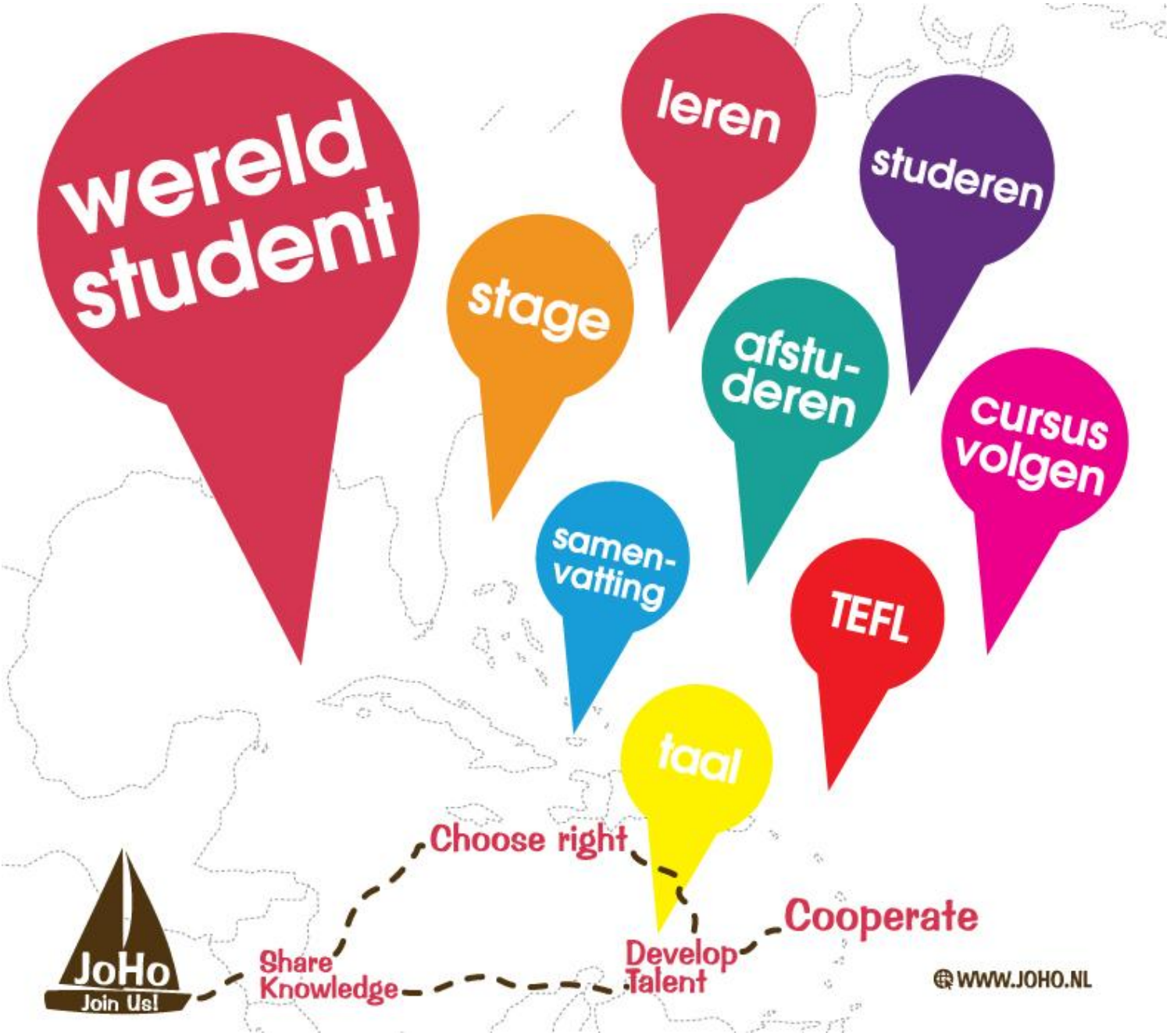

Macro-economie/ Macroeconomics

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Lecture notes midterm

Macroeconomics lecture notes midterm

Chapter 1: What is macroeconomics?

1. What do macroeconomists study?

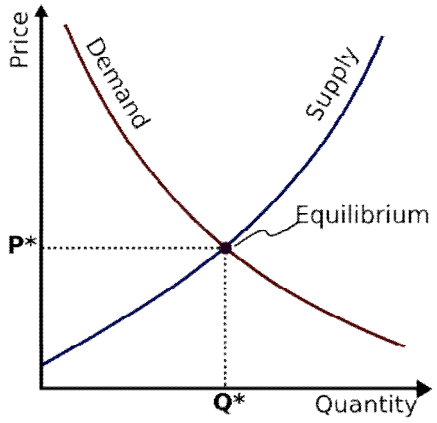
Economists use many types of data to measure the performance of an economy. There are three macroeconomic variables that are very important: *real gross domestic product* (GDP), *the inflation rate*, and *the unemployment rate.*
Real GDP measures the total income of everyone in the economy. **The inflation rate** measures how fast prices are rising. **The unemployment rate** measures the fraction of the labor force that is out of work.

Recently, there is much discussion of ***recessions***--periods in which real GDP falls mildly-and ***depressions***, when GDP falls more severely.

2. How do macroeconomists think?

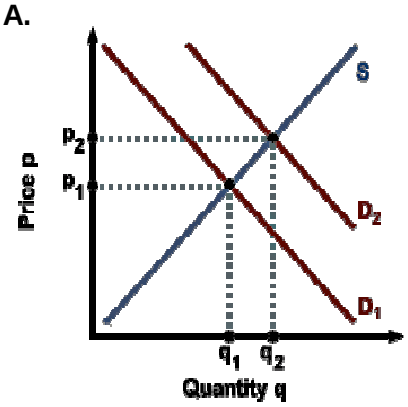
Economists use ***models*** to understand what goes on in the economy.
Models have two kinds of variables: ***endogenous variables*** and ***exogenous variables*****.** Endogenous variables are those, which the model tries to explain. Exogenous variables are those variables that a model takes as given. In short, endogenous are variables within a model, and exogenous are the variables outside the model.

The **Model of Supply and Demand** is the most famous economic model. It describes the relationship between buyers and sellers in the market. The point of intersection is called an *equilibrium.*



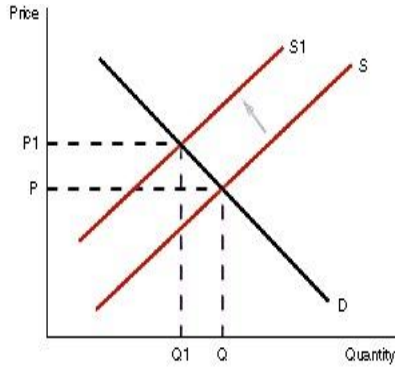
The **Changes in Equilibrium**

A.



