank has a hard time controlling the amount of money, because they use the interest rate as a monetary policy instrument.

There are 3 basic types of interest:

- Refinancing interest (**refi**): A weekly auction for the market to help the weekly liquidity of banks
- Marginal loan interest: A daily interest for the daily liquidity of banks
- Deposit interest: For if banks deposit money at the ECB.

Normally -> Marginal loan interest > Refinancing interest > Deposit interest

Monetary policy

Monetary policy is a task of the central bank. This is done with **instruments**, for example interest or mandatory reserves. It's done via **monetary strategy**, for example money growth rules and it's done with specific objectives in mind, for example 2% inflation a year.

Objectives of the monetary policy: Price stability, for example 2% interest
Strategy of the monetary policy: Money growth targeting and inflation targeting.
Instruments of the monetary policy: Open market operations, for example the auction for the REFI, or directly purchasing assets of commercial banks, interest payments and mandatory reserves.

An important equation which describes the monetary policy relatively well is the **Taylor Rule**:

- $i = \bar{i} + a(\pi - \bar{\pi}) + b\frac{Y-\bar{Y}}{\bar{Y}}$
- $Y - \bar{Y}$ is the output gap. So how far off the trend the production is
- $\pi - \bar{\pi}$ is the difference between the real inflation and the target inflation.
- It's important to see that when economic activity is low, interest is lowered and when economic activity is high, interest is increased.

Transmission channels of the monetary policy:

1. Interest policy
   Quantitative easing (buying stocks of commercial banks)
2. Prices of financial assets and property (Via wealth of households and Tobin's q for firms).
3. Lending by banks

Banking is inherently unstable because of:

- Banks lend out money too easily (credit boom)
- Because of bad monitoring of debtors (assymetric information) the loans can decrease in value.
- Customers of commercial banks don't trust the bank anymore (bank run)
- Banks don't trust eachother anymore and will stop lending them credit on the interbank market.
- 'Contagion': Bankruptcy of one bank leads to problems for the other bank (systemic risk)

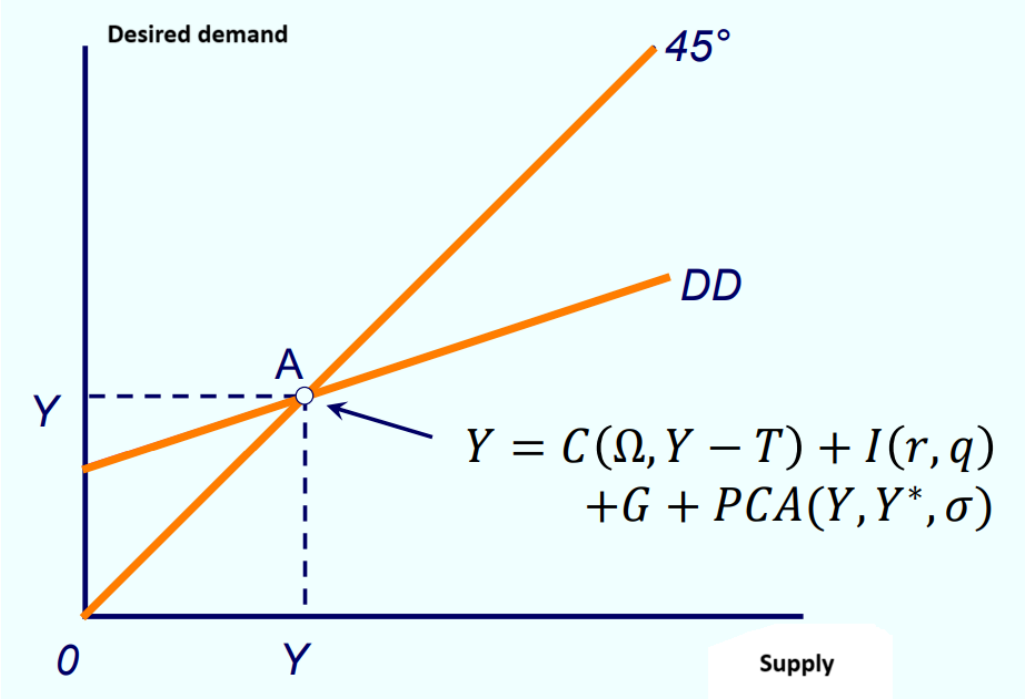
The central bank can take these factors into account by adding it to their Taylor rule. For example add the inflation of house prices and stock prices to the Taylor Rule.
$i = \bar{i} + a(\pi - \bar{\pi}) + b\frac{Y-\bar{Y}}{\bar{Y}} + c(w - \bar{w})$.
This formula will most likely be very important for the midterm.

Macroeconomics - IBEB
Lecture 9&10 - Week 4

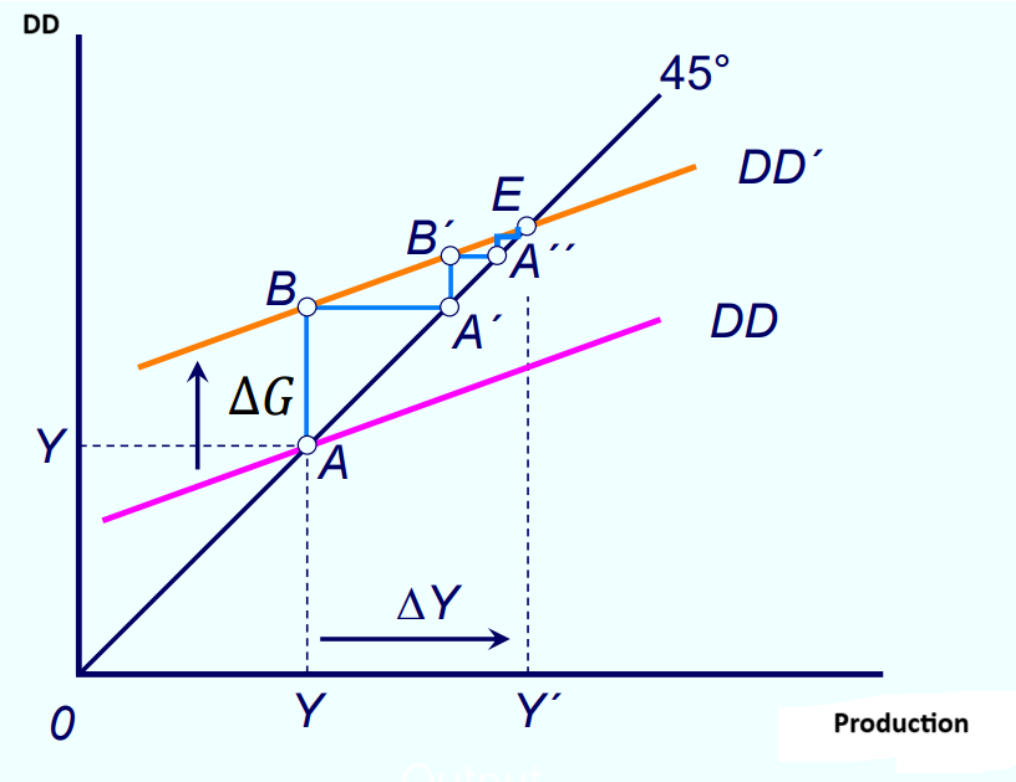
Interactions of markets in a closed economy

We'll look in the summary of this lecture at two markets. The market of goods and the money market. The market of goods influences the money market via income. Income influences the demand for money / policy of the central bank. The money market influences the market of goods via the interest. The interest influences the aggregated demand.

