Summary

- Macroeconomics -

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Chapter 1. A tour around the world

1.1 Europe and the Euro

- *Output:* The level of production of the economy as a whole - and its rate of growth.
- *Unemployment rate:* The proportion of workers in the economy who are not employed and looking for a job.
- *Inflation rate:* the rate at which the average price of goods in the economy is increasing over time.
- *Trade deficit:* The difference between import and export.

Chapter 2. A tour of the book

2.1 Aggregate output

- *Aggregate output:* total output à Gross Domestic Product (GDP)
- *Intermediate good:* a good used in the production of another good. Some products can be both intermediate as final product (potatoes for consumption and used in chips)
- *Several definitions of GDP*
    - GDP is the value of the **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. (added value = value of production - values of intermediate products used)
    - GDP is the sum of incomes in the economy during a given period (labour income + capital/profit income)
- *Aggregate output (thus GDP) in three ways*
    - From the production side: GDP equals the value of the final goods and services produced in the economy during a given period.
    - From the production side: GDP is the sum of value added in the economy during a given period
    - From the income side: GDP is the sum of incomes in the economy during a given period.
- *Nominal GDP*: the sum of the quantities of final goods produced times their current prices. Increases over time for two reasons:
    - *Production of most goods increase over time*
    - *Prices of most goods also increase over time*
- *Real GDP:* sum of quantities of final goods times constant (rather than current) prices. (Thus use the price of one year and multiply that by the quantities of each year. The rate of change should be the same if a different price year is chosen as standard)à Nominal GDP adjusted by inflation.
- Nominal GDP (€Y_t) is also called GDP at current prices.
- Real GDP (Y_t) is also called GDP in terms of goods, GDP at constant prices, GDP adjusted for inflation.

- *Real GDP per capita:* Ratio of real GDP to the population of the country. Average standard of living of the country.
- *GDP Growth:* The rate of growth of the real GDP
- *Expansion:* periods of positive GDP growth
- *Recessions:* Periods of negative GDP growth
- Hedonic pricing: determine price based on the characteristics of a good.

2.2 Other major macroeconomic variables

- *Employment:* the number of people who have a job
- *Unemployment:* the number of people who do not have a job but are looking for one
- *Labour force:* the sum of the employment and the unemployment:
  - $L_{labour\ force} = N_{employment} + U_{unemployment}$
- *Unemployment rate:* is the ratio of the number of people who are unemployed to the number in the labour force
- Those who do not have a job and are not looking for one are not counted in the labour force
- *Discouraged worker:* Unemployed people who give up to find a new job
- *Participation rate:* ratio of the labour force to the total population of working age
- Two reasons why economists care about unemployment rate:
  - It has a direct effect on the welfare of the unemployed (financial and psychological)
  - It is a signal that the economy may not be using some of its resources efficiently (not fully utilizing its human resources)
- *Inflation rate:* is the rate at which the price level increases.
- *Deflation:* is a sustained decline in the price level. à negative inflation rate
- *GDP deflator:* is defined as the ratio of nominal GDP to real GDP in year t.
- *Rate of change of GDP deflator:* $(P_t - P_{t-1})/P_{t-1}$ *à* the rate at which the general level of process increases over time - the rate of inflation
- The set of goods produced in the economy is not the same set of goods purchased by consumers because:
  - Some of the goods in GDP are sold not to consumers but to firms (machine tools), to the government or to foreigners
  - Some of the goods bought by consumers are not produces domestically but are imported from abroad.
- *Consumer price index (CPI):* the average price of consumption, the cost of living.
- *Harmonised index of consumer prices (HICP):* is an index with a standard year used in the EU.
- The HICP and the GDP deflator move together most of the time
- But there are exceptions (e.g. the plummet of the oil prices)
- Why is inflation important?
  - During periods of inflation, not all prices and wages rise proportionately. Because they don't, inflation affects income distribution. Pensions do not keep up with the price level.
  - Inflation leads to other distortions. Some prices which are fixed by law or by regulation lag behind the others, leading to changes in relative prices. Variation in relative prices

leads to more uncertainties à harder to make decisions such as investments. In addition, taxation interacts with inflation. If tax brackets are not adjusted for inflation, people move to higher brackets when their nominal income increases while their real income doesn't .

- Is deflation good? No, it brings the same problems as inflation.
- 1-4% inflation is considered to be plausible.

2.3 Output, unemployment and the inflation rate, Okun's law and the Phillips curve.

- *Okun's law:* If output growth is high, unemployment will decrease. à the key to decreasing unemployment is high enough growth. Downward sloping line.
    - A constant small positive output growth is necessary to ensure that unemployment rate will remain the same.
- *Phillips curve*: When unemployment rate becomes very low the economy is likely to overheat and will lead to upward pressure on inflation. → relation between the change in the rate of inflation and the unemployment rate.
    - on average: low unemployment → high inflation,
      high unemployment → low inflation
    - on average a minimal unemployment rate of 4-5% should be held to avoid overheating.

2.4 The short run, the medium run and the long run

- What determines the level of aggregate output in an economy?
    - movements in output come from movements in the demand for goods → demand
    - how much can the economy produce (depends on technology, capital available and number /skill of labour force) → supply
    - factors of a country, like education system, saving rate, quality of government.
    - <u>short run (2-3 years)</u>: year-to-year movements in output are primarily driven by movements in demands
    - <u>medium run (a decade):</u> the level of output is determined by supply factors: capital stock, technology, size / skill of labour force
    - <u>long run (few decades):</u> it depends on the countries determinants: government, education system, saving rate etc, etc…
- Appendix
    - To determine rate of growth of real GDP between two years, calculate both real GDP with price standards of both years and average them.

Chapter 3: The Goods Market

3.1 The composition of GDP:

- Decomposition of GDP, Y:

- *Consumption (C)*: are the goods and services purchased by consumers. It is by far the largest component of GDP
- *Investment (I)*: fixed investment to distinguish from inventory investment. Investment is the sum of non-residential investment, the purchase by firms of new machines and the residential investment, the purchase by people of new houses or apartments. Investment is the purchase of new capital goods.
- *Government spending (G)*: the purchase of goods and services by the national, regional and local governments. does **NOT** include government transfers such as pensions, social benefits nor interest payments on the government debt.
- *Imports (IM)*: should be subtracted, because these are services and goods not bought within the country itself.
- *Exports (X)*: The purchase of domestic goods and services by foreigners, must be added.
- *Trade balance*: (X-IM) also named net export or trade balance. If X > IM then trade surplus. if IM > X then trade deficit
- *Inventory investment **(Not part of demand)***: the difference between goods produced and goods sold in a given year.
    - Inventory investment = production - sales
    - production = sales + inventory investment
    - sales = production - inventory investment

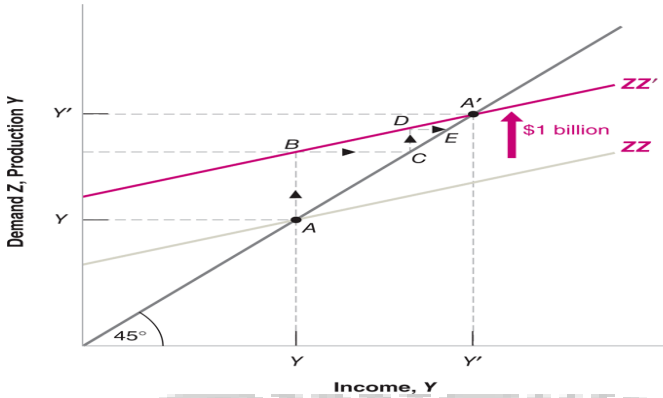
3.2 The demand for goods

- *Total Demand (Z)*: $Z \equiv C+I+G+(X-M)$
- *There are simplifications made to determine Z:*
  ** Homogeneous goods(firms produce the same goods)*
  ** Firms are willing to supply any amount of the good at a given price level P.*
  ** The economy is closed.*
- *Said that, $Z = C + I + G$*
- Consumption (C) depends on:
    - Simple model
        - disposable income (Y_D) → the income that remains once consumers have received transfers from the government and paid their taxes $Y_D \equiv Y-T$
          Y is income, T is taxes minus government transfers received by consumers.
        - Disposable income is a function of consumption: $C(Y_D)$
    - Adding realism:
        - individuals do not consume all their income
            - They consume a percentageà
            - C1=marginal propensity to consume
        - Consumption that does not depend on income, we need food/housing etc.
            - = autonomous consumption= C0
    - So $C = c_0 + c_1Y_D$

- Investment (I):
    - Endogenous variables: variables that depend on other variables in the model → explained within the model.
    - Exogenous variables: variables not explained within the model.
    - → $I = \bar{I}$ (the bar represents that it is a given value)
    - This means that investment does not respond to changes in production
- Government spending (G)
    - This describes **<u>Fiscal policy</u>** → the choices of taxes and spending by the government.
    - G and T are exogenous
    - Governments do not behave with the same regularity as consumers or firms. And macroeconomists try to explain G and T thus therefore are chosen by economists.

3.3 The determination of equilibrium output

- $Z = c_0 + c_1(Y-T) + \bar{I} + G$
- Z depends on income Y, Taxes T, investment $\bar{I}$, and government spending G.
- Positive inventory investment → producing more than demand (inventory grows)
- Negative inventory investment → producing less than demand (inventory shrinks)
- Equilibrium in the goods market → when inventory investment is exactly what firms wanted it to be, production Y is equal to demand Z. Y = Z → this is an equilibrium condition.
- → $Y = c_0 + c_1(Y-T) + \bar{I} + G$ → production and income are identically equal
- can be written to $Y=1/1-c_1 [c_0 + \bar{I} + G - c_1T]$
    - $[c_0 + \bar{I} + G - c_1T]$ → does not depend on output thus it is <u>autonomous spending</u> which is likely to be positive.
    - If the government runs a <u>balanced budget</u> - taxes equal gov. spending then T = G then $(G - c_1T) = (T-c_1T) = (1 - c_1) T > 0$
    - $1/1-c_1$ is called the <u>multiplier</u> → the closer c_1 is to one the larger the multiplier
- *Multiplier*
    - Production depends on demand, which depends on income, which itself equals to production. An increase in demand, such as an increase in government spending, leads to an increase in production and a corresponding increase in income. This increase in income leads to a further increase in demand, which leads to a further increase in production and so on. The end result is an increase in output that is larger than the initial shift in demand, by a factor equal to the multiplier



- *Dynamics of adjustment* → adjustment of output over time an increase of consumption does not directly increase the output, but rather over time. For example firms that decide each quarter what their new quota will be for the next period. If during that period the consumptions rise, the quota will remain the same until the following period.

3.4 Investment equals saving: An alternative way of thinking about the goods-market equilibrium

- *Saving*: Is the sum of private saving and public saving
- *Private saving (S):* $S = Y_D - C \rightarrow S = Y - T - C \rightarrow$ saving by consumers
- *Public saving*: is equal to taxes (net of transfers) minus the government spending, T - G.
- *IS relation*: investment equals saving → $\bar{I} = S + (T - G)$ → Also equilibrium. What firms want to invest must be equal to what people and the government want to save.
- Thus two ways of stating the condition for equilibrium
    - Production = Demand
    - Investment = Saving
- Saving decision→ $S = Yd - C$ $S = Y - T - c_0 - c_1 (Y - T)$ $S = -c_0 + (1 - c_1)(Y - T)$
- *Marginal propensity to save* → $(1 - c_1)$ → how much of an additional unit of income people save.
- *Autonomous (dis)saving=-C0*
- equilibrium → $\bar{I} = -c_0 + (1 - c_1)(Y - T) + (T - G) \rightarrow$ $1/1-c_1[c_0 + \bar{I} + G - c_1T]$
- *Paradox of saving:* As people attempt to save more, the result is both a decline in output and unchanged saving, while people tell us that saving is good. (on the short run!)