In model A, a rise in aggregate income causes the demand to increase. At any given price, consumers now want to buy more.

B.



In model B, a rise in price of materials decreases the supply. At any given price, production decreases.

Price: Flexible Versus Sticky

Economists typically assume that the market will go into equilibrium of supply and demand, which is called the ***market clearing process.*** Assuming that markets clear *continuously* is not realistic. For markets to clear continuously, prices would have to adjust instantly to changes in supply and demand. But, evidence suggests that prices and wages often adjust slowly.

Although market clearing models assume that wages and prices are ***flexible,*** in actuality, some wages and prices are ***sticky.***

Microeconomic Thinking and Macroeconomic Models

Microeconomics is the study of how households and firms make decisions and how these decision makers interact in the marketplace. In microeconomics, a person chooses to maximize his or her *utility* subject to his or her budget constraint.

Macroeconomic events arise from the interaction of many people trying to maximize their own welfare. Therefore, when we study macroeconomics, we must consider its microeconomic foundations.

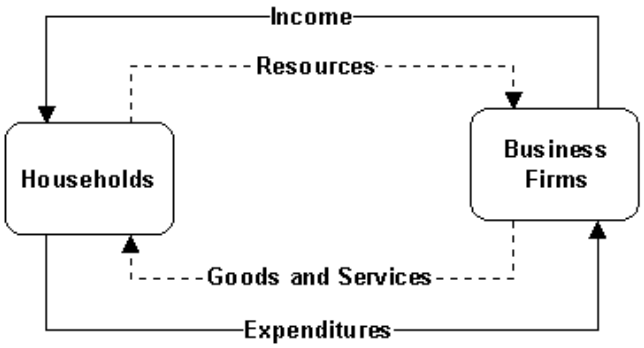
Chapter 2: The Data of Macroeconomics

Gross Domestic Product (GDP) is the dollar value of all final goods and services produced within an economy in a given period of time.
GDP is the best measure of how well the economy is performing. The Bureau of Economic Analysis calculates GDP via *administrative data* (such as tax collection, education programs, defence, regulation, etc.).

There are two ways of viewing GDP. First, as a total income of everyone in the economy. Second, as a total expenditure on the economy's output of goods and services.
For the economy as a whole, ***income must equal expenditure.*** GDP measures *flow* of dollars in the economy.

- The Circular Flow

This figure illustrates the flows between firms and households in an economy that produces one good from one input. The upper part represents the flow of an input and a good. The bottom part illustrates the flow of dollars.



- Rules for Computing GDP

Suppose, for example, that the economy produces four apples and three oranges. To compute the total value of different goods and services, the national income accounts use market prices because these prices reflect how much people are willing to pay for a good or service. Therefore, if apples cost $0.50 each and oranges $1.00 each, the GDP would be:

GDP = (Price of apples × Quantity of apples) + (Price of oranges × Quantity of Oranges)
= $5.00

1. Used goods are not included in the calculation of GDP.

2. The treatment of inventories depends on if the goods are stored or if they spoil. IF the goods are stored, their value is included in GDP. If they spoil, GDP remains unchanged. When the goods are finally sold out of inventory, they are considered used goods (and are therefore not counted).

3. Intermediates goods are not counted in GDP, only the value of final goods, because the value of intermediate goods is already included in the market place. ***Value added*** of a firm equals the value of the firm's output less the value of the intermediate goods the firm purchases.

4. Some goods are not sold in the marketplace and thus don't have market prices. We must use their ***imputed value*** as an estimate of their value (i.e. home ownership and government services)

- Real GDP versus Nominal GDP

The value of final goods and services measured at current prices is called nominal GDP. It can change over time, either because there is a change in the amount (real value) of goods and services or a change in the prices of those goods and services.

– **Nominal GDP** = P × *y*, where P is the price level and *y* is real output.

– **Real GDP** = Y ÷ P, is the value of goods and services measured using a constant set of prices

The distinction between real and nominal can also be applied to other monetary values, such as wages. Nominal wages can be denoted by *W* and decomposed into a real value *w* and a price variable *P.*

Hence, *W* = nominal wage = *P* × *w*
w = real wage = *W* ÷ *P*

For example, if we wanted to compare output in 2009 and output in 2010, we would obtain base-year prices, such as 2009 prices.

Real GDP in 2009 = (2009 price of apples × 2009 quantity of apples) + (2009 price of oranges × 2009 quantity of oranges)

Real GDP in 2010 = (2009 price of apples × 2010 quantity of apples) + (2009 price of oranges × 2010 quantity of oranges)

Real GDP in 2011 = (2009 price of apples × 2011 quantity of apples) + (2009 price of oranges × 2011 quantity of oranges)

Because prices are held constant from year to year, real GDP varies only when the quantities vary.

- The GDP Deflator

The GPD deflator, also called the *implicit price deflator for GDP,* is the ratio of nominal GDP to real GDP. It measures the price of output relative to its price in the base year. It reflects what is happening to the overall level of prices in the economy.

$$\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}}$$

Nominal GDP measures the current dollar value of the output of the economy.
Real GDP measures output valued at constant prices.

- Chain-Weighted Measures of Real GDP

In some cases, it is misleading to use base-year prices that prevailed 10 to 20 years ago (i.e. computers and college). In 1995, the Bureau of Economic Analysis decided to use *chain-weighted* measures of real GDP. The base year changes continuously over time. This new chain-weighted measure is better than the more traditional measure because it ensures that prices will not be too out of date.
Average prices in 2009 and 2010 are used to measure real growth from 2009 to 2010.

Average prices in 2010 and 2011 are used to measure real growth from 2010 and 2011, and so on.

1. Take period *t* as a base period, and compute the growth rate of real GDP between *t* and *t + 1.*
2. Take period *t + 1* as base period, and compute again the growth rate of real GDP between *t* and *t + 1.*
3. The average of both growth rates is the **chain-weighted growth rate of real GDP** between *t* and *t + 1*

- The Components of Expenditure

The national income accounts divide GDP into four broad categories of spending.

- Consumption (C)
  - durables
  - nondurables
  - services
- Investment (I) –
  - by households, firms, and the government
  - including houses, inventory investment
  - **not** purchases of financial assets
- Government purchases (G)
  - **not** transfer payments
- Net exports (NX)
  - export-import

$$Y = C + I + G + NX$$

- Other Measures of Income

1. To obtain ***gross national product (GNP)***, we add receipts of factor income (wages, profit, rent) from the rest of the world and subtract payments of factor income to the rest of the world.