Let's first start with the equilibrium scenario where Y = C + I + G + NX. We do this with the desired demand curve (C+I+G+NX) and the 45* diagram. Which is also called the Keynesian cross. The desired demand has to equal supply therefore we can set a 45* equilibrium curve: Ydemand=Ysupply. All points on this curve can be a equilibrium depending on the desired demand curve. This is illustrated below.



The Keynesian Multiplier is a situation where the government increases its spendings which leads to an increase of income/production greater than its increase of spendings. This is illustrated below:



Eventually this multiplier effect will come to an end. This is because one of the following three leaks:

- A percentage of income will be saved: savings leaks
- A percentage of income will be spend on import: import leak
- A percentage of income will be taxed: tax leak.

When these percentages increase the multiplier will decrease.

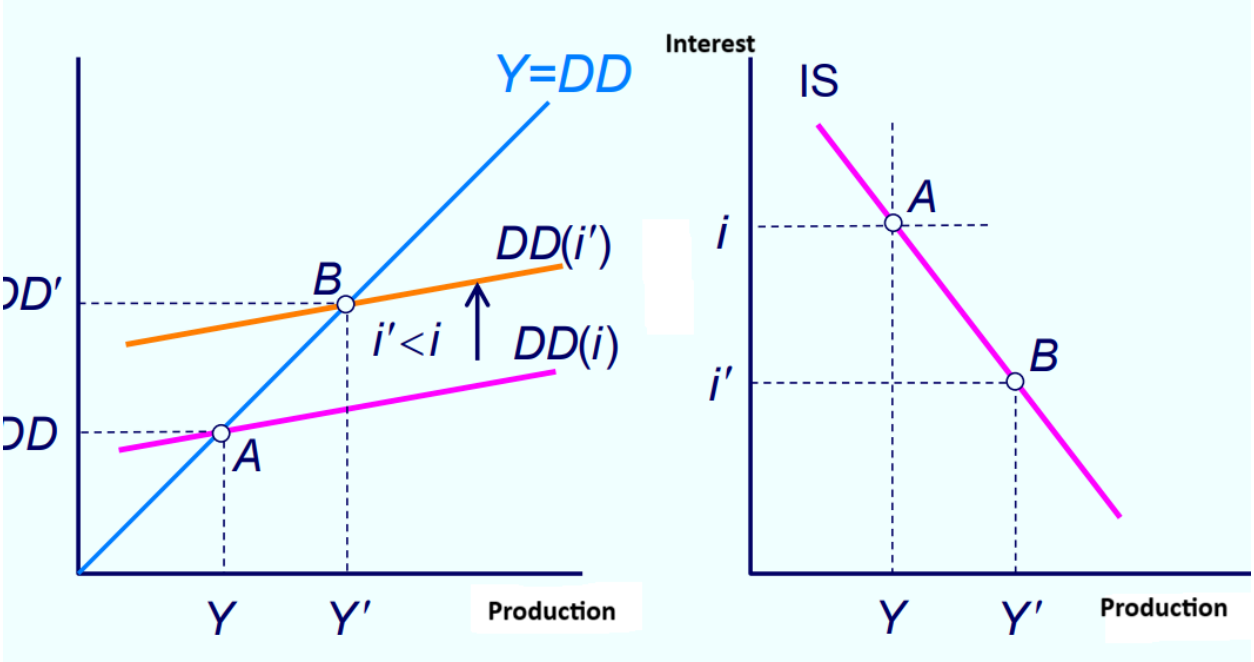
It's possible to derive the Keynesian Multiplier yourself:
$Y = C + I + G + X - Z \Leftrightarrow Y = \overline{C} + c(Y - \overline{T} - tY) + \overline{I} + \overline{G} + \overline{X} - \overline{Z} - zY$
$Y = \frac{1}{1-c+ct+z}(\overline{C} - c\overline{T} + \overline{I} + \overline{G} + \overline{X} - \overline{Z}$. In which 1/(1-c+ct+z) is the multiplier.

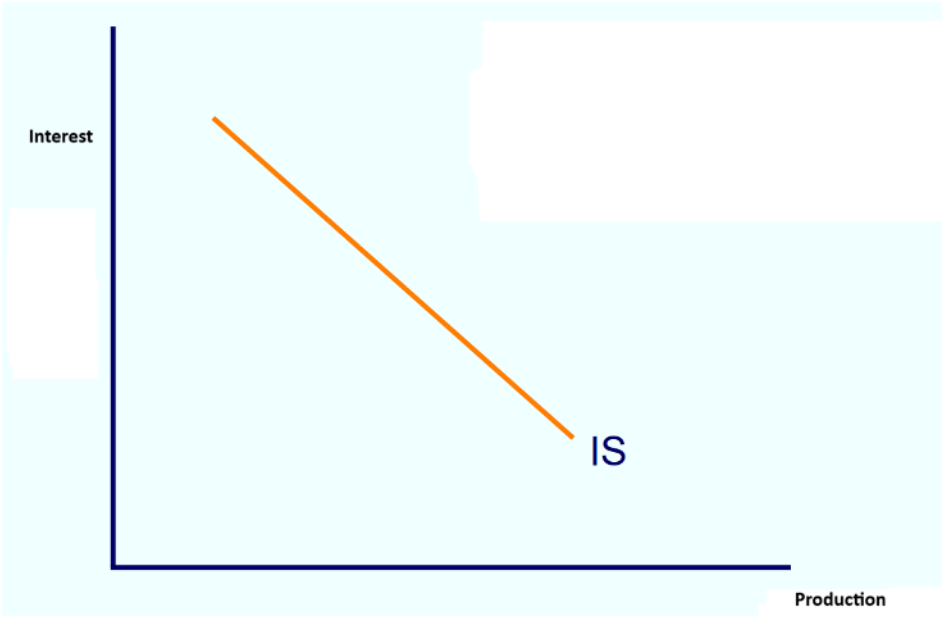
We'll start out with the **IS-curve**. This curve will describe the market of goods. These are combinations of interest (i) and production/income (Y) for each DD=Y equilibrium. Because the desired demand is a function of i it's possible to create a

function for the interest and production/income for when all the other variables are ceteris paribus.