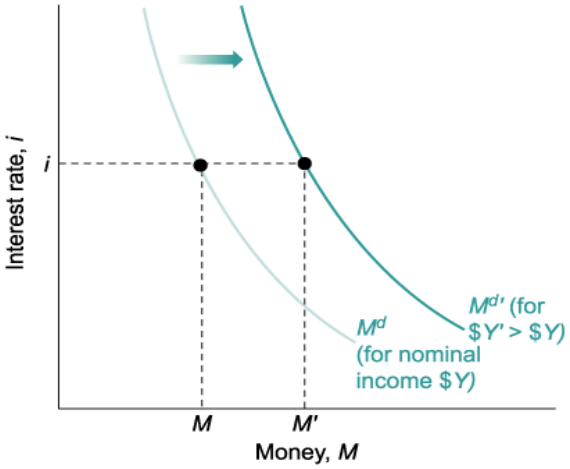
3.5 Is the government omnipotent? A warning

- The government cannot choose the level of output.
    - Changing government spending or taxes takes time (voting etc)
    - Investment is not a constant as assumed
    - Anticipation of consumers on changes are very important
    - Achieving high level of output can result in inflation
    - Cutting taxes or increasing gov. spending result in large budget deficits

Chapter 4: Financial markets

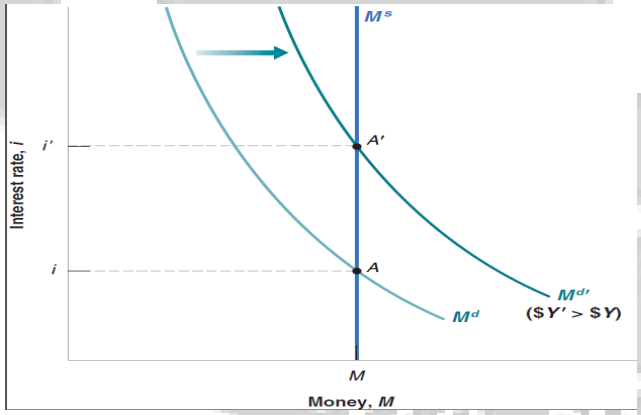
4.1 The demand for money

- = amount of assets that people are willing to hold as money (instead of as bonds).
    - You need money to buy goodsà increase demand for goodsà increase in money demand.
- Functions of money:
    - Medium of change
    - Unit of account
    - Store of value
- *Flow:* something expressed in units of time: weekly/monthly/yearly.
- *Stock*: variable, something at a given moment in time
- *Income:* is what you earn from working plus what you receive in interest and dividends. It is a flow.
- *Saving:* part of after-tax income that you do not spend. (also a flow)
- *Savings*: sometimes used as a synonym for wealth - the value of what you have accumulated over time. It is a stock.
- *(Financial) wealth*: is the value of all your financial assets minus all your financial liabilities (e.g. mortgage). It is a stock.
- *Investment:* purchase of new capital goods, from machines to plants to office buildings
- *Financial investment*: purchase of shares or other financial assets
- *Assets:*
    - *Money:* pays no interest, can be used for transactions
        - currency: coins and bills
        - deposit accounts
        - Sum of currency and deposits is called **M1**
    - *Bonds*: pay a positive interest rate *i* but cannot be used for transactions
    - Money does barely pay interest ratesà higher interest rates makes money in the form of bonds more attractive.
- Proportions of balance between setting your wealth in *Money* and *Bonds* depends on:
    - your level of transactions (how much money you will need for payments)
    - the interest rate on bonds (how much interest will you receive for bonds)
- *Money market (mutual) funds*: pool together funds of many people
- relation between demand for money, nominal income and interest rate
    - $M^d = €YL(i)$
      $(-)$
    - M^d → total demand for money
    - $€Y$ → nominal income
    - $L(i)$ → interest rate
    - (-) → interest rate has a negative relation with money demand (if i + → M^d -)

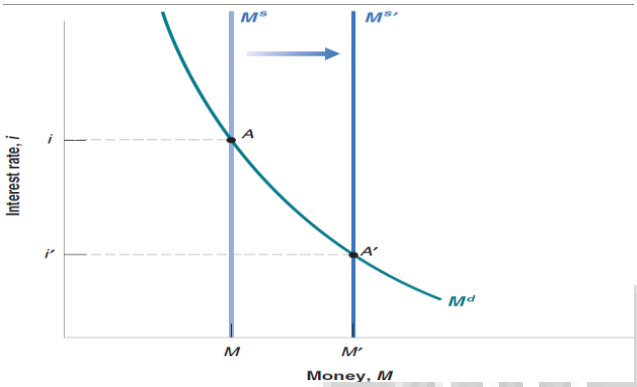


4.2 Determining the interest rate: Part I

- Equilibrium in financial markets require money supply equal to money demand → $M^s = M$
  - Money supply is given by the central bank.
- M = €YL(i)
  - *i* must be that, given a certain €*Y*, people are willing to hold money equal to money supply *M* → this is the ***LM* relation**. (L stands for liquidity, M for money)
- *Liquidity*: measure of how easily an asset can be exchanged for money. (money is fully liquid, assets are less)
- An increase in nominal income will lead to an increase in transactions, which increases the interest rate (the *i, M* curve will shift to the right) → an increase of *i* is needed to decrease the amount of money people want to hold to re-establish equilibrium. ($Y↑ à i↑)



- An increase in the supply of money by the central bank leads to a decrease in interest rate (in the *i, M* curve, the money supply vertical line shifts to the right) → the decrease in interest will increase the demand for money so it equals the now larger money supply. (M^s↑ à i↓)

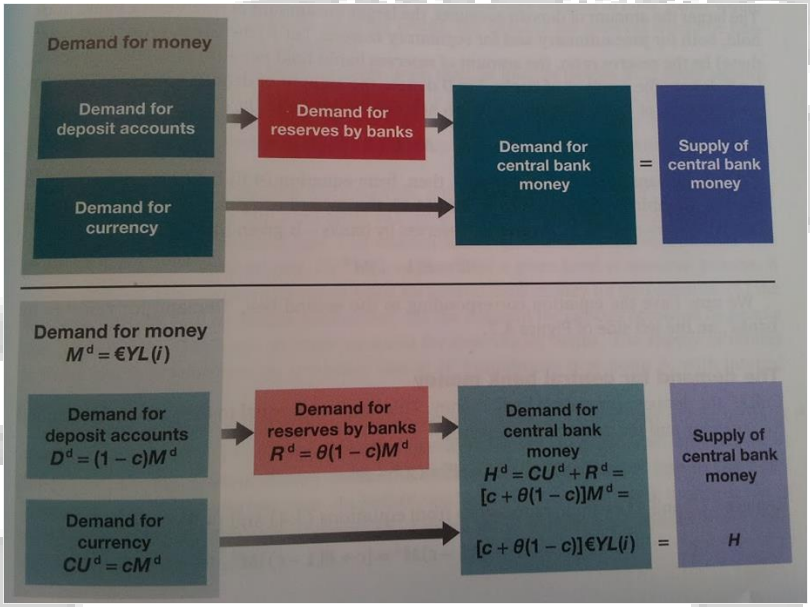


- The interest rate is determined by the equilibrium of the supply and the demand for money:
- The central banks change money supply by buying or selling bonds in the bond market
  → this is called <u>open market operations</u>
    - *Expansionary open market operation* : Increasing the amount of money: buy bonds, more money in the economy (the bank pays for the bondsà more demand for money). Interest rates decrease.
        - Individuals: Costs of holding money (i) ß à willingness to hold money Ý
    - *Contractionary open market operation* : Decreasing the amount of money: sell bonds, less money in the economy (the bank gets money for the bonds). Interest increases.
- *short term interest rate*: the rate directly controlled by the central bank
- The assets of the central bank are bonds. The liabilities are money.

4.3 Determining the interest rate: Part II

- (Interest rate of a bond is given by i = (€100 - €P_B) / €P_B → rewritten to €P_B = €100 / 1+i)
- *Financial intermediaries:* institutions which receive funds from people and firms, and use these funds to buy financial assets or to make loans to other people and firms. Assets: financial assets they own and the loans they have made. Liabilities: money (deposit accounts)
- Banks hold reserves for three reasons:
    - people may withdraw money, while people may deposit money, this may not be in equilibrium. Therefore, the bank has to keep some reserves
    - people write cheques to each other's bank accounts, also between different banks. Therefore, the bank has to have reserves.
    - special reserve requirements → <u>reserve ratio</u>
    - make loans
- *Narrow banking*: would restrict banks to holding liquids and safe government bonds. Thus, they are not allowed to provide loans. → to avoid bank runs
- *Deposit insurance:* the government insures each bank account up to a certain level.
- The demand for central bank money is equal to the demand for currency by people plus the demand for reserves by banks.

- The supply of central bank money is under the direct control of the central bank.
- The equilibrium interest rate is such that the demand and the supply for central bank money are equal.
- Overall money demand → M^d = €*YL(i)* *(-)*
- Demand for currency → $CU^d = cM^d$ → CU^d = demand for currency, c = fixed proportion being held in currency
- Demand for deposits → $D^d = (1\text{-}c)M^d$ → D^d = demand for deposits
- Demand for reserves by the banks → $R = \vartheta D$ → $R = \vartheta(1\text{-}c)M^d$
- Demand for central bank money→ $H^d = CU^d + R^d$ → [c+ ϑ(1-c)]€*YL(i)*



- Supply of the central bank money is equal to the demand of the central bank money

4.4 Two alternative ways of looking at the equilibrium

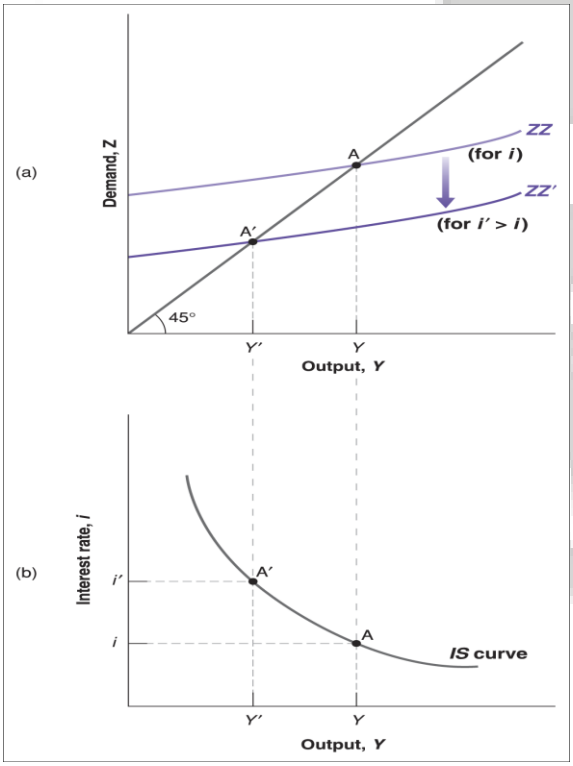
- The supply of reserves (R^d) is equal to the supply of central bank money (H) minus the demand for currency by the public (CU^d). → H - CU^d = R^d
- *Interbank market*: Foreign exchange market where banks exchange different currencies. The interbank market is an important segment of the foreign exchange market.
- Supply of money = demand for money 1/[c+ ϑ(1-c)]H = €*YL(i)*
- 1/[c+ ϑ(1-c) → this is called the money multiplier. The overall supply of money is therefore equal to central bank money multiplied by the money multiplier. E.g. is the mon. multipl. 4 then the overall supply of money is equal to four times the supply of central bank money.
- *High powered money:* also known as <u>monetary base</u> money supply depends on a 'base' the amount of central bank money in the economy
- What the bank doesn't have to keep in its reserves, it will buy bonds for instead.
- multiplier works as follows, seller 1 deposits €100 on Bank A.
  Bank A keeps 0.1 in reserves thus €10, the rest it buys bonds from Seller 2. (€90)
  Seller 2 deposits €90 to Bank B. Bank B keeps 0.1 in reserves thus €9, and with the rest it buys bonds from seller 3 (for €81).

So what is the eventual money supply? → €100 + €90 +€81 and so on….
Thus a result of successive rounds of purchases of bonds

Chapter 5: Goods and financial markets: the IS-LM model (Investment Saving–Liquidity Preference Money Supply)

5.1 The goods market and the *IS* relation

- Investment I not exogenous, but function of:
  - The level of sales (Y): If a company has high sales numbers, it will have the urge to expand (buy more machines, or additional plants). If low numbers then not. If Y increase, i increases.
  - The interest rate (i): If the firm must borrow then → the higher the interest rate the less attractive it is to borrow and buy the machine. If i increase, I decrease.
  - Multiplier: lower consumption, lower investments, lower output etc.
- *IS relation*: supply of goods is equal to demand for goods → tells how interest affects output → Y = C(Y - T) + I(Y, i) + G
- The relation between the interest rate and output is represented by the downward sloping curve. This curve is called the ***IS curve***.

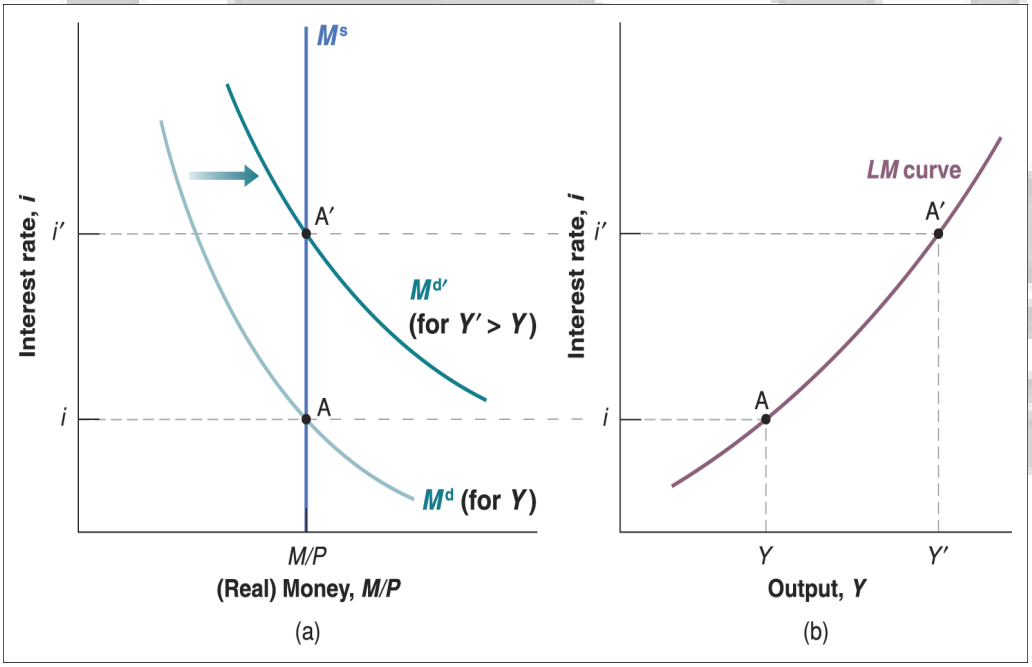


- Shifts of the IS curve

- Exogenous spending changes: Changes in the factors that decrease the demand for goods (e.g tax increase / decrease gov. spending), given the interest rate, shift the IS curve to the left. Changes in factors that increase the demands for goods (e.g. tax decrease, increase gov. spending), given the interest rate, shift the IS curve to the right
    - Factors that decrease exogenous spendingà IS curve shifts left.
    - Factors that increase exogenous spending: IS curve shifts right.
  - Changes regardless of the interest rates
- Shift along: change of Y because of a change in i.