GNP = GDP + Factor Payments from Abroad – Factor Payments to Abroad

GNP measures the total income earned by nationals.

2. To obtain ***net national product (NNP)***, we subtract the depreciation of capital, the amount of the economy's stock of plants, equipment, and residential structures that wears out during the year.

NNP = GNP – Depreciation

In the national income accounts, *depreciation* is called ***consumption of fixed capital.*** It equals about 10% of GNP. Because depreciation of capital is a cost of producing the output of the economy, subtracting depreciation shows the net result of economic activity.

The Consumer Price Index (CPI) turns the prices of many goods and services into a single index measuring the overall level of prices. The Bureau of Labor Statistics weighs different items by computing the price of a basket of goods and services produced by a typical customer. The CPI is the price of this basket of goods relative to the price of the same basket in some base year.

$$P_t = \frac{\text{price of a basket of goods and services in period t}}{\text{price of the same basket in the base period}}$$

For example, suppose that the typical consumer buys five apples and two oranges every month. Then the basket of goods consists of five apples and two oranges.

$$CPI = \frac{(5\times \text{ current price of apples}) + (2\times \text{ current price of oranges})}{(5\times \text{ 2009 price of apples}) + (2\times \text{ 2009 price of oranges})}$$

In this calculation, 2009 is the base year. The index tells how much it costs to buy 5 apples and 2 oranges in the current year relative to how much it cost to buy the same basket of fruit in 2009.

- CPI versus the GDP Deflator

The GDP deflator measures the prices of all goods produced, whereas the CPI measures prices of only the gods and services bought by consumers. Therefore, an increase in the price of goods bought only by firms or government will show up in the GDP deflator, but not in the CPI.

GDP deflator includes only those goods and services produced domestically. Imported goods are not part of GDP and therefore do not show up in the GDP deflator.

The CPI assigns fixed weights to the prices of different goods, whereas the GD deflator assigns changing weights.

Inflation

growth rate of a price index

$$p_t = \frac{P_t - P_{t-1}}{P_{t-1}} = \frac{\Delta P_t}{P_{t-1}}$$

Laspeyres price index is a price index with a fixed basket of goods.

$$CPI_t = \frac{\sum_i p_{i,t} q_{i,0}}{\sum_i p_{i,0} q_{i,0}}$$

Paasche index is a price index with a changing basket of goods.

$$GDP \quad deflator \quad in \quad t = \frac{\sum_i p_{i,t} q_{i,t}}{\sum_i p_{i,0} q_{i,t}}$$

$p_{i,t}$ is the price of good *I* in period *t,* $q_{i,t}$ is the quantity of good *i* in period *t*, and period 0 is the base period

Measuring the Unemployment Rate

The *labor force* is defined as the sum of the employed and unemployed.

The *unemployment rate* is defined as the percentage of the labor force that is unemployed.

$$\text{Unemployment rate} = \frac{\text{unemployed}}{\text{labor force}}$$

The *labor-force participation rate* is the percentage of the adult population who are in the labor force.

$$\text{participation rate} = \frac{\text{labor force}}{\text{population 15-64 years}}$$

Chapter 3: National Income: Where it Comes From and Where it Goes

The ***factors of production*** are the inputs used to produce goods and services. The two most important factors of production are *capital* and *labor*.

$$K = \bar{K}$$
$$L = \bar{L}$$

$\bar{K}, \bar{L}$ mean that each variable is fixed at some level

The available production technology determines how much output is produced from given amounts of capital (K) and labor (L).
The ***production function*** represents the transformation of inputs into outputs. A key assumption is that the production function has constant returns to scale, meaning that if we increase inputs by *z,* output will also increase by *z.*

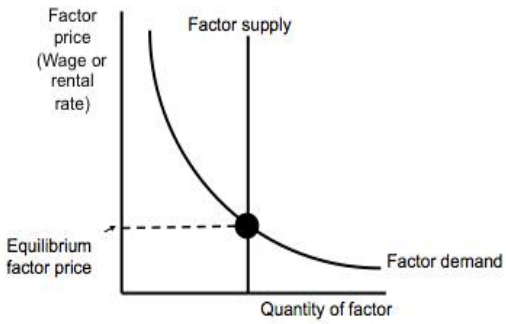
$$Y = F(K, L)$$

The factors of production and the production function together determine the quantity of goods and services supplied, which equals the economy's output.

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

- How is National Income Distributed to the Factors of Production?

The distribution of national income is determined by factor prices. ***Factor prices*** are the amounts paid to the factors of production—the ***wages*** workers earn and the ***rent*** the owners of capital collect.



→ The vertical supply curve is a result of the supply being fixed

The intersection of supply and demand determines the equilibrium factor price

To make a product, the firm needs two factors of production, capital and labor.

$$Y = F(K, L)$$

The firm sells its output at price ***P,*** hires workers at a wage **W**, and rents capital at a rate ***R***.

The goal of the firm is to maximize profit. **Profit** is revenue minus cost. Revenue equals $P \times Y$. Costs include both labor and capital costs. Labor costs equal $W \times L$, the wage multiplied by the amount of labor L. Capital costs equal $R \times K$, the rental price of capital R times the amount of capital K.

$$\text{profit} = \text{revenue} - \text{labor cost} - \text{capital cost}$$

$$\text{profit} = PY - WL - RK$$

$$\text{profit} = P \times F(K,L) - WL - RK$$

This equation shows that profit depends on P (the selling price of a good), W (the wage), R (the rental price of capital), L, and *K.* The *competitive firm* takes the product price and factor prices as given and chooses the amounts of labor and capital that maximize profit.

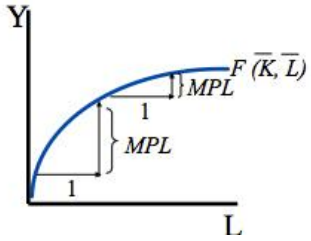
The Firm's Demand for Factors

The firm will hire labor and rent capital in the quantities that maximize profit.

1. The ***marginal product of labor*** *(MPL)* is the extra amount of output the firm gets from one extra unit of labor, holding the amount of capital fixed and is expressed using the production function:

$$MPL = F(K, L + 1) - F(K, L).$$

Most production functions have the property of ***diminishing marginal product:*** holding the amount of capital fixed, the MPL decreases as the amount of labor increases.