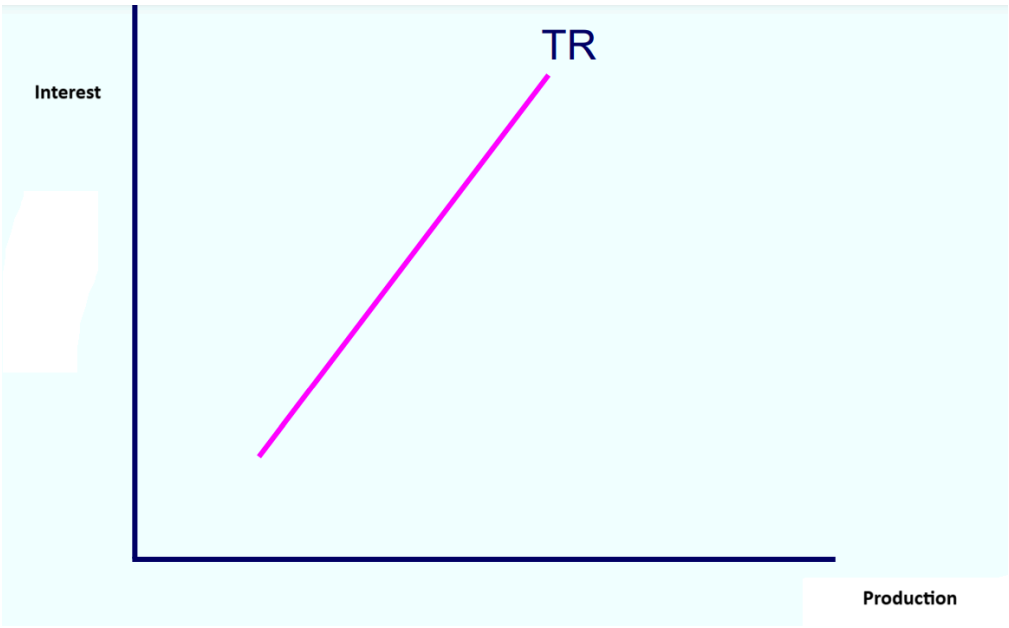
- The market is in an equilibrium state:
  $PCA = X(Y\ *,\ \sigma) - Z(Y,\ \sigma)$
  When σ increases X decreases. When σ increases Z increases. When σ increases the PCA will decrease.
  $Y = C(Y - T, \Omega) + I(r,\ q) + G + NX(Y,\ Y\ *,\ \sigma)$
- The prices are constant:
  $r = i + \pi = i$
- $\sigma = \frac{SP}{P*} = S$
- The slope is negative

The IS-curve is illustrated below. Make sure you understand that a change in interest causes a movement along the line. A change in for example exogenous variables as G(government purchases) causes the line to shift.





The **TR-curve** describes the money markets and in particular the monetary policy of the central banks. The monetary policy is described by the Taylor Rule. Because prices are constant the taylor rule given by: $i = \bar{i} + b(Y - \overline{Y})/\overline{Y}$.
A while ago we learned about monetary policy. The central banks are leaning "against the wind" therefore its slope is positive. This is illustrated below.



If b increases the central bank increases its interest more in reaction to output increases.

The equilibrium will be reached where the IS and TR curve intersect. This is where the market of goods and the market of money are in equilibrium. The budgetary policy of the government is described via the IS curve and the monetary policy is described via the TR curve.

Interactions of markets in a closed economy

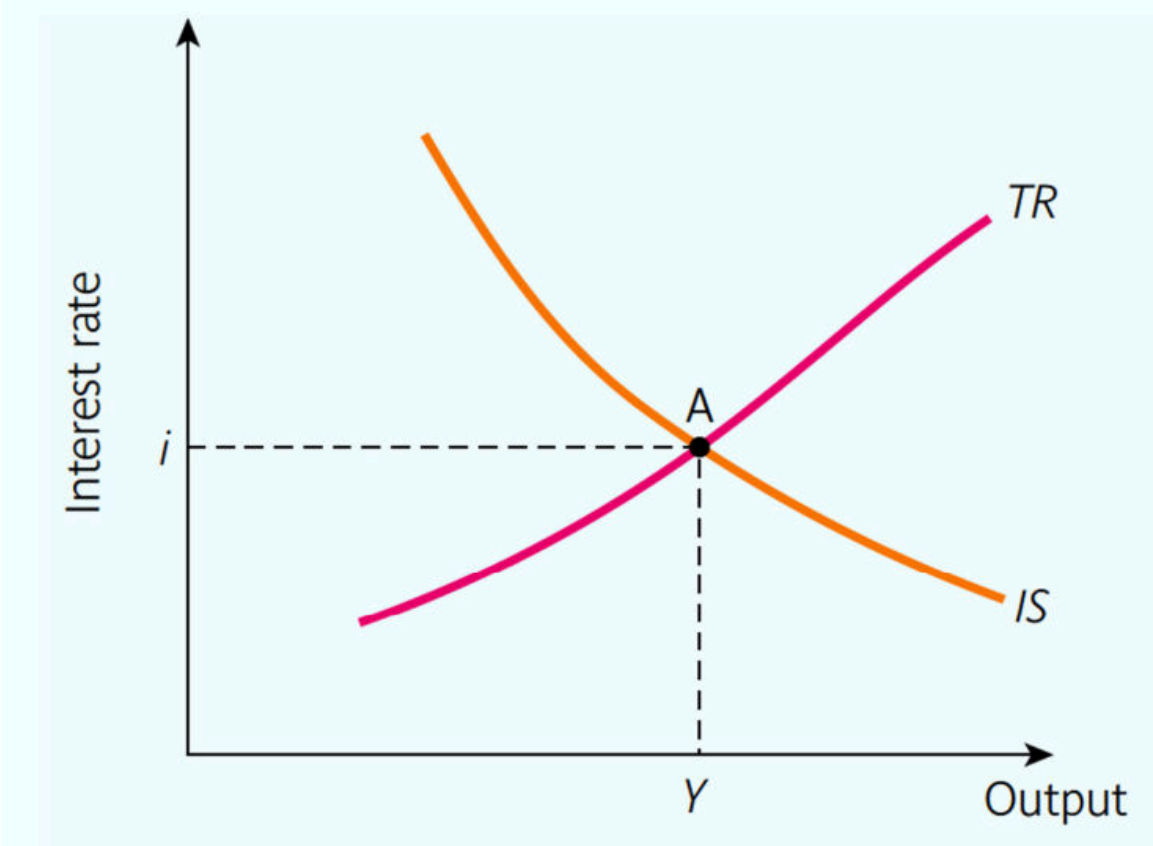
We are gonna look at the interactions of markets for a closed economy.
We use the IS-TR equilibrium:

- Markets of goods: IS-curve
- Money market: TR-curve

The budgetary policy is applied via the IS-curve. The monetary policy is applied via the TR-curve:

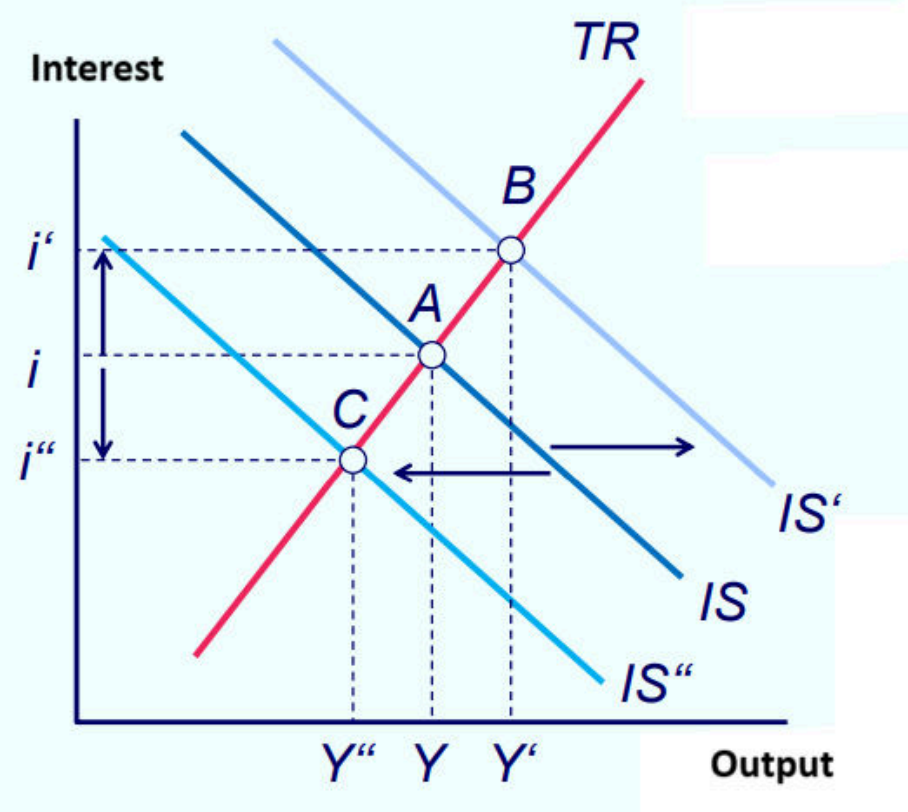
- Movements of the TR-curve: A variable changes which isn't the interest.
- Movements along the TR-curve: The interest changes.

The equilibrium is where the IS and TR curve intersect. This is illustrated below.



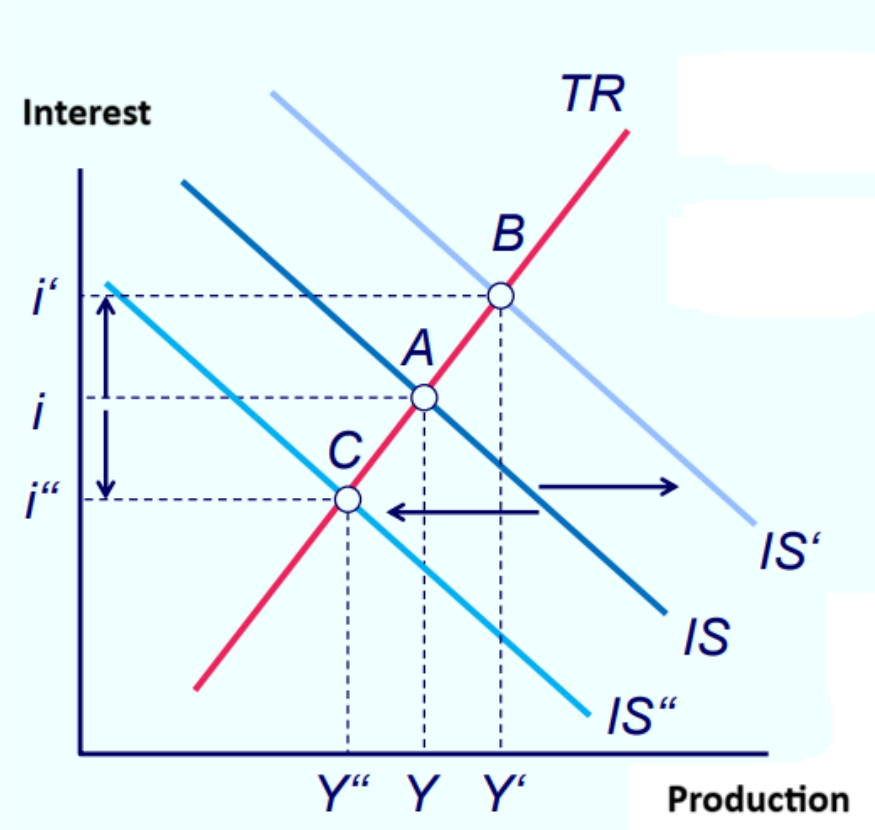
Macroeconomics shocks: TR-curve

When the central bank changes the neutral interest the TR-curve will move. When the natural interest goes up the bank is acting more restrictive. When the natural interest decreases the bank is acting more expansive. This is illustrated below

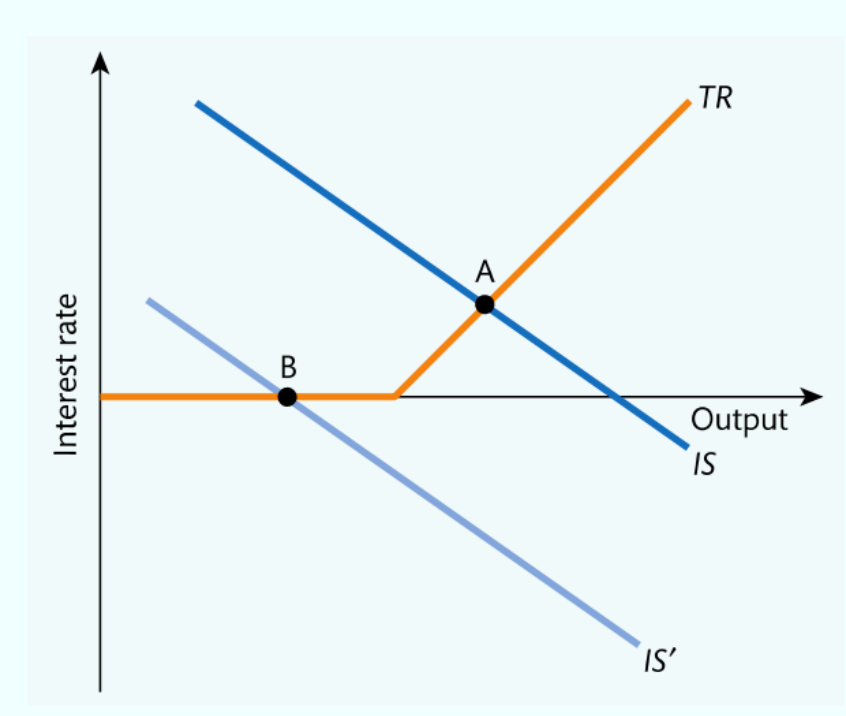


Macroeconomics shocks: IS-curve

The budgetary policy is done via the IS-curve. When the government raises its expenditures and lowers its taxes the IS-curve will move up. This is illustrated below.



We can also keep in mind that there is a zero lower bound on interest. We can apply this to the TR curve.