5.2 Financial markets and the *LM* relation

- Interest rate is determined by the equilibrium of the supply and the demand for money
  M = €YL(i)
- nominal income divided by the price levels equals real income, Y. Dividing both sides by price level P → M / P = YL(i) → *LM* relation (P=$)
- income increasesà consumption/output increasesà money demand increasesàthe money supply is given. Thus, the interest rate must go up until the money demand equals the money supply.
  ➔ Equilibrium in financial markets imply that the higher the level of output, the higher the demand for money, and therefore the higher the equilibrium interest rate.
- The relation between output and interest rate is represented by the upward-sloping curve → the ***LM curve***.

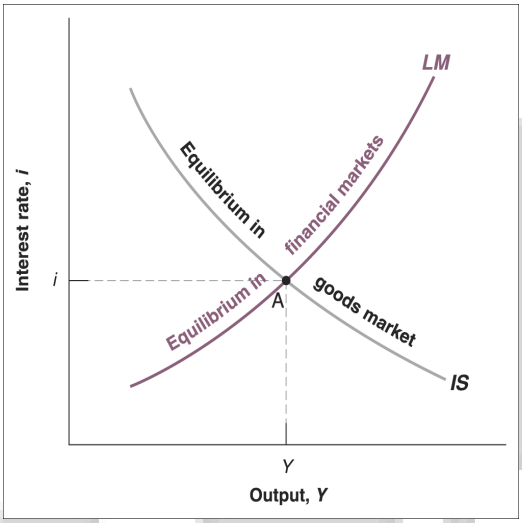


- Shifts along the LM curve
  - Y changesà I changes
- Shift of the curve:
  - Exogenous factors
  - In the short run only CB money supply.

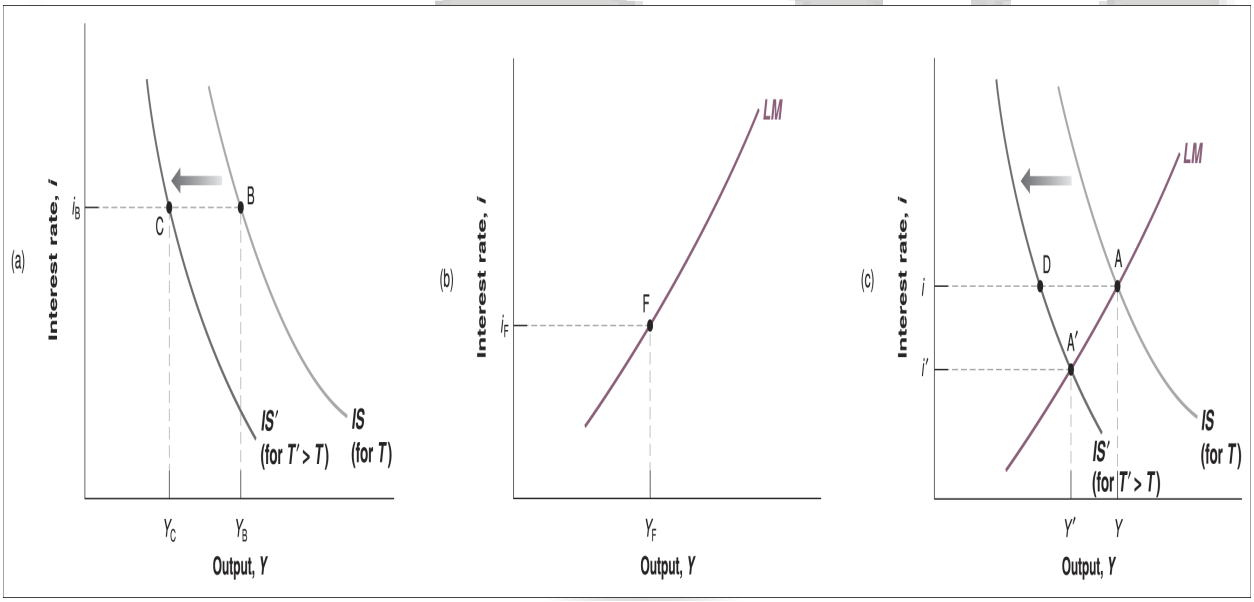
- In the short run P does not change.

5.3 Putting the *IS* and the *LM* relations together

- Goods and money markets are simultaneously in equilibrium at the intersection of the IS and LM curve.



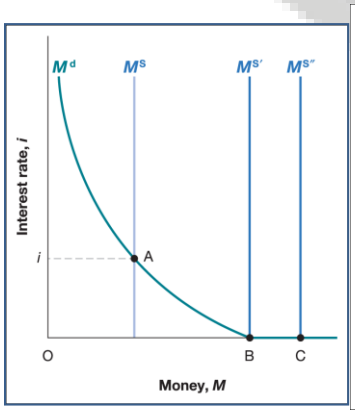
- *Fiscal policy*: the policy governments can do regarding taxes / spending.
  - *Fiscal contraction (or fiscal consolidation):* raise taxes, keep spending same → to lower the deficit
  - *Fiscal expansion:* lower taxes and/or raise spending → increasing the deficit

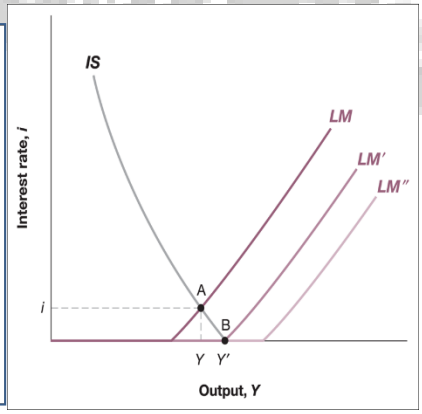


- Increase in taxes → lower disposable income → lower consumption → decrease in demand leads to decrease in output and income → decreases the demand for money → leading to decrease in interest rate. This does not completely offset the effect of higher taxes on the demand for goods. (lower interest rate leads to more investments)
- At any interest rate, higher taxes results in lower output → thus IS curve shifts to the left

- Y changesà i changes. There is a change in i because of a change in Yà shift along LM curve.
- However, investment depends on two factors
    - Sales (so lower consumption → lower sales → lower investments)
    - Interest rate (lower interest rate → investments go up)
    - ★ So if investments will increase or decrease depends also on sales.

- *Monetary policy:* The use of money stock by the central bank to affect interest rates and, by implication, economic activity and inflation
    - *Monetary expansion:* an increase in the money supply (increase in M)
    - *Monetary contraction* (*monetary tightening)*: a decrease in the money supply (decrease in M)
    - What happens when central bank increases M (With price level fixed on short run)
        - The LM curve shifts downwards, why? → given that income remains the same, and money supply increases → interest rate will decrease (more money has to go into circulation while income remains the same thus interest has to be low).
        - the LM curve shifts downwards while the equilibrium moves along the IS curve.
        - The increase in money leads to a lower interest rate. The lower interest rate leads to an increase in investment and in turn, to an increase in demand and output
        - Why does an increase in supply of money result in lower interest rates? Because interest rates can be seen as the price paid for money. When supply increases, but demands remains the same. The price (=interest) will go down.
    - There is a limit what the central bank can do (in monetary policy). It cannot decrease the interest rate below zero.
    - If interest rates equals zero → once people hold enough money, they will be indifferent about buying bonds or keeping their money. Both will give no interest.
    - <u>*Liquidity trap*</u>: People are willing to hold more money (more *liquidity*) at the same interest rate. (flat/horizontal LM curve in area of intersection with IS curve)
        - Consider when a case in which M^s is at a level where interest rate is already zero. If then the bank decides to increase the money supply to $M^{s'}$ it will have no effect on the interest rate. People are indifferent since both bonds as holding money results in nothing. → *expansionary monetary policy* becomes powerless.





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	Shift of IS	Shift of LM	Movement in output	Movement in interest rate
Increase in taxes	Left	None	Down	Down
Decrease in taxes	Right	None	Up	Up
Increase in spending	Right	None	Up	Up
Decrease in spending	Left	None	Down	Down
Increase in money	None	Down	Up	Down
Decrease in money	None	Up	Down	Up

5.6 How does the IS-LM model fit the facts?

- Economy does not move instantaneously therefore dynamics will be introduced
    - consumers are likely to take some time to adjust their consumption following a change in disposable income
    - firms are likely to take some time to adjust investment spending following a change in their sales
    - firms are likely to take some time to adjust investment spending following a change in the interest rate.
    - firms are likely to take some time to adjust production following a change in their sales.
- Time is needed to adjust to changes in fiscal and monetary policy

Chapter 8: The labour market

8.1 A tour of the labour market

- Until now we have only looked at the short run, but there are additional factors to consider in the medium run.
- *Labour force:* the sum of those either working or looking for work.
- *out of the labour force:* neither working in the marketplace nor looking for work.
- *Participation rate*: the ratio of the labour force to the population in working age (15 – 65)
- *Unemployment rate*: the ratio of the unemployed to the labour force
- a given unemployment rate may reflect two realities

    - many separations (workers who are leaving for another job or losing job) and many hires (workers newly employed by firms): active labour market
    - or a sclerotic labour market with few separations, few hires and a stagnant unemployment pool.
- *leavers*: workers leaving their jobs for a better alternative
- *layoffs*: are the effect of changes in employment levels across firms. some firms may see decrease in demands, others may see increase in demand → a high level of layoffs suggest a continual job destruction and job creation across firms.
- *discouraged workers*: not active job seekers, but they will take one if offered.
- *non-employment rate*: the ratio of working age population, minus employment, to population.
- *duration of unemployment*: the average length of time people spend unemployed.
- the average duration of unemployment equals the inverse of the proportion of unemployed leaving each month. (e.g if average duration of unemployment is 5 months, then at any given time 20% have been unemployed for 1 month, 20% for two months, 20% for three months etc… thus average duration of unemployment is 1/20% = 5)
- u = flows x duration
    - u = unemployment rate
    - flows = people losing job
    - duration = duration to find new job (often in months)

8.2 Wage determination

- *collective bargaining*: bargaining between a union (or a group of unions) and a firm (or a group of firms)
- wages determination is often based on two facts:
    - workers are typically paid a wage that exceeds their reservation wage: the wage that would make them indifferent between working and being unemployed.
    - wages typically depend on labour-market conditions. The lower the unemployment rate, the higher the wages
- Bargaining power of a worker depends on two factors:
    - how costly would it be for the firm to replace him/her, were he/she to leave the firm
    - how hard would it be for him/her to find another job, were he/she to leave the firm
- Efficiency wages → wages depends on both nature of the job and labour market conditions
    - firms - such as high-tech firms - that see employee morale and commitment as essential to the quality of their work will pay more than firms in sectors where workers' activities are more routine.
    - labour market conditions will affect the wage. a low unemployment rate makes it more attractive for employed workers to quit. When unemployment is low, it is easy to find another job. → when unemployment decreases, a firm that wants to avoid an increase in quits will have to increase wages to keep workers
- the aggregated nominal wage depends on three factors $W = P^eF(u, z)$
  $(-, +)$
- P^e = expected price level

- u = actual unemployment level
- z = a catchall variable, that stands for all other variables that may affect the outcome of wage setting.
- The expected price level:
    - why does this influence nominal wages(W) ? → because both workers and firms care about real wages, not nominal wages
    - workers do not care about how much euros they earn, but about how much goods (P) they can buy with that wage → W/P, the real wage
    - Firms also only care about W/P, the nominal wage (W) they pay relative to the price of goods they sell (P)
    - An increase in the expected price level leads to an increase in the nominal wage, in the same proportion.
    - Why does it depend on P^e, because wages are set in nominal terms, and when they are set, the relevant price level is not yet known
- The unemployment rate
    - an increase in the unemployment rate decreases nominal wages
- The other factors
    - an increase in z implies an increase in the wage
    - these factors include:
        - unemployment insurance: (more generous benefits will increase wages, in addition longer durative benefits will increase wages)
        - employment protection: (the higher the legal protection for workers, the more expensive it is for firms to lay off workers → likely leads to higher wages)
        - minimum wages set by law: an increase in minimum wage may increase the wages.