The ***MPL*** is the change in output when the labor input is increased by 1 unit. As the amount of labor increases, the production function becomes flatter, indicating diminishing marginal

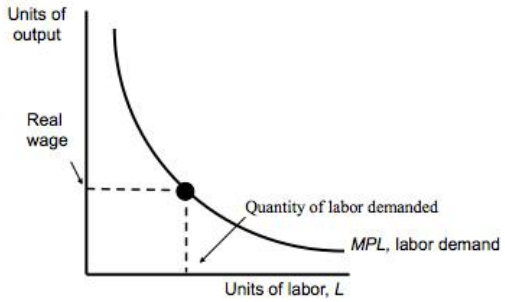
When the competitive, profit-maximizing firm is deciding whether to hire an additional unit of labor, it considers how that decision would affect profits. It therefore compares the extra revenue from the increased production that results from the added labor to the extra cost of higher spending on wages. The increase in revenue from an additional unit of labor depends on two variables: the *marginal product of labor*, and the *price of the output*. Because an extra unit of labor produces *MPL* units of output and each unit of output sells for *P* dollars, the extra revenue is $P \times MPL$. The extra cost of hiring one more unit of labor is:

$$\Delta profit = \Delta revenue - \Delta cost = (P \times MPL) - W$$

The firm's demand for labor is $P \times MPL = W$ determined by

$MPL = \frac{W}{P}$ where $\frac{W}{P}$ is the *real wage*, the payment to labor measured in units of output rather than dollars

The *MPL* depends on the amount of labor. The *MPL* curve slopes downward because the *MPL* declines as *L* increases. This schedule is also the firm's labor demand curve.



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2. The ***marginal product of capital***, or *MPK,* is the amount of extra output the firm gets from an extra unit of capital, holding the amount of labor constant:

$$MPK = F(K + 1, L) - F(K, L).$$

the *MPK* is the difference between the amount of output produced with K+1 units of capital and that produced with *K* units of capital. Like labor, capital is subject to *diminishing marginal product*.

The increase in profit from renting an additional machine is the extra revenue from selling the output of that machine minus the machine's rental price:

$$\Delta profit = \Delta revenue - \Delta cost = (P \times MPK) - R$$

To maximize profit, the firm continues to rent more capital until the *MPK* falls to equal the real rental price, *MPK = R/P.*
The ***real rental price of capital*** is the rental price measured in units of goods rather than in dollars. The firm demands each factor of production until that factor's marginal product falls to equal its real factor price.

Division of National Income
The income that remains after firms have paid the factors of production is the ***economic profit*** of the firms' owners.

Real economic profit is ⟹ Economic Profit = $Y - (MPL \times L) - (MPK \times K)$

$$Y = (MPL \times L) - (MPK \times K) + \text{Economic Profit}$$

Total income is divided among the returns to labor, the returns to capital, and economic profit.

If the production function has the property of constant returns to scale, then *economic profit is zero.* This conclusion follows from *Euler's theorem,* which states that if the production function has constant returns to scale, then

$$F(K,L) = (MPK \times K) - (MPL \times L)$$

If each factor of production is paid its marginal product, then the sum of these factor payments equals total output. In other words, constant returns to scale, profit maximization, and competition together imply that economic profit is zero.

The Cobb-Douglas Production Function

Paul Douglas observed that the division of national income between capital and labor has been roughly constant over time. Cobb, a mathematician, said that the production function would need to have the property that:

$$\text{Capital Income} = MPK \times K = \alpha$$
$$\text{Labor Income} = MPL \times L = (1 - \alpha)\, Y$$

α is a constant between zero and one and measures capital and labors' share of income

$$F(K, L) = AK^{a} L^{1-a}$$

A is a parameter greater than zero that measures the productivity of the available technology

The marginal product of labor is:

$$MPL = (1- \alpha)\, A\, K^{\alpha}\, L^{-\alpha}$$
$$MPL = (1- \alpha)\, Y / L$$

and the marginal product of capital is:

$$MPL = \alpha\, A\, K^{\alpha-1} L^{1-\alpha}$$
$$MPK = \alpha\, Y/K$$

The Cobb–Douglas production function has constant returns to scale. That is, if capital and labor are increased by the same proportion, then output increases by the same proportion as well. Next, consider the marginal products for the Cobb–Douglas production function.
The *MPL:*

$$MPL = (1- \alpha)\, Y/L$$
$$MPK = \alpha\, A/ K$$

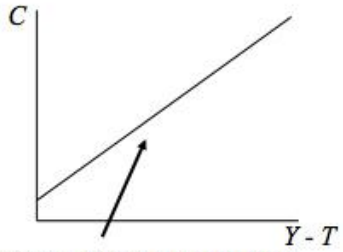
The *MPL* is proportional to output per worker, and the *MPK* is proportional to output per unit of capital. Y/L is called *average labor productivity,* and *Y/K* is called *average capital productivity.* If the production function is Cobb–Douglas, then the marginal productivity of a factor is proportional to its average productivity.

Consumption

Households receive income from their labor and their ownership of capital, pay taxes to the government, and then decide how much of their after-tax income to consume and how much to save.
The income after the payment of taxes, *Y−T,* is so called ***disposable income***. Households divide their disposable income between consumption and saving. A higher level of disposable income leads to greater consumption. Thus,

Consumption function

$C = C\ (Y-T)$



The slope of the consumption function is the *MPC*.

The *marginal propensity to consume (MPC)* is the amount by which consumption changes when disposable income (Y - T) increases by one dollar.

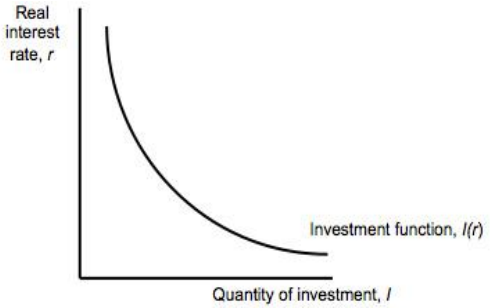
> For example: Consider a shopping scenario. A person who loves to shop probably has a large *MPC,* let's say ($.99). This means that for every *extra* dollar he or she earns after tax deductions, he or she spends $.99 of it. The *MPC* measures the sensitivity of the change in one variable (C) with respect to a change in the other variable (Y - T).

Investment

$$I = I\ (r)$$

The quantity of investment depends on the **real interest rate**, which measures the cost of the funds used to finance investment. When studying the role of interest rates in the economy, economists distinguish between the *nominal* interest rate and the *real* interest rate, which is especially relevant when the overall level of prices is changing.
The nominal interest rate is the interest rate as usually reported; it is the rate of interest that investors pay to borrow money.
The real interest rate is the nominal interest rate corrected for the effects of inflation.