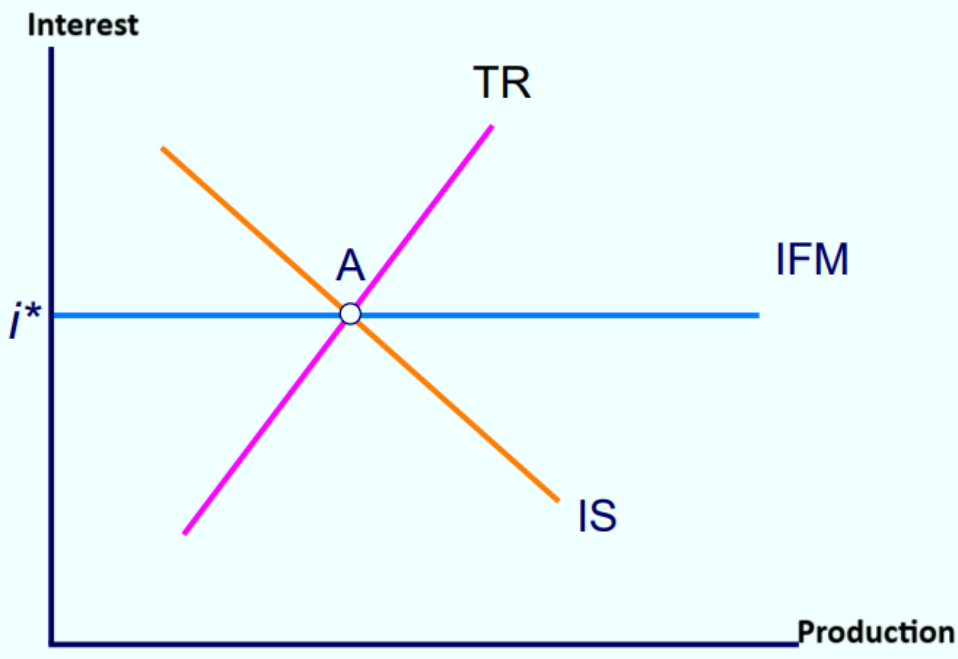
An equilibrium in a small open economy

In an open economy we have to keep exchange rates in mind.

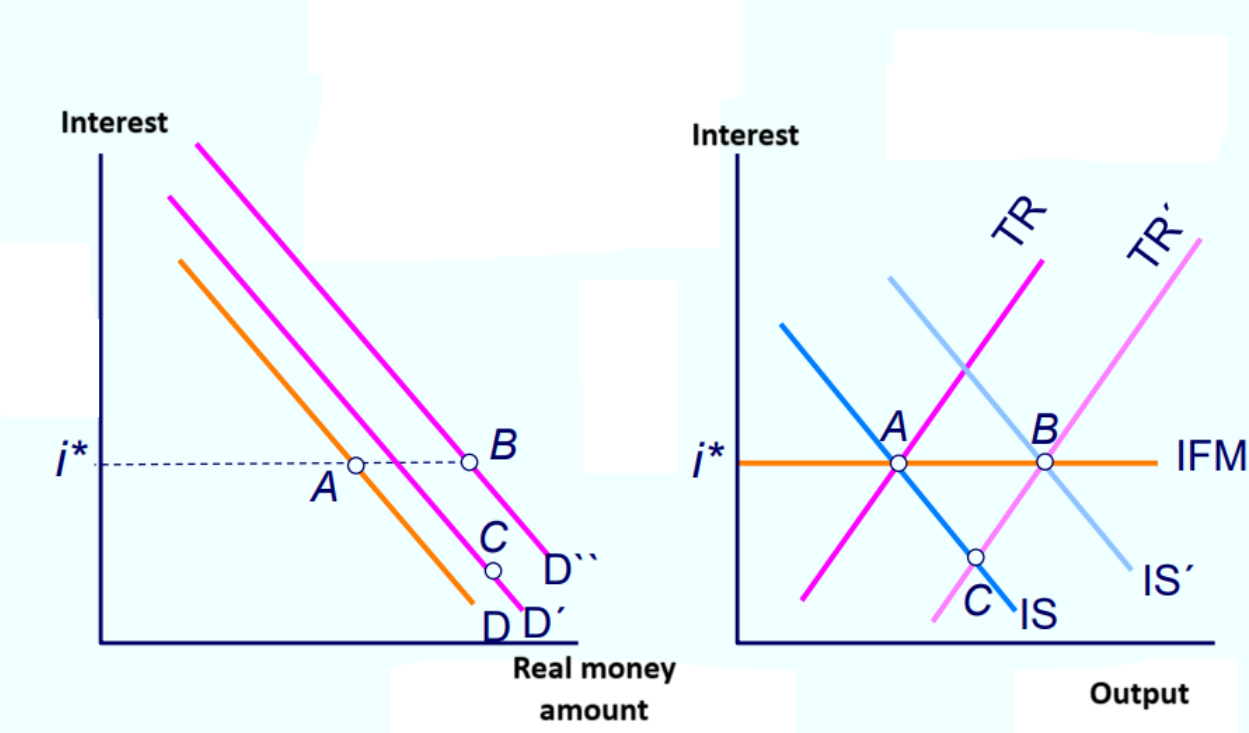
- Flexible exchange rates:
  The exchange rate is decided on the market and the central bank has control over the interest (Taylor rule). The budgetary policy is also not effective in the small open economy.
- Fixed exchange rate:
  The central bank sets the parity of the coin. The central bank loses control over the interest. Budgetary policy is effective.

The **IFM-curve:** the IFM curve is a horizontal curve at the set international interest rate (i*). The interest rate in a country will move until it reaches at i*. When i>i* capital moves into the country, the coin will appreciate and i will lower to i*.
When i<i* capital moves out of the country, the coin will depreciate and i will raise to i*.

We can summarize this in the **Mundell-Flemming model**. The markets of goods are summarized by the IS-curve. The money market is summarized by the TR-curve. The international capital market is summarized by the IFM-curve.



Let's now look at Monetary expansion. So when the natural interest is moved down. This is illustrated below. The points move from A to B to C.



Budgetary policy doesn't change the equilibrium for flexible exchange rates.

Macroeconomics - IBEB

Lecture 11 - Week 5

The Aggregate supply curve

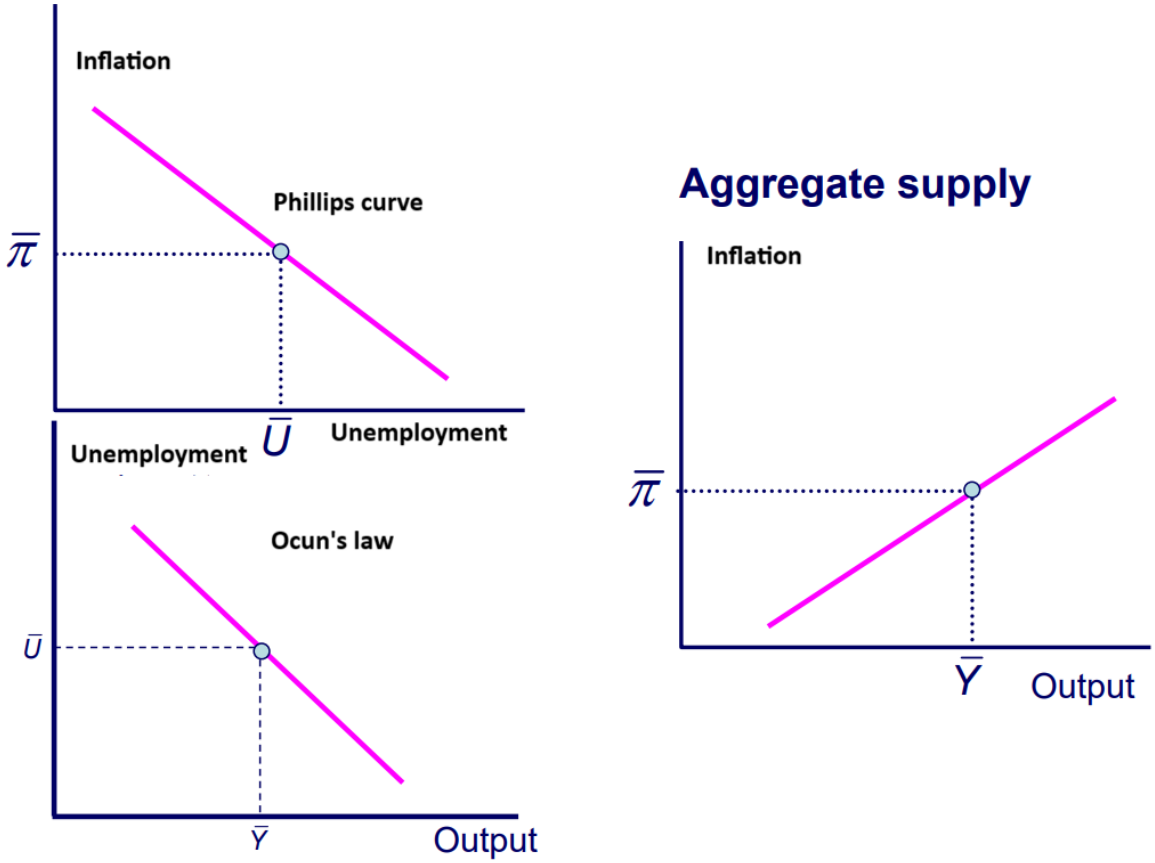
We learned that the Keynesians view prices as constant. This is a view which is acceptable in the short-run. Although it is in sharp contrast with the view of the neo-classicals. They believe prices are fully flexible. This is more of a view which holds true when moving to the long-run.