8.3 Price determination

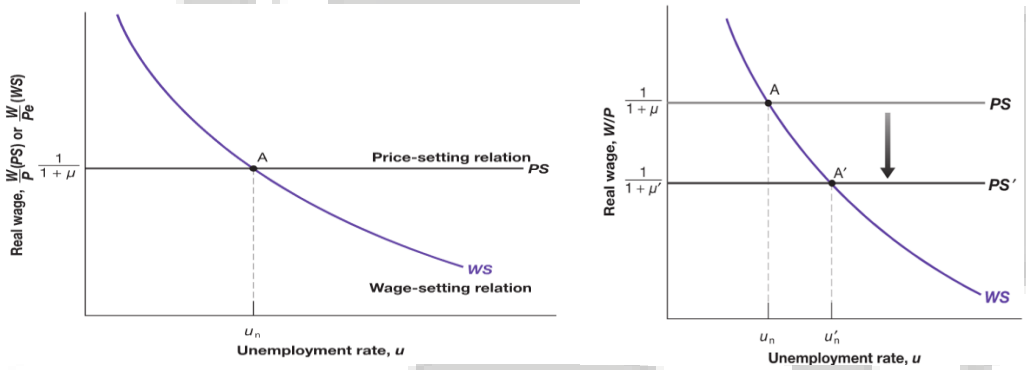
- prices set by firms depend on the costs they face
- these costs depend in turn on the nature of the production function
- when labour is the only factor of production → Y = AN
    - Y = output
    - A = labour productivity
    - N = employment
- → labour productivity = output per worker (here assumed to be constant and equal to A, e.g. if they double number of workers, they will double the amount of produced output)
- There is no perfect competition in the goods market → thus firms set prices higher than marginal costs → P = (1 + μ)W
    - μ = the mark-up of the price over the costs. (if perfect competition then μ = 0)
    - W = wages

8.4 The natural rate of unemployment

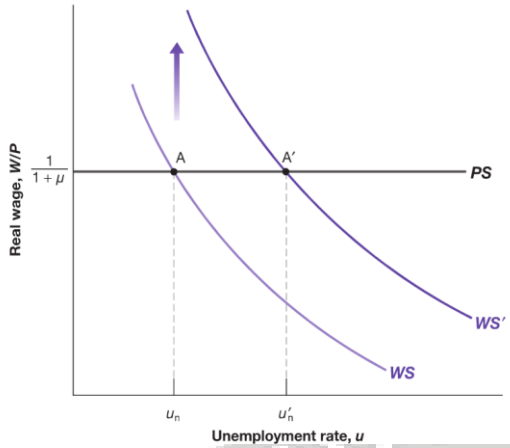
- Wage-setting relation

- $W = P^e F(u, z)$ → divide both sides by P^e → $W / P^e = F(u, z)$
- (-, +)
- wage-setting relation: the relation between the expected real wage and the rate of unemployment. Downward sloping curve: the higher the unemployment rate, the lower the expected real wage.

- Price-setting relation
  - if we divide the implications of price determination by the nominal wage then →
  - $P / W = 1 + \mu$ → invert both sides → $W / P = 1 / (1 + \mu)$
  - this indicates that price-setting decision determines the real wage paid by firms
  - if all firms increase the mark-up then your real wage decreases.
  - If your real wage decreases, it becomes more attractive to work, so u_n increases.
  -



- Equilibrium real wages and unemployment
  - equilibrium in the labour market = real wage expected by wage setting be equal to the effective real wage paid by firms. → the expected real wage and the effective real wage are equal when the expected price level is equal to the effective price level.
  - with $P^e = P$ → $F(u_n, z) = 1 / (1 + \mu)$
  - $u = u_n$ à $Y = Y_n$
  - u_n = the equilibrium unemployment rate that the expected real wage chosen in wage setting (left side of equation) is equal to the effective real wage implied by price setting (right side of equation)
  - u_n = the natural rate of unemployment
  - If the unemployment benefits increase → the reservation wage (the wage below which workers prefer to stay at home) increases and thus the nominal wage desired increases. The expected real wage turns out to be higher than the effective real wage. Thus the natural rate of unemployment has to increase to reach equilibrium again



- less stringent enforcement of existing anti-trust legislation (laws against monopoly and restriction of competition): an increase in mark-up μ → this decrease real wage firms are willing to pay → at initial equilibrium wage setters expect the real wage they were getting before, which now turns out to be higher than what firms are willing to pay. The new natural rate of unemployment has to go up to force workers to expect a comparatively lower wage.

- A better name for the equilibrium rate of unemployment would be the <u>structural rate of unemployment</u>
- From unemployment to employment
  - *Natural level of employment*: the level of employment that prevails when unemployment is equal to its natural rate.
  - u = U / L → L - N / L → 1 - N / L → N=L(1-u)
    - U = unemployment
    - L = labour force
    - N = employment
- From employment to output
  - *natural level of output*: the level of production when employment is equal to the natural level of employment
  - production function = Y = AN → replace with the N
    - $Y_n = AN_n = AL(1-u_n)$
  - using the relation between unemployment rate, employment and output →
    - $F(1- Y_n / AL , z) = 1 / 1 + \mu$
- The expected real wage targeted by wage setters is a decreasing function of the unemployment rate.
- The effective real wage firms are willing to pay is constant as the mark-up is constant, as implied by the price-setting relation.
- Equilibrium in the labour market requires that the expected real wage in wage setting be equal to the effective real wage. This determines the equilibrium unemployment rate.
- This equilibrium unemployment rate is known as the natural rate of unemployment.

- Associated with the natural rate of unemployment is a natural level of employment and a natural level of output.

8.5 Where we go from here

- In the short run, the factors that determine movements in output are the factors: Monetary policy, fiscal policy
- in the medium run, output tends to return to the natural level.

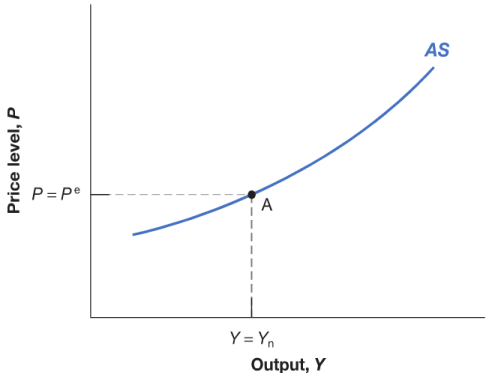
Chapter 9: Putting all markets together: The AS-AD model (aggregate supply-aggregate demand)

9.1 Aggregate supply

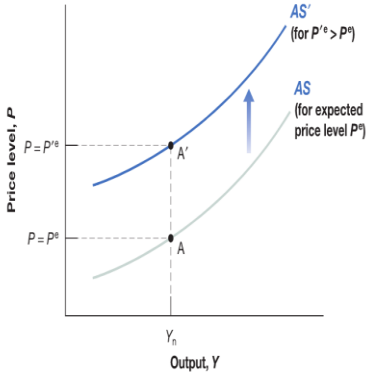
- *aggregate supply relation:* captures the effects of output on the price level.
- wage determination → $W = P^e F(u, z)$
  - W = nominal wage
  - P^e = expected price level
  - u = unemployment rate
  - z = catchall variable
- price determination → $P = (1 + \mu)W$
  - P = price set by firms (the price level)
  - W = wage
  - $1 + \mu$ = 1 plus the mark-up
- eliminating wage → $P = P^e(1 + \mu)F(u, z)$
- unemployment rate → $u = U / L \rightarrow$ $L - N / L \rightarrow$ $1 - N / L \rightarrow$ $u = 1 - Y / AL$
  - In words: for a given labour force, and a given productivity, the higher the output, the lower the unemployment rate.
- replacing unemployment rate → $P = P^e(1 + \mu)F(1 - Y/AL, z)$ → this is the <u>aggregate supply relation</u> or <u>AS relation</u>
  - P = price level
  - P^e = expected price level
  - Y = output
  - μ = mark-up
  - z = catchall variable
  - L = labour force
  - A = productivity
  - There are two important properties
    - given the expected price level, an increase in output leads to an increase in the price level.
      - An increase in output leads to an increase in employment

        - The increase in employment leads to a decrease in unemployment and therefore to a decrease in the unemployment rate.
        - The lower unemployment rate leads to an increase in the nominal wage
        - The increase in the nominal wage leads to an increase in the prices set by firms and therefore to an increase in the price level.
    - given unemployment, an increase in the expected price level leads, one-for-one, to an increase in the actual price level.
        - If wage setters expect the price level to be higher, they set a higher nominal wage
        - The increase in the nominal wage leads to an increase in costs, which leads to an increase in the prices set by firms and a higher price level.

- The AS curve
    - The aggregate supply curve is upward sloping → an increase in output Y leads to an increase in the price level P
    - The curve goes through point A, where $Y = Y_n$ and $P = P^e$ → when output Y is equal to the natural level of output of Y_n, the price level P turns out to be exactly equal to the price level P^e.
        - when output is above the natural level of output, the price level turns out to be higher than expected → a higher expected price level reduces the real wage workers expect to get and hence reduce the labour supply → with a lower employment N, output is also lower as Y = AN
    - An increase in the expected price level P^e shifts the aggregate supply curve up. Conversely, a decrease will shift the curve down
        - at a given level of output, and, correspondingly, at a given unemployment rate, the increase in the expected price level leads to an increase in wages, which leads in turn to an increase in prices.

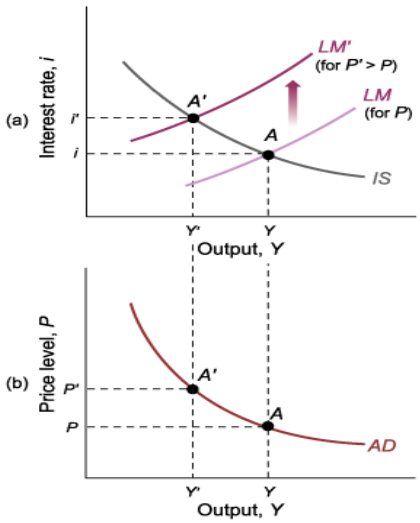


- Starting from wage determination and price determination in the labor market the aggregate supply relation is derived
- This relation implies that for a given expected price level, the price level is an increasing function of the level of output. It is represented by an upward-sloping curve, the aggregate supply curve.
- Increases in the expected price level shift the aggregate supply curve up, decreases in the expected price level shift the aggregate supply curve down.



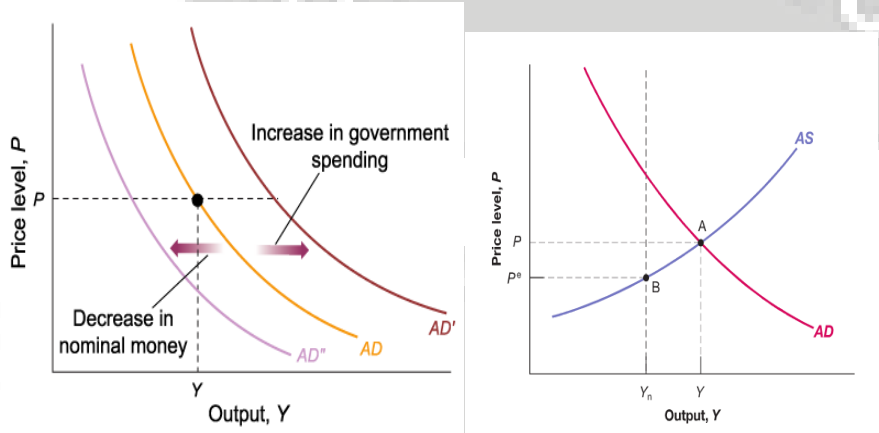
9.2 Aggregate demand

- *Aggregate demand relation*: the effect of the price level on output
- goods market equilibrium → Y = C(Y - T) + I(Y, i) + G → IS relation
- financial market equilibrium → M / P = YL(i) → LM relation
- IS curve → it is downward sloping, an increase in the interest rate leads to a decrease in output
- LM curve → it is upward sloping, an increase in output increases the demand for money, and the interest rate increases so as to maintain equality of money demand and the (unchanged) money supply.
- If price level increases → given stock nominal money M, real money stock decreases → LM curve shifts up (at given output, interest rate increases) → economy moves along IS curve to new equilibrium → interest rate increases and output decreases. In short, increase price level → decrease output
    - The increase in price levelà decrease real money supplyà increase interest ratesà LM curve shifts up.



- An increase in price levels leads to a decrease in output → <u>aggregate demand curve</u> (downward sloping curve AD)
- Y = Y (M/P, G, T)

- (+ , +, -)
  - Y = output
  - M/P = real money stock
  - G = government spending
  - T = taxes
- Starting from the equilibrium conditions for the goods and financial markets, we have derived the <u>aggregate demand relation</u>
- This relation implies that the level of output is a decreasing function of the price level. It is represented by a downward sloping curve, called the <u>aggregate demand curve</u>.
- Changes in monetary or fiscal policy - or any variable than the price level, that shifts the IS or the LM curves - shift the aggregate demand curve

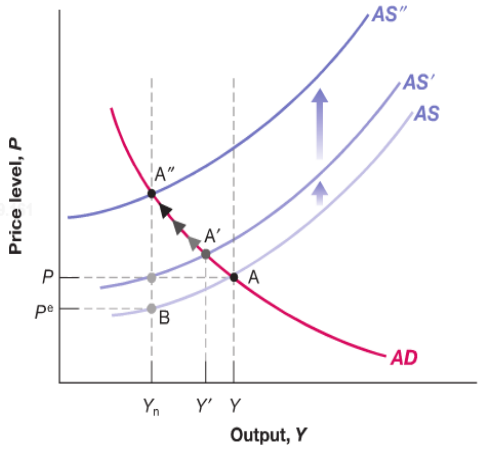


9.3 Equilibrium in the short and in the medium run

- Put the AS and AD relations together
  - AS relation → $P = P^e(1 + \mu)F(1 - Y/AL, z)$
  - AD relation → Y = Y (M/P, G, T)
- equilibrium in the short run, Y ≠ Yn
  - AS curve is upward sloping → the higher the level of output the higher the price level
  - AD curve is downward sloping → the higher the price level, the lower the level of output
  - The intersection between the AS and AD curve implies that there is equilibrium in the Labour market (AS curve), the Goods market (AD curve) and Financial market (AD curve).