The investment function relates the quantity of investment I to the real interest rate r. Investment depends on the real interest rate because the interest rate is the cost of borrowing. The investment function slopes downward; when the interest rate rises, fewer investment projects are profitable.



Government Purchases

- If government purchases equal taxes minus transfers, then $G = T$, and the government has a ***balanced budget.***
- If $G > T$, then the government is running a ***budget deficit.***

- If $G < T$, then the government is running a ***budget surplus***

$$G = G^*$$
$$T = T^*$$

- **<u>What Brings the Supply and Demand for Goods and Services Into Equilibrium?</u>**

1) $Y = C + I + G$	Demand for Economy's Output
2) $C = C\ (Y - T)$	Consumption Function
3) $I = I(r)$	Real Investment Function
4) $G = G$	Government Purchases
5) $T = T$	Taxes

- The demand for the economy's output comes from consumption, investment, and government purchases.
- Consumption depends on disposable income.
- Investment depends on the real interest rate.
- Government purchases and taxes are the exogenous variables set by fiscal policy makers.

1. The factor of production an the production function determine the quantity of output supplied to economy

$$Y = F\ (K^*, L^*)$$
$$= Y^*$$

2. Substituting all of our equations into the national income accounts identity.

$$Y = C\ (Y - T) + I\ (r) + G$$

3. Setting supply equal to demand, we obtain an equilibrium condition.

$$\boldsymbol{Y^* = C\ (Y^* - T^*) + I\ (r) + G^*}$$

- Supply of output equals its demand, which is the sum of consumption, investment, government purchases
- The greater the interest rate, the lower the level of investment.

The Supply and Demand for Loanable Funds

National income accounts identity: $Y - C - G = I$

Y – C – G is the output that remains after the demands of consumers and the government have been satisfied, it is called ***national saving*** *(saving (S))*

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

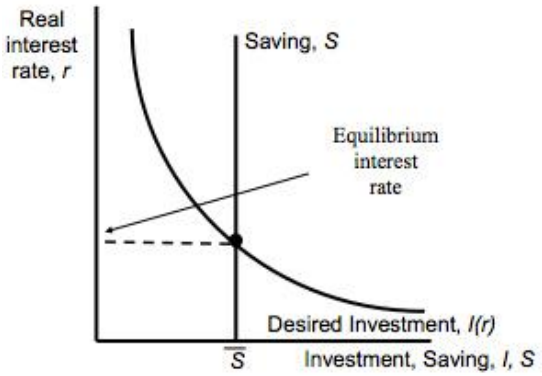
- The term $(Y - T - C)$ is disposable income minus consumption = ***private saving***.
- The term $(T - G)$ is the government revenue minus their spending = ***public saving***

National saving = private saving + public saving

To see how the interest rate brings financial markets into equilibrium, substitute the consumption function and the investment function into the national income accounts identity:

$$Y - C\ (Y - T) - G = I(r)$$

G and T are fixed by policy
Y is fixed by the factors of production and the production function
$Y^* - C(Y^* - T^*) - G^* = I(r)$
$S^* = I(r)$
The vertical line represents saving, the supply of loanable funds.
The downward-sloping line represents investment, the demand for loanable funds.
The intersection determines the equilibrium interest rate.



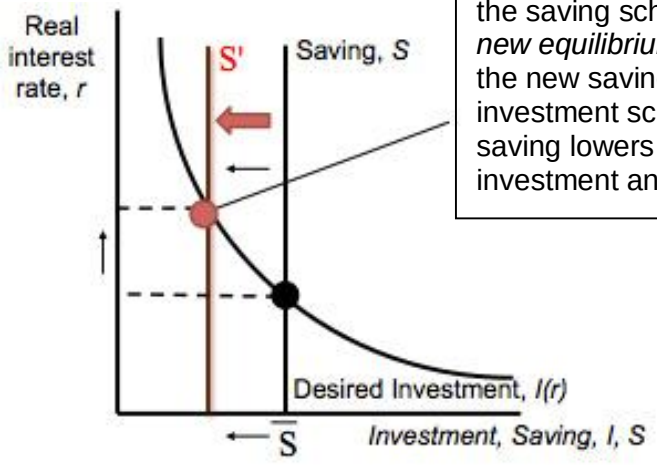
Changes in Savings: The Effects of Fiscal Policy

- An Increase in Government Purchases

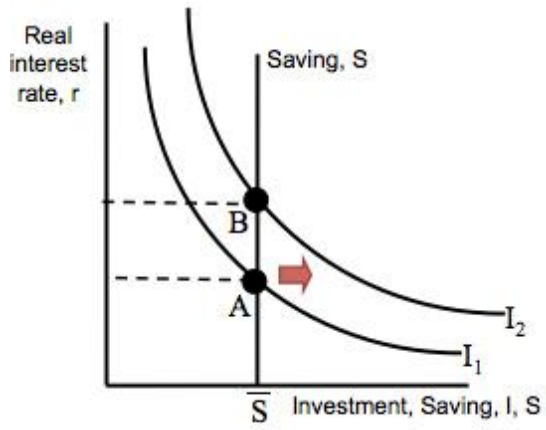
If we increase government purchases by an amount Δ*G,* the immediate impact is to increase the demand for goods and services by *ΔG.* Since total output is fixed by the factors of production, the increase in government purchases must be met by a decrease in some other category of demand. Because disposable *Y - T* is unchanged, consumption is unchanged. The increase in government purchases must be met by an equal decrease in investment. To induce investment to fall, the interest rate must rise. Hence, the rise in government purchases causes the interest rate to increase and investment to decrease. Thus, government purchases are said to ***crowd out*** investment.

- A Decrease in Taxes

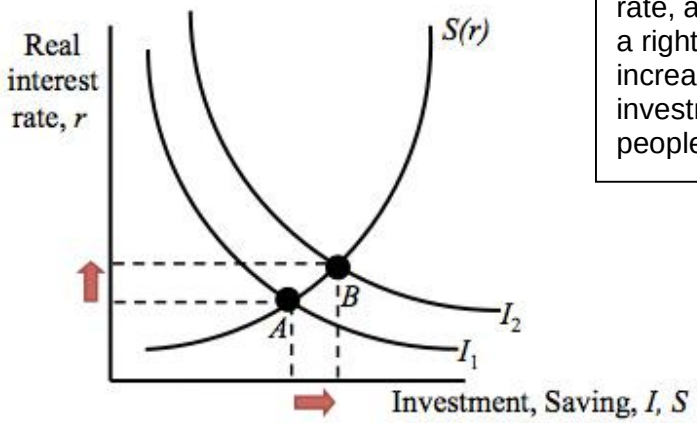
The immediate impact of a tax cut is to raise disposable income and thus to raise consumption. Disposable income rises by *ΔT,* and consumption rises by an amount equal to *ΔT* times the *MPC*. The higher the *MPC,* the greater the impact of the tax cut on consumption. Like an increase in government purchases, tax cuts crowd out investment and raise the interest rate



A reduction in saving, possibly the result of a change in fiscal policy, shifts the saving schedule to the left. *The new equilibrium* is the point at which the new saving schedule crosses the investment schedule. A reduction in saving lowers the amount of investment and raises the interest rate.