Let's review the Cambridge Equation: M=kPY. If we assume there is an exogenous increase in the money supply. The Keynesian Short-run assumes that prices on the short-run are constant and therefore production reacts to changes in the demand.

The Neo-Classical long-run assumes that changes in the money supply don't lead to changes in the production. It only leads to changes in the price level. This is in line with the monetary neutrality principle.

The **Phillips Curve** is a curve which describes a negative relationship between inflation and unemployment. There is a trade-off between levels of unemployment and inflation.
Okun's law is a curve which describes a negative relation between output and unemployment.

Combining these will lead to the **aggregate-supply curve**. This curve describes a positive relationship between output and inflation. These curves are illustrated below:



There are a few problems with the basic Phillips curve.

1. **Theoretical problems**: In the long-run there has to be monetary neutrality. Nominal variables don't affect the real variables. Therefore in the long run holds: $Y = \bar{Y}$, $U = \bar{U}$. This means that in the long-run the Phillips curve & aggregate supply curve are vertical.

2. **Empirical problems**: The negative relationship between unemployment and inflation didn't seem to always hold in the 70's. There was **stagflation**: this is a combination of stagnation (high unemployment) and inflation.

Therefore the **extended Phillips curve** was developed:
In markets where there is market power(i. e. imperfect competition) the price setters will want to have a profit margin. Therefore we can describe the prices as:
$P = (1 + \Theta)MC,\ with\ \Theta > 0$. We rewrite this as $P = (1 + \Theta)\frac{WL}{Y}$.

The share of the GDP that goes to labour (i. e. the real labour costs per unit) is: $\frac{WL}{PY}$.
The **labour forces** want to maximise the share of the GDP that goes to labour.
$s_L = \frac{WL}{P^e Y} = (1 + y)\,\overline{S_L}$ in which $y =$ the mark-up which depends on the business cycle and in which $\overline{S_L} =$ the "normal" share of labour in the GDP.

The **labour forces** negotiate on the nominal wages and shape expected prices: P^e which gives the formula: $W = (1 + y)\,\overline{S_L} P^e \frac{Y}{L}$

When combining these gives the formula: $P = (1 + \Theta)(1 + y)\,\overline{S_L} P^e$
When writing these into growth rates this gives the "Battle of the Mark-ups":
$\pi = \frac{d\Theta}{1+\Theta} + \frac{dy}{1+y} + \pi^e$. If we keep the cyclical nature of the battle of the mark-ups in mind: when the output rises the mark-ups i. e. $\Theta\ and\ y$ will rise, we get the equation $\pi = underlying\,\pi - bU_{gap}$ in which $underlying\,\pi = \alpha\pi^e + (1 - a)\pi_{-1}$

We can expand this equation with supply shocks. These are changes in the other costs which aren't labour costs. For example, price increases in energy costs or transport costs. We will write this as 's' in which the average of s will equal 0:
$\pi = underlying\,\pi - bU_{gap} + s$. This function is called the expectations-augmented Phillips curve with supply shocks.

We can also rework this extended Phillips curve to the aggregate supply curve. We now know that:
$\pi = underlying\,\pi - bU_{gap} + s$

We can write Okun's law as:
$U_{gap} = -\,hY_{gap}$

Substituting this gives us the aggregate supply curve:
$\pi = underlying\,\pi + bhY_{gap} + s = underlying\,\pi + aY_{gap} + s$

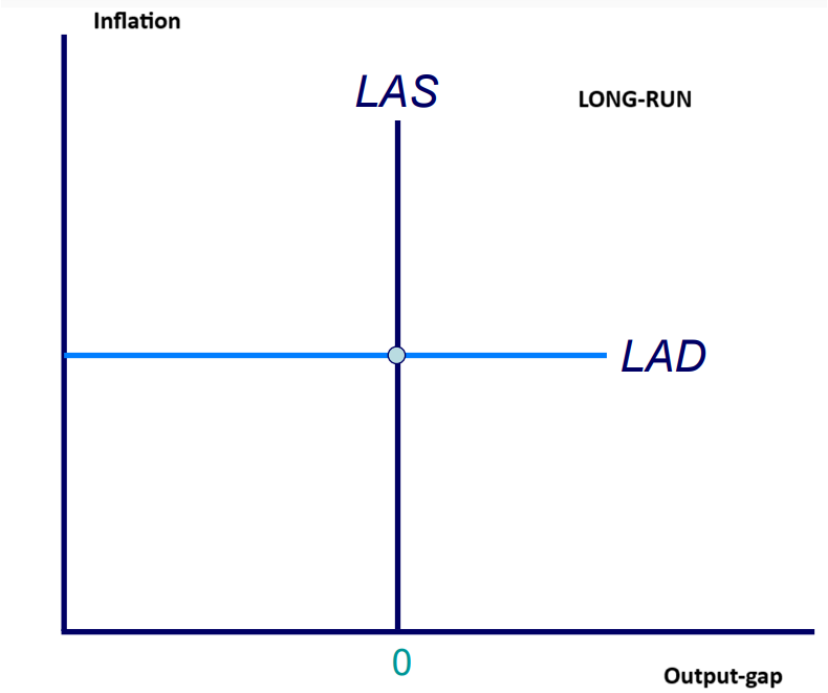
Keep in mind that for the new curves in the long-run they are still vertical i. e. $U = \overline{U}$, $Y = \overline{Y}$ and are independent of the inflation level.

Macroeconomics - IBEB
Lecture 12 - Week 5

The aggregate demand curve

In the long-run the **aggregate supply curve** is vertical at the point where there is no output gap i. e. $Y = \overline{Y}$.
The long-run **aggregate demand curve** is a horizontal curve at the inflation target of the central bank i. e. $\pi = \overline{\pi}$.