- From the short to the medium run, Y = Yn
  - As long as output exceeds the natural level of output, the price level turns out to be higher than expected. This leads wage setters to revise their expectations of the price

level upwards, leading to an increase in the price level. The increase in the price level leads to a decrease in the real money stock, which leads to increase interest rate, which decreases output → this adjustment stops when
$Y = Y_n$



- In the short run, output can be above or below the natural level of output. Changes in any of the variables that either enter the AS-relation or the AD-relation lead to changes in output and to changes in the price level. → $Y \neq Y_n$
- In the medium run, output eventually returns to the natural level of output. This adjustment works through changes in the price level. When output is above the natural level of output, the price level increases. The higher price level decreases demand and output. When output is below the natural level of output, the price level decreases, increasing demand and output. → $Y = Y_n$

9.4 The effects of a monetary expansion

- The dynamics of adjustment
  - Aggregate demand → Y = Y(M/P, G, T)
  - for a given price level, if M increases → M/P increases → output Y increases → AD-curve shifts to the right
  - Over time the adjustment of price level expectations comes into play → As $Y > Y_n$ → price level higher than wage setters expected → they revise their expectations which causes the AS-curve to shift up over time → economy moves up along the AD-curve. This adjustment stops when $Y = Y_n$, at which price level = expected price level.
  - Thus if nominal money increases, then on the medium run the price level ends up higher. → if M/P is unchanged, M and P each increases in the same proportion
- How does the IS-LM model change
  - on the short run monetary expansion shifts LM curve down (lower interest rate, and higher output. However there is a small offset, partly due to increase in price level)
    - Without price level change, an increase in nominal money shifts the LM curve downwards

        - However, since the price level does increase, this offsets the downward shift partially.
- In the short run, a monetary expansion leads to an increase in output, a decrease in the interest rate and an increase in the price level.
- Over time, the price level increases, and the effect of the monetary expansion on output and on the interest rate disappear. In the medium run, the increase in nominal money is reflected entirely in a proportional increase in the price level. → the increase in nominal money has no effect on output or on the interest rate.
- The neutrality of money (The proposition that an increase in nominal money has no effect on output or the interest rate, but is reflected entirely in a proportional increase in the price level)
- Expansionary monetary policy could still help → e.g. move an economy out of a recession. But it cannot sustain higher output forever

9.5 A decrease in the budget deficit

- Fiscal contraction → running a budget deficit
    - e.g government wants to reduce budget deficit → Lowers G, while keeping T unchanged. → AD curve shifts to the left → for a given price level, output is lower → in the short run output decreases and price level decreases
    - So the lower spending triggers lower output
    - Over time: → since $Y < Y_n$ then AS-curve keeps shifting down. → the economy moves down along the AD-curve until equilibrium is reached and $Y = Y_n$.
- Like an increase in nominal money, a reduction in the budget deficit does not affect output forever.
    - But there is a change between nominal money ↑ and budget deficit ↓, because now with the reduced budget deficit the price level and interest rate are lower than before.
- Deficit reduction, output and interest rate
    - As government reduces budget deficit, IS-curve shifts to the left. If price level would not change the shift would be bigger. But, because price level declines in response to decrease in output, real money stock increases, leading to partially offsetting shift of the LM curve → Both output and the interest rate are lower than before the fiscal contraction
      As long as $Y < Y_n$ the price level continues to decline, leading to further increase real money stock. → LM-curve continues to shift down → eventually $Y = Y_n$.
      Now the interest rate is lower than before the budget deficit reduction.
      In addition, the composition of output is different → $Y_n = C(Y_n - T) + I(Y_n, i) + G$
      Because income Y_n, T and C are unchanged. And G is lower, then i should be increased.
      Thus, in the medium run, a reduction in budget deficit unambiguously leads to a decrease in the interest rate and an increase in investment.
- In the short run, a budget deficit reduction - if implemented alone -, thus without change in monetary policy, leads to a decrease in output and may lead to a decrease in investment.
  → Y decreases, I increases or decreases

- In the medium run, output returns to the natural level of output, and the interest rate is lower. In the medium run, a deficit reduction leads unambiguously to an increase in investment. → Y unchanged, I increases

9.6 An increase in the price of oil

- *stagflation*: a sharp recession and a large increase in inflation
- Introduction of other production than labour, namely energy.
- If price of oil increases → increase in μ mark-up → lower real wage implied by price setting. → natural unemployment rate increases. getting workers to accept the lower real wage requires an increase in unemployment. → decrease in natural level of employment → decrease in natural level of output.
    - Thus an increase in the price of oil leads to a decrease in the natural level of output.
- On the short run → AS-relation $P = P^e(1 + \mu)F(1 - Y/AL, z)$
    - given P^e, increase of the price of oil → firms increase prices → increase in price level P, at any level of output Y. The AS-curve shifts up.
- The AD-relation does not change, high oil prices may shift investment plans (cancels projects or more energy saving ones)

9.7 Conclusion

- Changes in policy have different effects in the short and the long run

		Short run			**Medium run**	
	Output level	Interest rate	Price level	Output level	Interest rate	Price level
Monetary expansion	Increase	Decrease	Increase (small)	No change	No change	Increase
Deficit reduction	Decrease	Decrease	Decrease (small)	No change	Decrease	Decrease
Increase in oil price	Decrease	Increase	Increase	Decrease	Increase	Increase

- *Output fluctuations (business cycles):* movements in output around its trends
- *Shocks*: sudden changes in the economy.
    - each shock has dynamic effects on output and components → propagation mechanism

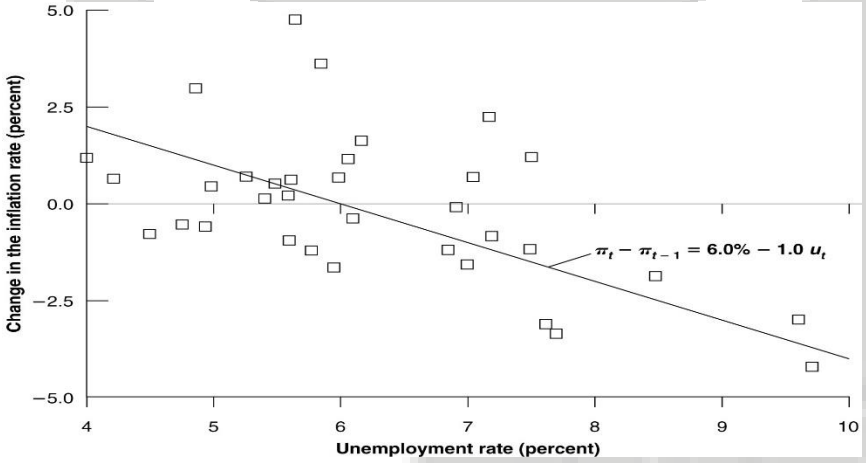
Chapter 10: The Phillips curve, the natural rate of unemployment and inflation

10.1 Inflation, expected inflation and unemployment

- Aggregate supply relation: $P = P^e(1 + \mu)F(u, z)$
  - F = effect on the wage of the unemployment rate u
  - z = catchall variable
- Special function for F → $F(u, z) = 1 - \alpha u + z$
  - higher the unemployment rate, the lower the wage, the higher the z (e.g more generous benefits) the higher the wage.
  - α denotes the strength of the effect of the unemployment rate.
- Replace F in the AS-relation with the function for F
  - $P = P^e(1 + \mu)(1 - \alpha u + z)$
- Let π denote the inflation rate, and π^e the expected inflation rate. Then →
  - $\pi = \pi^e + (\mu + z) - \alpha u$
  - an increase in π^e leads to an increase in the actual inflation π
  - an increase in mark-up μ or z leads to an increase in π
  - an increase in actual unemployment rate u leads to a decrease in π
  - an increase in α leads to a decrease in π
- To include time indexes in the equation → $\pi_t = \pi^e_t + (\mu + z) - \alpha u_t$

10.2 The Phillips curve

- *Original Phillips curve:* relation between unemployment and inflation → when unemployment is low inflation is high, and vice versa, when unemployment is high inflation is low.



- Assume expected inflation equals 0 ($\pi^e_t = 0$) , then → $\pi_t = (\mu + z) - \alpha u_t$
  - this is exactly the Phillips curve that was found.
  - given the expected price level, lower unemployment leads to a higher nominal wage. A higher nominal wage leads to a higher price level
  - lower unemployment leads to a higher price level this year relative to last year's price level → to higher inflation
- *Wage price spiral:*
  - low unemployment leads to a higher nominal wage

- → in response firms increase their price → price level increases
- → then workers ask for a higher nominal wage, the next time the wage is set
- → higher nominal wage leads to further price increase by firms → price level increases
- → this results in a further increase in nominal wage the next time
- → and so on and so on, the race between prices and wags result in a steady wage and price inflation

- Why did the original Phillips curve vanish?
  - High increase of oil price → results in higher mark-up μ. This resulted in an increase in inflation given the current level of unemployment
  - Wage setters changed the way they formed their expectations. After the 1960 inflations became more stable and persistent, this changed the expectation formation.
    - suppose expectations are equal to $\pi^e_t = \theta\pi_{t-1}$
      - θ = the effect of last year's inflation rate on this year's expectation inflation rate π^e_t
    - the higher the value of θ, the more last year's rate will have influence → higher the π^e_t will become
    - As long as inflation was low and not very persistent, past inflation was ignored and thus price $level_{t-1}$ = price $level_t$ → thus $\theta \approx 0$ and $\pi^e_t = 0$
    - but as inflation became more persistent $\theta > 0$ → last year's inflation became more influential → $\theta \approx 1$
  - applying in the equation $\pi_t = \theta\pi_{t-1} + (\mu + z) - \alpha u_t$
  - with $\theta \approx 0$ → $\pi_t = (\mu + z) - \alpha u_t$ → the original Phillips curve
  - with $\theta > 0$ → $\pi_t = \theta\pi_{t-1} + (\mu + z) - \alpha u_t$
  - with $\theta \approx 1$ → $\pi_t - \pi_{t-1} = (\mu + z) - \alpha u_t$ → expectations-augmented P-curve
    - if $\theta \approx 1$ then unemployment affects the change in the inflation rate → high unemployment leads to decreasing inflation, low unemployment leads to increasing inflation.
  - original Phillips curve: increase in u_t → lower inflation
  - (modified) Phillips curve: increase in u_t → decreasing inflation
- the original Phillips curve implied that there was no such thing as a natural unemployment rate → if policy makers tolerate high inflation, they could keep low unemployment rate forever
  - however, would wage setters always underpredict inflation? No
  - the unemployment rate could not be maintained below a certain level → the natural rate of unemployment
  - <u>natural rate of unemployment</u> u_n: unemployment rate that the actual price level is equal to the expected price level → or that the actual inflation rate is equal to the expected inflation rate.
    - then → $0 = (\mu + z) - \alpha u_n$
    - → $u_n = \mu + z / \alpha$
    - the higher the mark-up μ or the higher z, → higher natural rate of unemployment
  - → $\pi_t - \pi^e_t = -\alpha(u_t - \mu + z / \alpha)$ note that the last part $(\mu + z / \alpha)$ equals u_n

- → $\pi_t - \pi^e_t = -\alpha(u_t - u_n)$ if we change it to the last year's inflation rate
- → $\pi_t - \pi_{t-1} = -\alpha(u_t - u_n)$
  - gives another way of thinking about the Phillips curve, as a relation between actual unemployment rate u_t, natural unemployment rate u_n and the change in inflation rate $\pi_t - \pi_{t-1}$.
  - $u_t < u_n = \pi_t > \pi_{t-1}$
  - $u_t > u_n = \pi_t < \pi_{t-1}$
  - gives another way of thinking about the natural unemployment rate: the natural rate of unemployment is the rate of unemployment required to keep the inflation rate constant. Therefore it is also called the non-accelerating inflation rate of unemployment (NAIRU).

- The neutrality of money, revisited
  - the effect of change in nominal money on output and price level in the medium run
    - output returned to its natural level, unaffected by the level of nominal money
    - the price level moved in proportion to the nominal money stock, leaving the real money stock unchanged.
  - in the medium run expected inflation = actual inflation → thus the unemployment rate = the natural rate
  - aggregate demand relation → $Y = Y(M/P, G, T)$
  - If unemployment returns to the natural rate u_n. then → Y must return to Y_n thus
    - $Y_n = Y(M/P, G, T)$
  - If Y_n is constant, for this equality to hold, the aggregate demand has to be kept constant → thus if unchanged fiscal policy is assumed (G, T constant) then → real money stock M/P should be constant.
  - → <u>This implies that rate of inflation must be equal to the rate of money growth</u>
    - $\pi = g_m$
  - Thus in the medium run, the rate of inflation is determined by the rate of money growth. Thus while strikes, fiscal deficits, increases in price oil will increase inflation in the short run, it will not (<u>unless they affect the rate of money growth</u>) have no effect on inflation in the medium run.