An increase in the demand for investment goods shifts the investment schedule to the right. At any given interest rate, the amount of investment is greater. The equilibrium moves from A to B. Because the amount of saving is fixed, the increase in investment demand raises the interest rate while leaving the equilibrium amount of investment unchanged.



An Increase in Investment Demand When Saving Depends on the Internet Rate
When saving is positively related to the interest rate, as shown by *the upward-sloping S(r)* curve, a rightward shift in the investment schedule *I(r),* increases the interest rate and the amount of investment. The higher interest rate induces people to increase saving, which in turn allows

Chapter 4: The Monetary system

As a medium of exchange, ***money*** is used to buy goods and services. The ease at which an asset can be converted into a medium of exchange and used to buy other things is sometimes called an asset's liquidity. Money is the economy's most liquid asset.
Money has three purposes: it is a store of a value, a unit of account and a medium of exchange.

As a **store of value**, money is a way to transfer purchasing power from the present to the future. However, money is an imperfect store of value: if prices are rising, the amount you can buy with any given quantity of money is falling.

As a **unit of account**, money provides the terms in which prices are quoted and debts are recorded.

As a **medium of Exchange**, money is what we use to buy goods and services.

The Types of Money

Money takes many forms. Money that has no intrinsic value is called ***fiat money*** because it is established as money by government degree, or fiat. Fiat money is the norm in most economies today, but most societies in the past have used commodity with some intrinsic value for money. This type of money is called ***commodity money*** (i.e. gold). When people use gold as money, the economy is said to be on a *gold standard.*

Measures of Money

There are different measures of money depending on the degree of liquidity.

The most obvious asset to include in the quantity of money is **currency** (C), the sum of outstanding paper money and coins.

A second type of asset used for transactions is **demand deposits** (M_1), the funds people hold in their checking accounts. Demand deposits are added to currency when measuring the quantity of money

$$M_1 = C + \textit{demand deposits}$$

…

Another type are the funds in savings account that can be easily transferred into checking accounts.

$$M_2 = M_1 + \textit{saving deposits} + \textit{money market mutual funds}$$

…

The Instruments of Monetary Policy

1. **Open-Market Operations**

   a. *"Open market"* of especially government bonds.
   Government promises a holder of a government bond (zero-coupon) to get a face value F in 1 year. Price today is: $P_B = \frac{F}{1+i}$ where *I* is the interest rate, therefore P_B increases as *i* decreases and vice versa.

   b. To *expand* the money supply the Central Bank (CB) buys bonds and pays for them with new money. Then the currency *C* increases and P_B increases as *i* increases.

$$C \uparrow$$
$$P_B \uparrow \Rightarrow i \downarrow$$

   c. To *reduce* the money supply the CB sells bonds and receives the existing dollars and then destroys them. Therefore:

$$C \downarrow$$
$$P_B \downarrow \Rightarrow i \uparrow$$

2. **Loans to Banks**
   The Central Bank either sets the discount rate for a commercial bank – ***Discount window*** or holds an ***Auction***, where the CB sets the quantity of loanable funds.

3. **Reserve Requirements and the interest rate on reserves**
   Reserve requirements impose a minimum value for reserve deposit ratio (*rr).* The interest rate on reserves affect to what extent banks hold *excess reserves*.

Chapter 5: Inflation

The Quantity Theory of Money

The ***quantity equation*** is an ***identity***: the definition of four variables makes it true. If one variable changes, one or more of others also change to maintain the identity. The quantity equation is the money supply (*M*) times the velocity of money (*V*) which equals price (*P*) times the number of transactions (*T*)

$$\text{Money} \times \text{Velocity} = \text{Price} \times \text{Transactions}$$
$$M \times V = P \times T$$

V in the quantity equation is called the ***transaction velocity of money.*** This tells us the number of times a dollar bill changes hands in a given period of time.

Transactions and output are related, because the more the economy produces, the more goods are bought and sold.

If *Y* denotes the amount of output and *P* denotes the price of one unit of output, then the dollar value of output is *PY*.

$$\text{Money} \times \text{Velocity} = \text{Price} \times \text{Output}$$
$$M \times V = P \times Y$$

This version of the quantity equation is called ***the income velocity of money***, which tells us the number of times a dollar bill enters someone's income in a given time.

$\frac{M}{P}$ is called ***real money balances*** that measures the purchasing power of the stock of money.

A ***money demand function*** is an equation that shows the determinants of real money balances people wish to hold.

$\left(\frac{M}{P}\right)^d = kY$ Where *k* is a constant that tells us how much money people want to hold for every dollar they earn. This equation states that *the quantity of real money balances demanded is proportional to real income.*

The money demand function is like the demand function for a particular good. Here the "good" is the convenience of holding real money balances. Higher income leads to a greater demand for real money balances. The money demand equation offers another way to view the quantity equation (*MV*= *PY*) where *V* = 1/*k*. This shows the link between the demand for money and the velocity of money. When people hold a lot of money for each dollar of income (*k* is large), money changes hands infrequently (*V* is small). Conversely, when people want to hold only a little money (*k* is small), money changes hands frequently (*V* is large).

Assumption of Constant Velocity

The quantity equation can be viewed as a definition: it defines velocity *V* as the ratio of nominal GDP*, PY,* to the quantity of money *M.* But, if we make the assumption that the

velocity of money is constant, then the quantity equation $MV = PY$ becomes a useful theory of the effects of money. The V^* means that velocity is fixed.

$$MV^* = PY$$

Money, Prices and Inflation

The factors of production and the production function determine the level of output *Y.*
The money supply determines the nominal value of output, *PY.* This follows from the quantity equation and the assumption that the velocity of money is fixed. The price level *P* is then the ratio of the nominal value of output, *PY,* to the level of output *Y.*

If *Y* is fixed because it depends on the growth in the factors of production and on technological progress, and we just made the assumption that velocity is constant,

$$MV^*=PY^*$$

or in percentage form:

$$\frac{\Delta M}{M}+\frac{\Delta V}{V}=\frac{\Delta P}{P}+\frac{\Delta Y}{Y}$$

if *V* and *Y* are fixed, then it reveals that percentage change in *M* is what induces percentage changes in *P*.
The *quantity theory of money* states that the central bank, which controls the money supply, has the ultimate control over the inflation rate. If the central bank keeps the money supply stable, the price level will be stable. If the central bank increases the money supply rapidly, the price level will rise rapidly.