This is illustrated below:



Below follows a small reminder of the other curves we derived in the previous lecture:

- Phillips curve: $\pi = underlying\,\pi - bU_{gap} + s$
- Okun's law: $U_{gap} = -hY_{gap}$
- Aggregate supply curve: $\pi = underlying\,\pi - bY_{gap} + s$

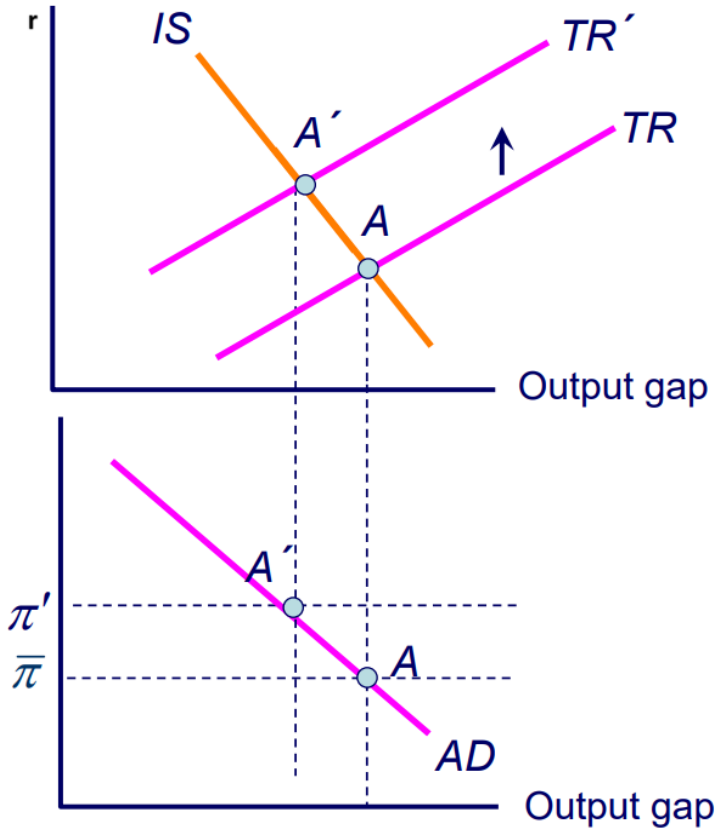
Let's now derive the aggregate demand curve. We start from the Taylor rule and now inflation is relevant because we are trying to move from the short-run to the long-run.

TR: $i = \bar{i} + a(\pi - \bar{\pi}) + b\frac{Y-\bar{Y}}{\bar{Y}} = \bar{i} + a\pi_{gap} + bY_{gap}$

Fisher equation: $r = i - \pi \Leftrightarrow \bar{i} = \bar{r} + \bar{\pi}$

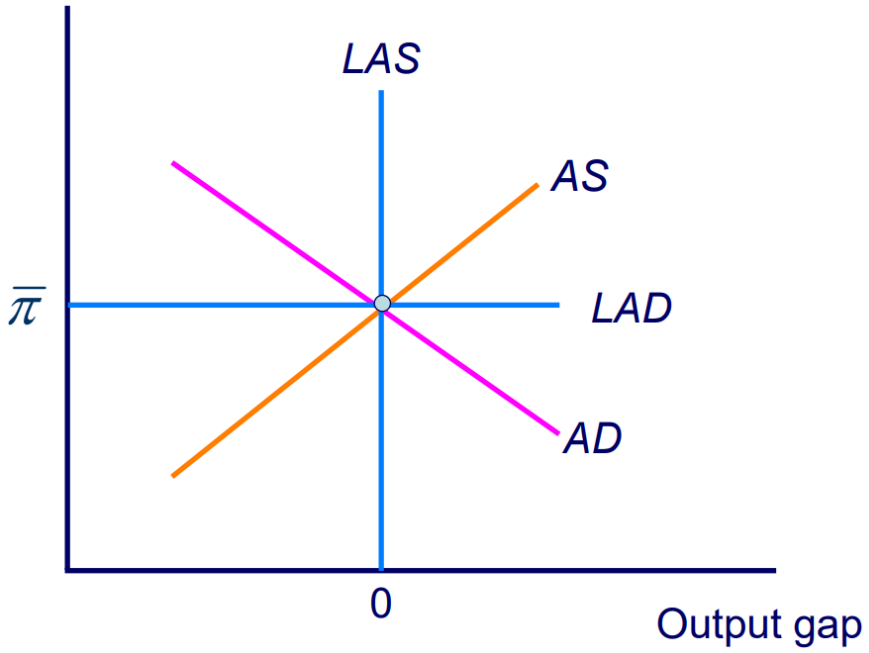
This gives: $r = \bar{r} + \pi(a - 1) + \bar{\pi}(1 - a) + bY_{gap}$. Let's now assume a>1 instead of a>0. You see that when inflation rises the real interest increases.

The aggregate demand curve is derived by determining the increase in the output gap at each inflation level where the Taylor rule curve changes. Since inflation isn't on the Y-axis in the IS-TR model the curve will move instead of a movement along the curve. This is illustrated below:



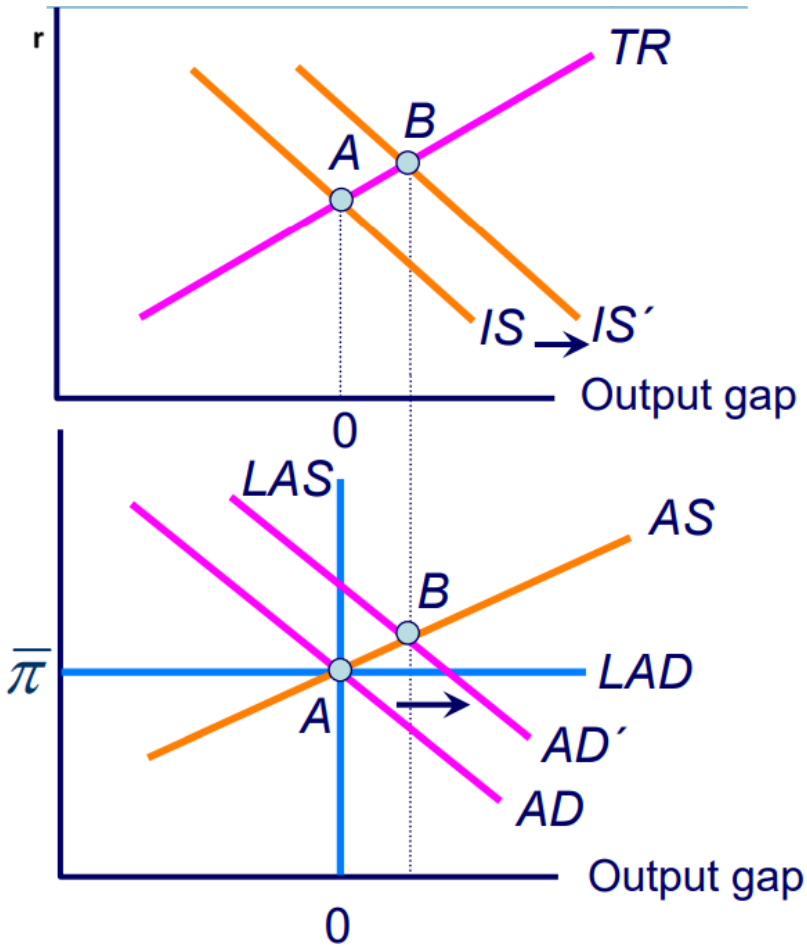
This works exactly the same for deriving the aggregate demand curve in a small open economy with flexible exchange rates. Although keep in mind that the IS-curve will also move so that the equilibrium is on the IFM curve.