10.3 The Phillips curve and the natural rate of unemployment in Europe.

- Why does the natural rate of unemployment differ between countries? It depends on
  - labour market institutions: factors (z) that affect workers bargaining power
  - price-setting side: the mark-up (u) set by firms
  - the effect of unemployment on the wage (a)
- Labour market rigidities
  - a generous system of ***unemployment insurance***: the <u>replacement rate</u> (ratio of unemployment benefits after-tax wage) is often high, and the duration of benefits are long, often in years → high unemployment insurance, reduces incentives to find new jobs, and increases wages firms have to pay (higher benefits, leads to higher <u>reservation</u>

wage: (the wage that would make them indifferent between working and being unemployed)
    - high degree of ***employment protection***: rules that increase layoffs for firms: from high severance payments (to lay off workers) to the possibility for workers to appeal in court. → this increases costs of labour
    - ***minimum wages***: high minimum wages run the risk of decreasing employment for the least skilled workers → thus increasing unemployment rate
    - ***bargaining rule*** - strong bargaining power induced by unions may result in higher unemployment → higher unemployment is needed to reconcile the demands of workers with the wages paid by firms
    - High forms of social protection gives bargaining power to the workers → higher normal wage (W) at a given expected price level (P^e), for any given unemployment rate. → countries with higher social protection have higher natural rates of unemployment for any given price setting by firms.
    - → generous social protection is consistent with low unemployment, but it has to be provided efficiently. → unemployed should be forced to take jobs if such jobs are available.
    - Creating incentives for the unemployed to take jobs and simplifying the rules of employment protection are on the reform agenda of many EU countries.
- Product market regulation
    - unemployment depends on mark-up (μ)
    - mark-up depending on the degree of competition in the goods market.
    - → higher the degree of competition, lower the mark-up and, vice versa, lower degree of competition, higher the mark-up
    - also mark-up depends on degree of regulations on goods market. High regulation → more trade barriers → lower degree of competition → high mark-up level
    - Lower mark-up → increase in real wages + a decrease in unemployment
    - Lower product market regulation → higher real wages → and lower level of natural rates of unemployment
- variations in the natural rate over time
    - μ + z are not constant, they could change because of
        - degree of monopoly of the firm
        - structure of wage bargaining
        - system of unemployment benefits
    - changes are hard to measure, since you only can measure the actual rate u_t
- Disinflation, credibility and unemployment
    - fighting inflation implied tightening monetary policy, decreasing output growth, and higher unemployment for some time.
    - *Deflation:* decrease in the price level (equivalently, negative inflation)
    - *Disinflation:* a decrease in the inflation rate.
    - $\pi_t - \pi_{t-1} = -\alpha(u_t - u_n)$ → implies that only way to bring down inflation is to accept unemployment level > natural rate of unemployment

- disinflation might be much less costly
    - *Lucas critique*: to predict policy changes, taking relations from past data may be very misleading
    - what if wage setters take policy changes into consideration when setting wages? → if the policy pursued would induce inflation reduction, they could reduce their expected inflation when setting wages.
    - This really depends on the ***credibility*** (the belief by wage setters that the central bank was truly committed to reducing inflation. This could change the expectations) of the policy pursued by the government.
    - The behaviour of inflation depends very much on how people and firms form expectations

- High inflation and the Phillips curve relation
    - The relation between unemployment and inflation is likely to change with the level and the persistence of inflation.
    - When inflation rate becomes high, it also becomes more variable. → workers and firms become more reluctant to set contracts with long term nominal wages → if wages turns out higher than expected, real wages may plunge. If inflation turns out lower than expected, real wages may go up sharply and firms may no longer able to afford it.
    - Solutions:
        - nominal wages are set for shorter period of time
        - <u>wage indexation</u>: a provision that automatically increases wage in line with inflation
    - These solutions lead in turn to a stronger response of inflation to unemployment
    - Imagine two labour contracts in an economy
        - $\pi_t = [\lambda\pi_t + (1 - \lambda)\, \pi^e_t] - \alpha(u_t - u_n)$
            - λ = proportion labour contracts indexed
            - $\lambda\pi$ = proportion that responds to actual inflation
            - $(1 - \lambda)\, \pi^e_t$ = proportion that responds to expected inflation
    - if we assume $\pi^e_t = \pi_{t-1}$
        - $\pi_t = [\lambda\pi_t + (1 - \lambda)\, \pi_{t-1}] - \alpha(u_t - u_n)$
    - when $\lambda = 0$, all wages are set on the basis of expected inflation
        - $\pi_t - \pi_{t-1} = -\alpha(u_t - u_n)$
    - when $\lambda > 0$, a proportion of wages is set on the basis of actual inflation, and divide both sides by $(1-\lambda)$ to get
        - $\pi_t - \pi_{t-1} = -(\alpha / (1-\lambda))\, (u_t - u_n)$
    - Wage indexation increases the effect of unemployment on inflation
    - The higher the proportion of wage contracts that are indexed (higher λ) the larger the effect of unemployment rate on the change in inflation and the higher the coefficient $\alpha / (1-\lambda)$. → if λ is large then $1-\lambda \approx 0$ → $0 < \alpha < \infty$
    - Without wage indexation, lower unemployment increases wages, which in turn increase prices. But because wages do not respond to prices right away, there is no further increase in prices within the year.

    - With wage indexation, an increase in prices leads to a further increase in wages within the year, which leads to a further increase in prices, and so on → so the effect of unemployment on inflation within the year is higher.
- Deflation and the Phillips curve relation
    - At very low or negative rates of inflation, the Phillips curve relation becomes weaker.
    - During the great depression the actual rate of unemployment increased rather than the natural rate of unemployment
    - One reason might be the reluctance of workers to accept decreases in their nominal wages. Workers will unwittingly accept a cut in their real, when nominal wages increase more slowly than inflation.
      → if this is correct it implies that the Phillips curve relation between the change in inflation and unemployment may disappear or at least become weaker when the economy is close to zero

Chapter 13: The facts of growth

13.1 Measuring the standard of living

- *Growth*: the steady increase in aggregate output over time
- *Output per person (or output per capita)*: income per person, standard of living
- how to compare living standards, not with income and exchange rates
    - exchange rates can vary a lot, while living standards do not change
    - each country has its own GDP needed to live (in India less money is needed to buy the same goods as in the UK)
    - → solution: the numbers for GDP - and GDP per person - are constructed using a common set of price for all countries → **purchasing power parity, PPP numbers**
    - use purchasing power parity to compare standard of living across countries
- What matters for people's welfare is their consumption rather than their outcome
- Some think in differences in productivity, then output per hour is better
- We care about the standard of living because we care about happiness

13.2 Growth in rich countries since 1950

- There has been a large increase in output per person.
- There has been convergence of output per person across countries.
- Large increase in the standard of living
    - force of compounding - with a high growth rate, a small saving will result in a large amount over a long time e.g. 1% growth per year → 48% growth in 40 years.
- The convergence of output per person
    - the numbers for output per person are much more comparable now between countries. Countries who were behind grow faster and they close the gap: convergence.

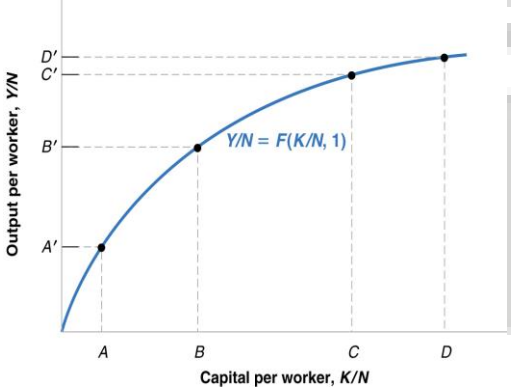
13.3 A broader look across time and space

- *Malthusian trap*: unable to increase its output per person. Each innovation led to an improvement of life expectancy → the population kept on growing thus no increase in GDP per person.
- Neither growth nor convergence are a historical necessity
- Most of the countries with very high growth rates are in Asia. In 1950 there were the four tigers: Singapore, Taiwan, Hong Kong and South Korea.
- Africa is struggling with development, but the two fastest growing countries are Botswana (diamonds) and Guinea (oil).

13.4 Thinking about growth: a primer

- *Aggregate production function*: a specification of the relation between aggregate output and the inputs in production.
    - Y = F(K, N)
    - Y = aggregate output
    - K = capital (the sum of all the machines, plants and office buildings
    - N = labour (the numbers of workers in the economy)
    - F = how much output is produced for given quantities of capital and labour
- The function F depends on the stage of technology → the higher the state of technology, the higher F(K, N) for a given K and N

- *Constant returns to scale:* if the scale of operations is doubled - that is, the quationaties of capital and labour are doubled - then output will also double.
    - 2Y = F(2K, 2N) or → xY = F(xK, xN)
- *Decreasing returns to capital*: given labour, increases in capital lead to smaller and smaller increases in output.
    - Shift of the curve: technological progress
    - Shift along the curve: capital accumulation.



- *Decreasing returns to labour*: given capital, increases in labour lead to smaller and smaller increases in output.
- → set x = 1/N in equation → Y/N = F(K/N, N/N) = F(K/N, 1)
    - Y/N = output per worker
    - K/N = capital per worker

- Increases in capital per worker lead to smaller and smaller increases in output per worker as the level of capital per worker increases. There is a upward-sloping curve: as K/N increases, Y/N increases.

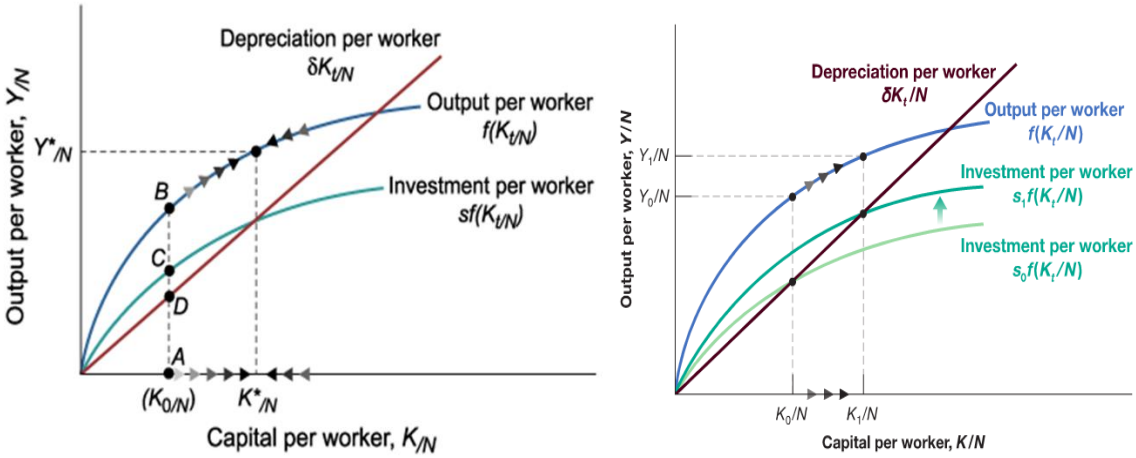
- The sources of growth - why does output per worker goes up over time?
    - Increases in output per worker (Y/N) can come from increase in capital per worker (K/N) → capital accumulation
    - Improvements in the state of technology: shifts (up) of the production function → technological process
    - Capital accumulation by itself cannot sustain growth → because of decreasing returns to capital sustaining a growth will require larger and larger increase in the level of capital per worker.
    - *Saving rate*: the proportion of income that is saved
        - a higher saving rate can sustain a higher level of output
    - sustained growth requires sustained technological progress. → in the long run an economy that sustains a higher rate of technological progress will eventually overtake all other economies.

Chapter 14: Saving, capital accumulation and output

14.1 interactions between output and capital

- *Saving rate*: the ratio of saving to GDP
- At the center of determination of output in the long run are two relations between output and capital.
    - the amount of capital determines the amount of output being produced.
    - the amount of output determines the amount of saving, and in turn, the amount of capital being accumulated over time
- The effects of capital on output
    - relation output and capital per worker → $Y/N = F(K/N, 1)$
        - with increase in capital per worker on output per worker decreases as the ratio of capital per worker gets larger
        - when capital per worker is already high, further increases only have small effect
    - Simplification → $f(K/N) = F(K / N, 1)$ → $Y/N = f(K/N)$
    - Two additional assumption will be made
        - First: the size of the population, the participation rate and the unemployment rate are constant, this implies that N is also constant
        - → the labour force is equal to population times participation rate. So if population is constant → and the participation rate is constant → the labour force is constant

        - → employment is equal to the labour force times one minus unemployment rate. So if labour force is constant, and the unemployment rate is constant then employment is constant
        - Second: there is no technological progress, so the production function f (or equivalently, F) does not change over time
    - These assumptions are necessary to focus on the capital accumulation solely.
        - relation between output and capital per worker from the production side → $Y_t / N = f(K_t/N)$
        - in words: higher capital per worker leads to higher output per worker.
- The effects of output on the capital accumulation
- Output and investment
    - We continue that the economy is closed → investment equals saving
      → $I = S + (T - G)$
    - we assume public saving $T - G = 0$ → $I = S$
    - we assume that private saving is proportional to income, so → $S = sY$
        - s = the saving rate (value between 0 and 1)
    - combining these two relation and time indexes → $I_t = sY_t$
      → investment is proportional to output: the higher the output, the higher the saving and thus the investment
- Investment and capital accumulation
    - investment = the new machines produced and plants built
    - capital = the current stock, existing machines and plants
    - evolution of capital stock → $K_{t+1} = (1 - \delta) K_t + I_t$
        - K_{t+1} = capital stock at the beginning of year t + 1
        - δ = capital depreciating parameter (capital that becomes useless)
    - combine relation between output and investment, and the relation between investment and capital accumulation. And dividing both sides by N
      → $K_{t+1} / N = (1 - \delta) K_t/N + s (Y_t / N)$
    - in words: capital per worker at the beginning of year t + 1 is equal to capital per worker at the beginning of year t, adjusted for depreciation, plus investment per worker during year t, which is equal to the saving rate times output per worker during year t.
    - after expanding and reorganizing the terms → $K_{t+1}/N - K_t/N = s(Y_t/N) - \delta(K_t/N)$
    - in words: change in the capital stock per worker (left terms), is equal to saving per worker (first right term) minus depreciation (second right term)
    - From the saving side: the level of output per worker determines the change in the level of capital per worker over time