Seigniorage: The Revenue From Printing Money

The revenue raised through the printing of money is called ***seigniorage***. When the government prints money to finance expenditure, it increases the money supply. The increase in the money supply, in turn, *causes inflation*. Printing money to raise revenue is like imposing an ***inflation tax***.

Real and Nominal Interest Rates

Economists call the interest rate that the bank pays the ***nominal interest rate*** and the increase in your purchasing power the ***real interest rate***

$$r = i - p$$

This shows the relationship between the nominal interest rate and the rate of inflation, where *r* is real interest rate, *i* is the nominal interest rate and π is the rate of inflation, which is simply the percentage change of the price level *P.*

The Fisher Effect

The ***Fisher equation*** illuminates the distinction between the real and nominal rate of interest.

$$i = r + p$$

The actual (market) nominal rate of interest is equal to the real rate of interest times the inflation. The one-to-one relationship between the inflation rate and the nominal interest is the ***Fisher effect***. It shows that the nominal interest can change for 2 reasons: because the real interest rate changes or because the inflate rate changes.

Ex Ante versus Ex Post Real Interest Rates

The real interest rate the borrower and lender expect when a loan is made is called the ***ex ante real interest rate***. The real interest rate that is actually realized is called the ***ex post real interest rate***. Although borrowers and lenders cannot predict future inflation with certainty, they do have some expectation of the inflation rate. Let π denote actual future

inflation and π^e the expectation of future inflation. The *ex ante* real interest rate is $i - \pi^e$, and the *ex post* real interest rate is $i - \pi$. The two interest rates differ when actual inflation π differs from expected inflation π^e.

$$i = r + E\pi$$

The *ex ante* real interest rate *r* is determined by equilibrium in the market for goods and services. The nominal interest rate *i* moves one-for-one with changes in expected inflation $E\pi$.

The Cost of Holding Money

The nominal interest rate is the opportunity cost of holding money. It is what you give up by holding money instead of bonds.

$$\left(\frac{M}{P}\right)^d = L(i, Y)$$

This equation states that the demand for the liquidity of real money balances is a function of income (*Y*) and the nominal interest (*i*). The higher the level of income *Y*, the greater the demand for real money balances.

Future Money and Current Prices

As the quantity theory of money explains, money supply and money demand together determine the equilibrium price level. Changes in the price level are the rate of inflation. Inflation affects the nominal interest rate through the Fisher effect. Because the nominal interest rate is the cost of holding money, the nominal interest rate feeds back into the demand for money.

The Social Cost of Inflation

- **The Costs of Expected Inflation**

The inconvenience of reducing money holding is called the ***shoe-leather cost*** of inflation, because walking to the bank more often induces one's shoes to wear out more quickly.

When changes in inflation require printing and distributing new pricing information, then, these costs are called ***menu costs***.

Another cost is related to tax laws. Often tax laws do not take into consideration inflationary effects on income.

- **The Costs of Unexpected Inflation**

Unanticipated inflation is unfavourable because it arbitrarily redistributes wealth among individuals. For example, it hurts individuals on fixed pensions. Often these contracts were not created in real terms by being indexed to a particular measure of the price level.
There is a benefit of inflation-many economists say that some inflation may make labor markets work better. They say it "greases the wheels" of labor markets.

Hyperinflation

Hyperinflation is defined as inflation that exceeds 50 percent per month, which is just over 1 percent a day.
Costs such as *shoe-leather* and *menu costs* are much worse with hyperinflation. Eventually, when costs become too great with hyperinflation, the money loses its role as store of value, unit of account and medium of exchange, Bartering or using commodity money becomes prevalent.

The Classical Dichotomy and Monetary Neutrality

Economists call the separation of the determinants of real and nominal variables the ***classical dichotomy***. A simplification of economic theory, it suggests that changes in the money supply do not influence real variables. This irrelevance of money fore real variables is

called ***monetary neutrality.*** For the purpose of studying long-run issues, monetary neutrality is approximately correct.

Chapter 6: The open Economy

When an economy is so-called, "open," it means that a country's spending in any given year is not equal to its output of goods and services. A country can spend more that it produces by borrowing from abroad, or it can spend less and lend the difference to foreigners.

National Income Accounts Identity in an Open Economy

$$Y = C + I + G + NX$$

Total demand for domestic output is composed of: consumption spending by households (C), investment spending by businesses and households (I), government purchases of goods and services (G) and net export or net foreign demand (NX).

$$\Updownarrow$$
$$NX = Y - (C + I + G)$$

This equation shows that in an open economy, domestic spending need not equal the output of goods and services. If output exceeds domestic spending, we export the difference: net exports are positive. If output falls short of domestic spending, we import the difference: net exports are negative.

Net Foreign Investment and Trade Balance

$$Y = C + I + G + NX$$
$$\Updownarrow$$
$$Y - C - G = I + NX$$
$$\Updownarrow$$
S stands for national saving
$$S = I + NX$$
$$S - I = NX$$

This shows that an economy's net export must always equal the difference between its saving and investment.

If $NX = 0$ there is a *balanced trade.*
If $NX > 0$ there is a *trade surplus.*
If $NX < 0$ there is a *trade deficit*.

A ***bilateral trade balance*** between two countries means that the value of what a country sells to one country is equal to the value of what it buys from that country. For example, there would be a bilateral trade balance between the United States. and China if the United States buys a pair of shoes from China valued at $300, but also sells a pair of jeans to China for $300.

Capital Mobility and the World Interest Rate

Assume a *small open economy* with perfect capital mobility in which it takes the world interest rate r^* as given, denoted $r = r^*$.

The goods market is in equilibrium if

$$Y = C + I + G + NX$$

Furthermore the economy' output *Y* is fixed by the factors of production and the production function.