The long-run and short-run aggregate demand and supply curves are illustrated below. If the short-run becomes longer the aggregate demand curve will become flatter and the aggregate supply curve will become steeper.

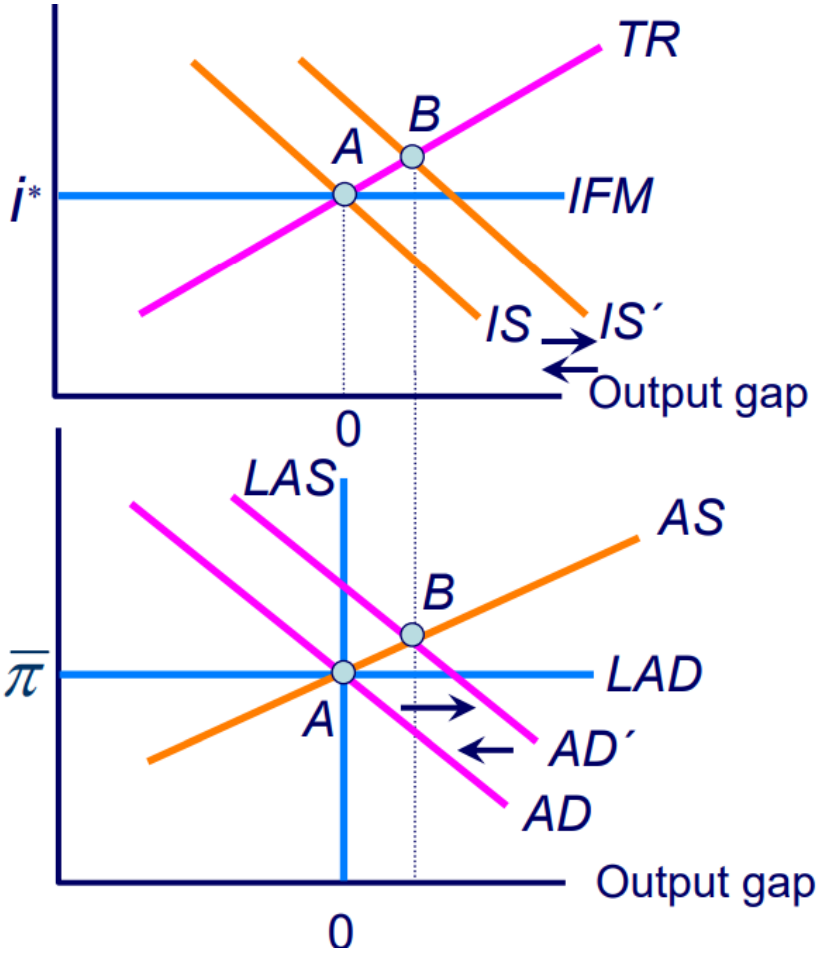


Budgetary and monetary policy in the AD-AS model

Let's first look at **expansive budgetary policy** in a closed economy. Let's say the government increases its expenditure. This will move up the IS curve and with that the aggregate demand curve will move up. This leads to a positive output gap and a higher inflation. The higher inflation will lead to a higher expected inflation and therefore underlying inflation which will move the aggregate supply curve up until the short-run AS and AD intersect in the LAS. This is illustrated below:

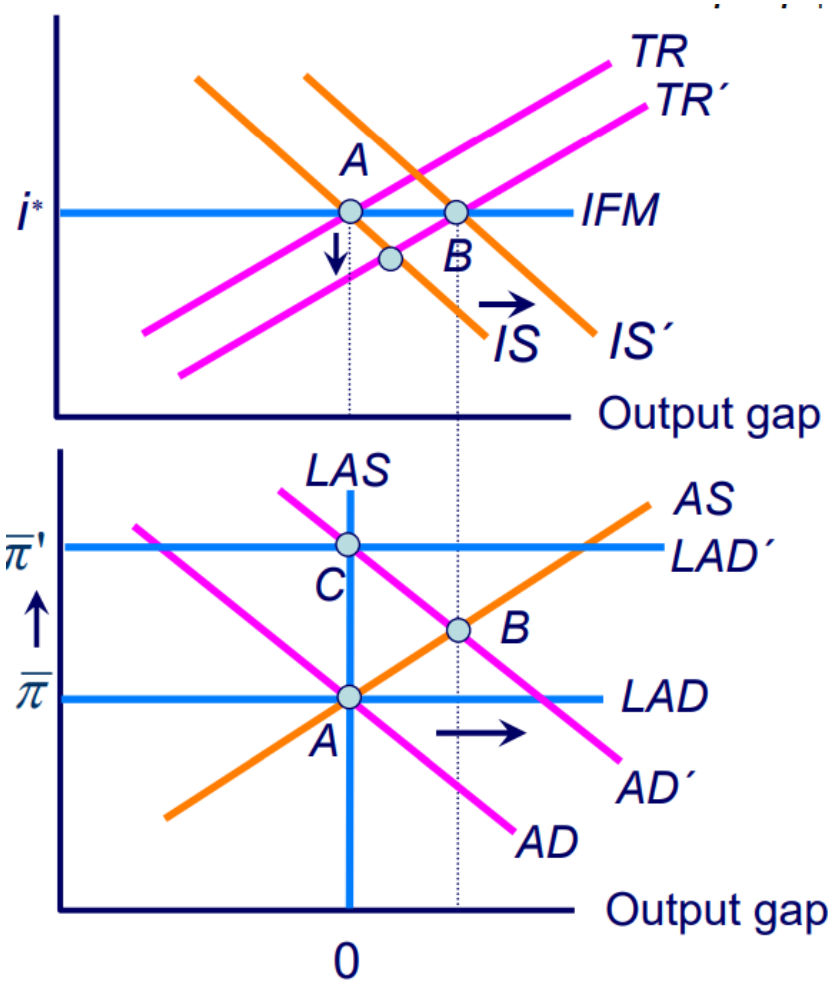


We are now gonna look at **expansive budgetary policy in a small open economy** with flexible exchange rates will have no effect in the long-run. This is because the IS-curve will move up once again. Because the interest in our country is now higher than the IFM curve capital will flow in the country. This makes our exchange rate appreciate. Which makes our international competitiveness worse. Which in turn will lead to the IS-curve moving back to its original state. This is illustrated below:



Now we are gonna look at **expansive monetary policy in a small open economy**. Expansive monetary policy means that we are gonna decrease our natural interest rate. This will lower the Taylor rule curve. Which in turn will increase the output gap for the same inflation rate. Therefore the aggregate demand curve will move up. The higher inflation will influence the underlying inflation and therefore the aggregate supply curve will gradually move up until the equilibrium rests in the LAS. The LAD will also move up to this point because part of the reason why the government does this, is to reach a higher goal of inflation.

This is illustrated below:



Now we know how these curves we ca

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