14.2 The implications of alternative saving rates

- from the production side → capital determines output
- from the saving side → output determines capital accumulation
- Dynamics of capital and output (s = saving rate)
    - replacing output per worker (Y_t/N) by capital per worker gives
      $K_{t+1}/N - K_t/N = sf(K_t/N) - \delta(K_t/N)$
      Change in capital Investment Depreciation
    - If investment per worker > depreciation, the change in capital per worker is positive
    - if investment per worker < depreciation, the change in capital per worker is negative
- When capital per worker is low, capital per worker and output per worker increases over time.
- When capital per worker is high, capital per worker and output per worker decrease over time.
- Evolution of capital per worker → first low capital per worker thus investment > depreciation → capital per worker increases. And because output moves with capital, output per worker increases. → Ultimately capital per worker will reach the level where investment = depreciation → thus capital per worker remains constant as output → equilibrium on the long run.
- Steady-state capital and output
    - *Steady state*: state where output per worker and capital per worker is constant
    - steady state is given by → $sf(K^*/N) = \delta(K^*/N)$
        - amount of saving is enough to cover depreciation
    - steady state value of output per worker → $Y^*/N = f(K^*/N)$
- The saving rate and output. How does saving rate affect the growth of output per worker?
    - the saving rate has no effect on the long-run growth rate of output per worker
    - the saving rate determines the level of output per worker in the long run
    - an increase in the saving rate will to higher growth of output per worker for some time, but not forever. Increase in the saving rate will reach the point where investment is equal to depreciation and the growth ends.
- The saving rate and consumption
    - recall: saving is the sum of private plus public saving. Public saving <-> budget surplus; public dissaving <-> budget deficit
    - Governments can affect saving rate

        - they can vary public saving (budget surplus / budget deficit)
        - they can use taxes to affect private saving (e.g. give tax breaks to people who save)
    - what matters to people is not how much is produced, but how much they consume
    - Does an increase in saving lead to an increase in consumption in the long run? Not necessarily
        - a saving rate = 0 → low level of output → consumption = 0 in the long run
        - when saving rate = 1 → level of capital is high → thus output is high. But since everyone saves their income, consumption = 0
    - *Golden-rule level of capital:* the level of capital associated with the value of the saving rate that yields the highest level of consumption in steady state.

14.3 Getting a sense of magnitudes

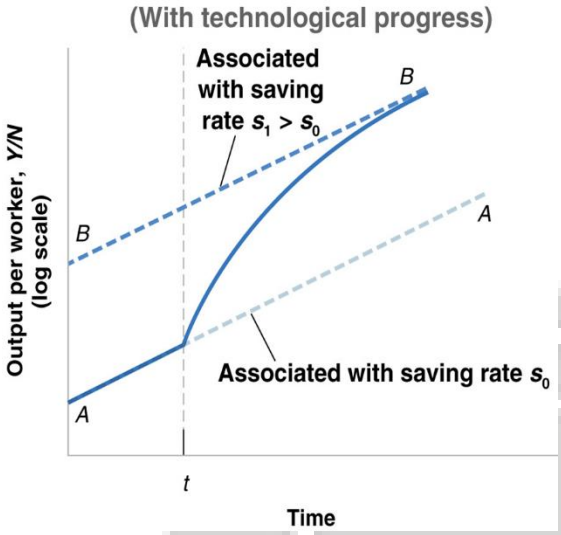
- assume production function
    - $Y = \sqrt{K}\sqrt{N}$
    - dividing both sides by N we get (to get per worker)
    - $Y / N = (\sqrt{K}\sqrt{N}) / N = \sqrt{K} / \sqrt{N} = \sqrt{(K/N)}$
    - the production function f, relating output per worker to capital per worker is
    - $\rightarrow f(K_t/N) = \sqrt{(K_t/N)}$
    - replacing $f(K_t/N)$ with $\sqrt{(K_t/N)} \rightarrow (K_{t+1}/ N) - (K_t / N) = s\sqrt{(K_t/N)} - \delta(K_t/N)$
    - this equation describes the evolution of capital per worker over time
- The effects of the saving rate on steady-state output
    - In steady state the amount of capital per worker is constant, this implies $s\sqrt{(K^*/N)} = \delta(K^*/N)$ → * means looking at steady state
    - square both sides → $s^2(K^*/N) = \delta^2(K^*/N)^2$
    - divide both sides by K/N and reorganize → $K^*/N = (s/\delta)^2$
    - steady state capital per worker is equal to the square of the ratio of the saving rate to the depreciation rate
    - steady state output per worker is given by → $Y^*/N = \sqrt{(K^*/N)} = \sqrt{(s/\delta)^2} = s/\delta$
    - steady state output per worker is equal to the ratio of the saving rate ot the depreciation rate
    - Steady state capital per worker → $K^*/N = (s/\delta)^2$
    - Steady state output per worker → $Y^*/N = s/\delta$
- The increase in saving rate increases the growth rate of output per worker for a long time. → They have no effect on growth in the long term, they lead to higher growth for a long time
- The saving rate and the golden rule
    - in steady state, consumption is equal to what is left after enough is put aside to maintain a constant level of capital → consumption per worker is equal to output per worker minus depreciation per worker
      $C / N = Y / N - \delta(K/N)$
    - using the formulas for capital/output per worker
      $C / N = s / \delta - \delta(s/\delta)^2 = (s(1-s))/\delta$

    - at saving rate = 50% consumption per worker is maximal
    - → thus is s < 50% then increasing s → increasing consumption per worker
- Physical versus human capital
    - *Human capital*: the set of skills of the workers in the economy
    - expand the production function → Y / N = f(K/N, H/N)
      (+ , +)
    - The level of output per worker depends on both the level of physical capital per worker and the level of human capital per worker
    - Human capital also have decreasing return with high levels of human capital, a larger increase is needed to improve output.
- Human capital, physical capital and output
    - investment ('saving') in human capital also increases steady-state human capital which results in an increased output from workers.
    - hard to determine investment numbers for human capital
        - human capital is partly consumption and partly investment
        - formal education is only part of education. Much learning comes with experience in the field
        - depreciation of acquired skills goes much more slowly than physical capital like machines
    - *Models of endogenous growth*: models that generate steady growth without technological progress
    - Output per worker depends on both physical capital per worker and human capital per worker. Both can be gained (physical investment, and training/education). Increases in either both saving rates can lead to much higher levels of output per worker on the long run. However, given the rate of technological progress, such measures do not lead to a permanently higher growth rate.

Chapter 15: Technological progress and growth

15.1 Technological progress and the rate of growth

- Technological progress has many dimensions
    - it can lead to larger quantities of output for a given quantities of capital and labour
    - it can lead to better products
    - it can lead to new products
    - it can lead to a larger variety of products



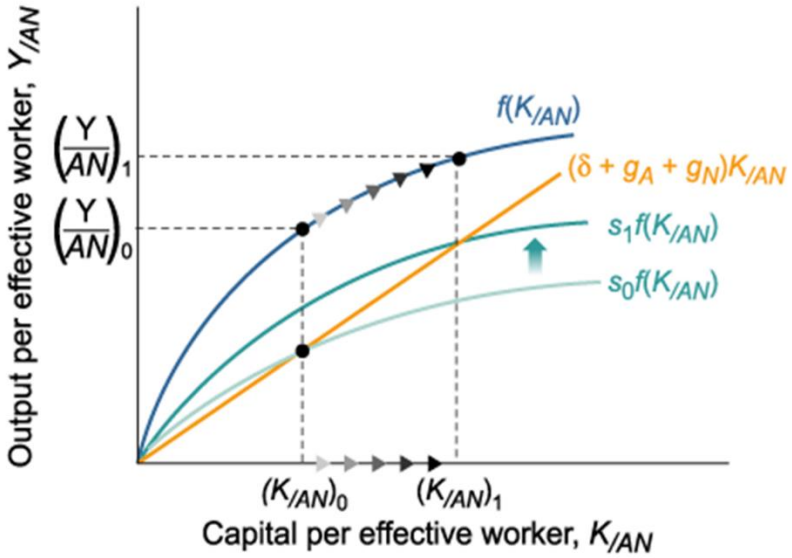
- Y = F(K, N, A)
  (+, +, +)
  - K = capital
  - N = labour
  - A = the state of technology
- → Y = F(K, AN) This equation tells us two things
  - technological progress *reduces* the number of workers needed to produce a given amount of output.
  - technological progress *increases* the output that can be produced with a given number of workers
- The relation between output per effective worker and capital per effective worker
  → Y / AN = f(K/AN)
  - in words: output per effective worker (left side) is a function of capital per effective worker (right side)
  - This relation also has a decreasing rate of return at higher values
- Dynamic of output per effective worker and capital per effective worker
  - the relation between output per worker and capital per worker
  - the relation between investment per worker and capital per worker
  - the relation between depreciation per worker (also the investment per worker needed to maintain a constant level of capital per worker - and capital per worker.
- assumption that investment equals private saving, and private saving is constant, investment is
  → I = S = sY
- divide both by numbers of effective workers, AN, to get
  → I / AN = s(Y/AN)
- replacing output per effective worker, Y/AN
  → I / AN = sf(K/AN)
- The amount of investment needed to maintain a given level of capital per work is different now. Since now, next to depreciation, due to technology the number of effective workers (AN)

increases. Therefore:

→ $I = \delta K + (g_A + g_N)K$ or $I = (\delta + g_A + g_N)K$

- g_A = rate of technological progress
- g_N = rate of population growth

- Dividing both sides by number of effective worker
  - $I / AN = (\delta + g_A + g_N)K / AN$
- In steady state, the growth rate or output equals the rate of population growth g_N plus the rate of technological progress g_A. By implication, the growth rate of output is independent of the saving rate.
- Suppose that the economy tried to sustain output growth in excess of $g_A + g_N$. because of decreasing returns to capital, capital would have to increase faster than output. The economy would have to devote a larger and larger proportion of output to capital accumulation. At some point this would be impossible → thus the economy cannot permanently grow faster that $g_A + g_N$.
- *balanced growth*: output, capital and effective labour all grow at the same rate, $g_A + g_N$, in steady state. → this implies
  - capital per effective worker and output per effective worker are constant
  - equivalently, capital per worker and output per worker are growing at the rate of technological progress, g_A.
  - or in terms of labour, capital and output: labour is growing at the rate of population growth, g_N: capital and output are growing at a rate equal to the sum of population growth and the rate of technological progress, $g_A + g_N$
- Changes in the saving rate do not affect steady state growth rate, but do increase the steady-state level.
- In an economy with technological progress and population growth, output grows over time. In steady state, output per effective worker and capital per effective worker are constant



15.2 The determinants of technological progress

- the level of Research and Development (R&D) spending does not only depend on the fertility of the research process (how spending of R&D translates into new ideas/products) but also on the appropriability of research results (the extent to which firms benefit from the results of their own R&D)

15.3 The facts of growth revisited

- suppose a country that has high growth of output per worker over time, this comes from
  - a high rate of technological progress under balanced growth
  - the adjustment of capital per effective worker, K/AN, to a higher level
- if high growths reflect high balanced growth → growth rate of output per worker equals rate of technological progress
- if high growth reflects the adjustment to a higher level of capital per effective worker, this adjustment should be reflected in a growth rate of output per worker that exceeds the rate of technological progress
- two source of convergence between countries
  - poorer countries are poor because they have low capital to start → they can accumulate capital faster
  - poorer countries are poor because of low technological advancement → they can either import technology or develop them themselves.
- Institutions and growth → institutions determine the rules of the game
  - legal
  - social
  - political
  - cultural
  - and economic
- Economic institutions
  - the presence of markets
  - property rights
  - affect the way how income is distributed to different production factors

Chapter 17: Expectations, consumption and investment

17.1 Consumption theory and the role of expectations

- the theory of a very foresighted consumer: How would he or she decide how much to consume?
  - He would check his financial wealth and housing wealth (goods that owners have)
    - → human wealth the labour-income component of wealth
    - → non human wealth the financial and housing component of wealth
    - Human + non-human wealth = total wealth
  - He would then decide how much to spend of his total wealth
  - He would spend roughly the same level of consumption each year throughout his life.

- C_t = C (total wealth)
  - C_t = consumption at time t
  - total wealth = the sum of non-human wealth and human wealth at time t
- human wealth = $V(Y^e_{Lt} - T^e_t)$ expected present value after-tax income expected of year t
  - Y_{Lt} = real labour income in year t
  - T_t = real taxes in year t
- the intertemporal budget constraint
  - the consumer's budget constraint → consumption cannot exceed what he or she has → value of consumption must be equal to the value of resources
  - $p_1c_1 + p_2c_2 = p_1y_1 + p_2y_2$ or $c_1 + (p_2/p_1)c_2 = y_1 + (p_2/p_1)y_2$
    - c_1 & c_2 = quantities of goods 1 and 2 consumed
    - y_1 & y_2 = the amount of goods 1 and 2 owned by consumers → <u>endowments</u>
    - p_1 & p_2 = prices of goods 1 and 2
  - p_1/p_2 is the relative price of current consumption in terms of future consumption: it corresponds to the real interest rate, r, which measures by how much future consumption can increase by lending one more unit of good today
    - $1 + r = p_1/p_2$
  - → formula rewritten as: $c_1 + (1/(1+r))c_2 = y_1 + (1/(1+r))y^e_2 = V(y^e_t)$ t = 1, 2
    - y^e_t = the expected endowment for tomorrow
  - the present discounted value of each individual's consumption (the sum of present and future consumption measured in terms of goods today) must be equal to the discounted present value of his or her endowments.
  - *intertemporal budget constraint:* analyses consumption choices across two subsequent periods.
- the intertemporal consumption decisions
  - *consumption smoothing*: the preference for a balanced consumption path
  - Intertemporal utility function → $U(c_1, c_2) = u(c_1) + 1 / (1+\rho)\, u(c_2)$
    - u = instantaneous utility function
    - ρ = discount rate (it measures the weight consumers attaches to the future compared to the present)
    - ρ = 0 consumer attaches same importance to increase in consumption, irrespective of time
    - ρ > 0 an increase of consumption increases total utility to a greater extent if it occurs in the current period rather than the future

17.2 Toward a more realistic description

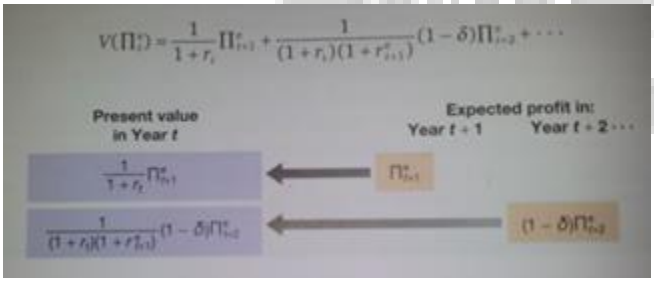
- Why does consumption react so much to current income?
- $C_t = C(\text{total wealth}_t, Y_{Lt} - T_t)$

  (+ , +)

- consumption is an increasing function of total wealth and of current after-tax labour income. Total wealth is the sum of non-human wealth (financial wealth plus housing wealth) and human wealth (the present value of expected after-tax labour income)
- Liquidity constraints → consumers cannot obtain credit as easily
    - $c_1 \leq y_1$
- two type of consumers
    - 1: consumers with no liquidity constraints
    - 2: consumers with liquidity constraints → can only consume of their current disposable income.
- expectations affect consumption in two ways:
    - directly through human wealth → to compute human wealth they have to form their own expectations (income, real interest rate, taxes)
    - indirectly through non-human wealth → no computation needed while consumers just can take the values of these assets as given
- this relation has two implications between consumption and income
    - consumption is likely to respond less than one-for-one to fluctuations in current income. (if they think it is transitory/temporary)
    - consumption may move even if current income does not change (e.g. elections, loss of thrust in economy)

17.3 Investment

- invest: if the present value exceeds the costs, the firm should buy the machine.
- not-invest: if the present value is less than the cost, then the firm should not buy the machine
- investment and expected profit
    - depends on depreciation of physical capital
    - depends on the present value of expected profits
        - Expected profit in year t+1
          → $1 / (1+r_t)\ \Pi^e_{t+1}$
            - Π = profit per machine
    - expected profit per machine in year t+2 → Π^e_{t+2}
        - the present value of this expected profit of year t is
          $1 / ((1+r_t)(1+r^e_{t+1}))\ (1-\delta)\ \Pi^e_{t+2}$



- The investment decision
    - Investment depends positively on the expected present value of future profits (per unit of capital)

- $I_t = I\ [V(\Pi^e_{t+1})]$
  - I_t = aggregate investment
  - $V(\Pi^e_{t+1})$ = the expected present value of profit per unit of capital
- → The higher the current or expected future profits, the higher the expected present value, and the higher the level of investment. The higher current or expected real interest rates, the lower the expected present value, and thus the lower the level of investment.

- *static expectations*: expectations that the future will be like the present
  - together with the assumption that expected future profits (per unit of capital) and future interest rates remain at the same level as today
    → $V(\Pi^e_{t+1}) = \Pi_t / (r_t + \delta)$
  - → $I_t = I\ (\Pi_t / (r_t + \delta))$
  - Investment is a function of the ratio of the profit rate to the sum of the interest rate and the depreciation rate.
- *user cost (or rental cost of capital)*: the sum of the real interest rate and the depreciation rate
- rental costs = $(r_t + \delta)$
- → $I_t = I\ (\Pi_t / (r_t + \delta))$ → means investment depends on the ratio of profit to the user costs
- Current profit appears to affect investment, even after controlling for the expected present value of profits
- Why does current profit play a role in the investment decision?
  - Higher current profit may lead the firm to invest more (if a firm has very good profit, then it can use part of the profit to invest. On the other hand, if it is poor, it has to borrow money for investments which puts them at more risk)
  - In addition, even if firms want to invest, it might have difficulty borrowing money
  - → $I_t = I\ [V(\Pi^e_t), \Pi_t]$
    (+, +)
  - Investment depends both on the expected present value of future profits and on the current level of profit.
- What determines profit per unit of capital?
  - the level of sales
  - the existing capital stock
  - → $\Pi_t = \Pi\ (Y_t / K_t)$
    (+)
  - Y_t = output / equivalently, sales
  - K_t = capital stock at time t
  - profit decreases in recessions, and increases in expansions

17.4 The volatility of consumption and investment

- Whether consumers perceive current movements in income to be transitory or permanent affects their consumption decision
- Whether firms perceive current movement in sales to be transitory or permanent affects their investment decisions.

- Differences between consumption decision and investment decision
    - theory in consumption: when faced with increase in income (perceived as permanent) consumers respond with <u>at most</u> an equal increase in consumption
    - theory in investment: when faced with increase in sales (perceived as permanent) firms may respond with an increase in investment exceeding increase in sales
- Consumption and investment usually move together. e.g. recessions typically results in decrease in both investment and consumption
- Investment is much more volatile than consumption
- The level of investment (16% GDP) is much smaller than the level of consumption (64% GDP) thus changes result in overall magnitude when compared. → both components contribute roughly equally to fluctuations over time.

Chapter 22: Policy and policy makers, What do we know?

22.1 Uncertainty and policy

- There is a substantial uncertainty about the effects of macroeconomic policies. This uncertainty should lead policy makers to be more cautious and to use less active policies. → Policies should be broadly aimed at avoiding prolonged recessions, slowing down booms and avoiding inflationary pressure. The higher the unemployment or the higher the inflation, the more active the policies should be. But they should stop well short of fine tuning, of trying to achieve constant unemployment or constant output growth.

22.1 expectations and policy

- One reason why the effects of macroeconomic policy are uncertain is the interaction of policy and private agents' expectations.
- Economy consists of firms and people, they will react not only to current policy but also to expectation of future policy.
- What people and firms do depends on what they expect policy makers to do. In turn, what policy makers do depends on what is happening in the economy.
- $\pi = \pi^e - \alpha(u - u_n)$
    - inflation π, depends on expected inflation π^e, and on the difference between the actual unemployment rate, u, and the natural unemployment rate, u_n.
    - α is the coefficient that captures the effect of unemployment on inflation, given expected inflation.
- Suggest, central bank will announce to follow monetary policy with 0 inflation.
    - thus (assuming people will believe it) $\pi^e = 0 \rightarrow \pi = -\alpha(u - u_n)$
    - Suppose the central bank rather thinks it is better to have 1% inflation to reduce unemployment rate by 1%. → this incentive to deviate from the announced policy after wage setters have set the wage is known as <u>time inconsistency</u> of optimal policy
    - However, seeing that the central bank has increased money more than announced, wage setters wise up and begin to expect a 1% inflation. Thus if the central bank wants

to reduce unemployment rate by 1% it now has to run a policy for increasing inflation by 2%. → wage setters wise up again and expect 2% now → so the central bank has to run 3%... and so on.
    - The eventual outcome is likely to be high inflation, due to wage setters understand the central bank's motives → attempts by the central bank to make things better turned out to make things worse. The economy ends with same unemployment rate and much higher inflation
- What can be done better? → by credibly committing that it will not try to decrease unemployment below the natural rate.
- Establishing credibility
    - Give up / strip (by law) the central bank of its policy making power → but this also restrict its option when they are necessary
    - Making the central bank independent → this make it easier for the central bank to be influenced by political pressure
    - Give the central bank incentives to look at the long run → this will make them think about the long run of pursuing inflation changing policy
    - Appoint a 'conservative' central banker which is reluctant to increase inflation in order to reduce the unemployment rate.

22.3 Politics and policy

- *Political-business-cycle argument*: Policy makers try to get high output growth before the elections so that they will be re-elected.
- The game between political parties
    - if multiple parties want to pursue different policies, nothing happens. → so what one party can do is create a larger budget deficit → if the deficit is large enough one party have to give to safe the economy for 'the greater good'.

Chapter 23: Monetary and fiscal policy rules and constraints

23.1 The optimal inflation rate

- 4 main costs of inflation
    - shoe-leather costs
    - tax distortions
    - money illusion
    - inflation variability
- Shoe-leather costs

- in the medium run, the real interest rate is not affected by inflation. The increase in inflation is reflected one-for-one in an increase in the nominal interest rate. → the Fisher effect
- In the medium run, higher inflation leads to higher nominal interest rate and to a higher opportunity cost of holding money. → people go to the bank to decrease money balances. (explains the shoe-leather costs)

- Tax distortions
  - interaction between tax system and inflation
  - e.g. you have to pay taxes for the difference in price that you bought and sold your house. But if you sell your house for the price equal to the increase in inflation, you actually didn't had any profit (just a higher selling price since inflation pushed it higher) but you still have to pay taxes because you sold your house for a higher price than that you bought it
- Money illusion
  - the notion that people appear to make systematic mistakes in assessing nominal versus real changes.
- Inflation variability
  - higher inflation is typically associated with more variable inflation. → this means that higher inflation makes assets such as bonds, which promise fixed nominal payments, more riskier.
- The benefits of inflation
  - Seignorage
    - the revenues of the creation of money
  - The option of negative real interest
    - an economy with higher average inflation rate has more scope to use monetary policy to fight a recession. An economy with low average inflation may find itself unable to use monetary policy to return output to the natural level of output.
  - interaction between money illusion and inflation in facilitating real wage adjustments
    - if people get more money they are more willing to take a cut due to inflation, then if they do not get an increase. e.g. if Wages go up by 1% and inflation by 3% this is more accepted by people than wages remain the same and inflation increases by 2%.

23.2 monetary policy rules

- Inflation targeting
  - = achievement of a low inflation rate, both in the short and in the medium run
  - better to have an inflation rate as the target, than a nominal money growth target, which may not lead to the desired rate of inflation
  - inflation targeting would lead the central bank to act to eliminate all deviations of output from its natural level → however, this relation is too strong because
    - the central bank cannot always achieve the rate of inflation it wants in the short run

        - the Phillips curve (between unemployment and inflation) does not exactly hold. → it will happen that inflation increases, even if $u_t = u_n$
    - inflation targeting makes good sense in the medium run and allows monetary policy to stabilize output around its natural level in the short run.
- Interest rate rules
    - Taylor rule
        - $i_t = i^* + a(\pi_t - \pi^*) - b(u_t - u_n)$
            - π_t = rate of inflation
            - π^*= target rate of inflation
            - i_t = nominal interest rate
            - i^* = target nominal interest rate (the rate associated with the target rate of inflation π^* in the medium run)
            - u_t = unemployment rate
            - u_n = natural unemployment rate
        - if $\pi_t = \pi^*$ and $u_t = u_n$ then i^* should be i_t thus the bank should set the nominal interest rate equal to its target.
        - if $\pi_t > \pi^*$, the bank should increase the nominal interest rate i_t above i^*. This higher interest rate will increase unemployment and in turn decrease in inflation.
            - *a* should be higher than 1, since for spending <u>real interest rates</u> matters. Thus the nominal interest rate should be adjusted more than one-to-one with inflation
        - if $u_t > u_n$ the central bank should decrease the nominal interest rate. Lower nominal interest rate → increase output → decrease unemployment.
            - *b* reflect how much the central bank cares about unemployment relative to inflation. Higher the *b* the more central bank is willing to deviate from target inflation to keep unemployment close to natural rate of unemployment
        - Thus the central bank should try to achieve the inflation target by adjusting the nominal interest rates.

23.3 Fiscal policy rules and constraints

- Three issues in fiscal policy
    - Ricardian equivalence
        - ''when government budget constraints is taken into account, neither deficits nor debt have an effect on economic activity''
        - Suppose that government decreases tax by 1 billion, but increases the tax next year by 1+r → Net effect = no effect.
        - Or taken from saving side, if public saving decreases due to budget cuts, the private saving will increase in anticipation of higher taxes.

        - However the Ricardian equivalence is not set in stone, no government will do tax cuts with the announcements that they will go up again. → it is all about the expectations of the consumers!
    - Deficits, output stabilization and the cyclically adjusted deficit
        - deficits during recessions should be offset by surpluses during booms, so as not to lead to a steady increase in debt
        - cyclically adjusted deficit: gives a benchmark against which to judge the direction of fiscal policy: if the actual deficit is large but the cyclically adjusted deficit is zero, then current fiscal policy is consistent with no systematic increase in debt over time. If output < natural output → debt will increase, if output = natural level → debt will stabilize
        - cyclically adjusted deficit = positive → warning, the return of output to its natural level is not enough to stabilize the debt → gov. have to take additional measures (e.g. tax increases, cuts in spending)
    - Wars and deficits
        - Wars often result in large budget deficits, but is this bad?
            - Deficit finance is a way to pass some of the burden of the war to those alive after the war.
            - Deficit spending helps reduce tax distortions -->it is better to maintain a relatively constant tax rate: Tax smoothing: implies running large deficits when governments spending is exceptionally high, and small surpluses the rest of the time
- Politics and fiscal restraints
    - The politics can set up
        - use constitutional amendment to balance the budget → eliminates the use of fiscal policy as a macroeconomic instrument
        - rules to set limits on either deficits or debts → hard to do
        - place mechanisms to reduce deficits

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