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

$$C = C\,(Y - T)$$

$$I = I\,(r)$$

$$NX = (Y - C - G) - I$$

or

$$NX = S - I$$

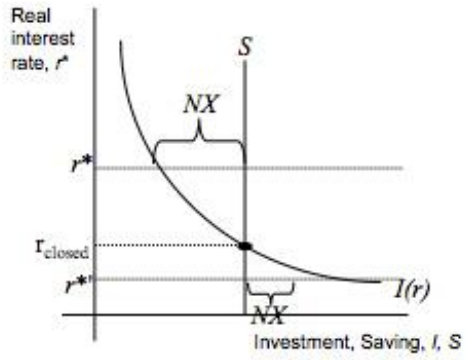
$$NX = (\bar{Y} - C(Y - T) - G) - I\,(r^*)$$

$$NX = \bar{S} - I\,(r^*)$$

This equation suggests that *the trade balance is determined by the difference between saving and investment at the world interest rate.*

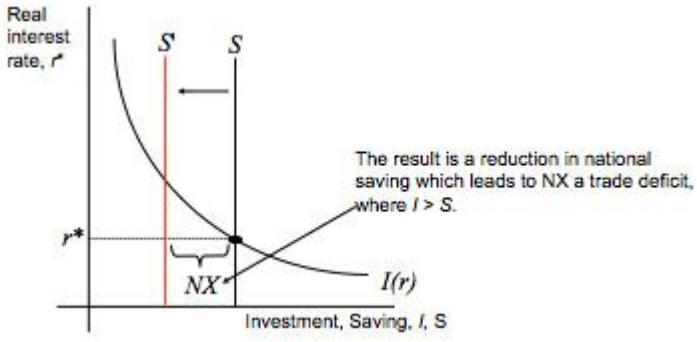
Saving and Investment in a Small Open Economy

In a closed economy, *r* adjust to equilibrate saving and investment. In a small open economy, the interest is set by world financial markets, The difference between saving and investment determines the trade balance. In this case, since *r** is above r_{closed} and saving exceeds investment; there is a **trade surplus**. If the world interest rate decreased to *r**, *I* would exceed *S* and there would be a **trade deficit.**



A Domestic Fiscal Expansion in a Small Open Economy

An increase in government purchases or a cut in taxes decreases national saving and thus shifts the national saving schedule to the left.

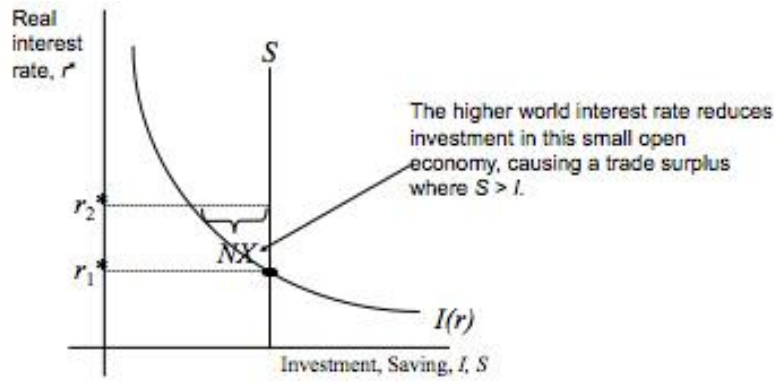


$$NX = (\bar{Y} - C(Y - T)\uparrow - G) - I\,(r^*)$$

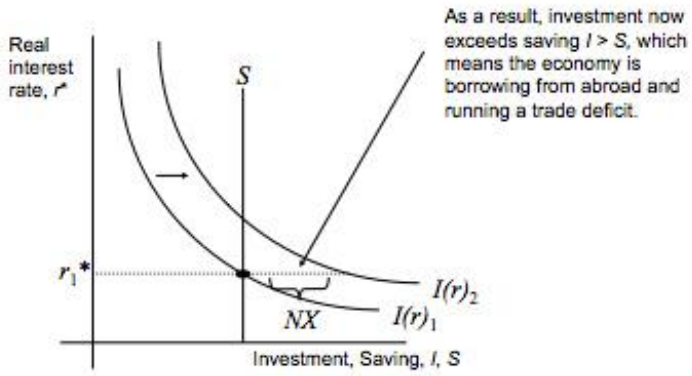
$$NX = \downarrow \bar{S} \qquad\qquad - I\,(r^*)$$

A Fiscal Expansion Abroad in a Small Open Economy

A fiscal expansion in a foreign economy large enough to influence world saving and investment raises the world interest rate from r_1* to r_2*.



A Shift in the Investment Schedule in a Small Open Economy
A outward shift in the investment schedule from *I(r)*, to $I(r)_2$ increases the amount of investment at the world interest rate *r*.*

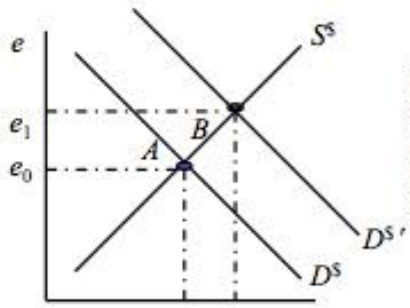


<u>The Foreign Exchange Market</u>
The foreign exchange market is a global market in which banks are connected through high-tech telecommunications systems in order to purchase currencies for their customers.

Nominal versus Real Exchange Rates
The *exchange rate* between two countries is the price at which residents of those countries trade with each other. Economists distinguish between two exchange rates: *the nominal exchange rate and the real exchange rate.*

- The *nominal exchange rate* (*e)* is the <u>relative price of the currency</u> of two countries. It is a number of units of foreign currency that you can buy with one unit of domestic currency.
- The *real exchange rate (ε)* is the <u>relative price of the goods</u> of two countries. It is a number of units of the foreign goods basket that you can trade for one unit of the domestic goods market.

<u>Appreciation and Depreciation</u>



D^S shifts rightward and increases the nominal exchange rate, *e*. This is known as ***appreciation*** of the dollar.

Events which decrease the demand for the dollar, and thus decrease *e*, would be a ***depreciation*** of the dollar.

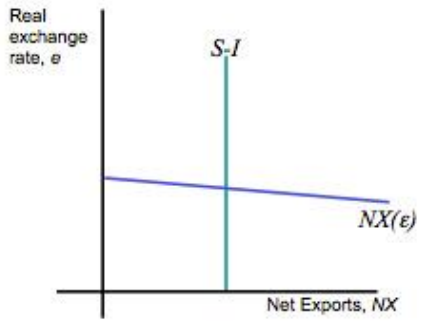
price level

- Relationship between the real and nominal exchange rate

$e = \frac{P \times e}{P*}$ where P* is the foreign aggregate

Purchasing – Power Parity

Purchasing-Power Parity suggests that nominal exchange rate movements primarily reflect differences in price levels of nations. It states that if international arbitrage is possible, then a dollar must have the same purchasing power in every country. *Purchasing power parity* does not always hold because some goods are not easily traded, and sometimes traded goods are not always perfect substitutes.

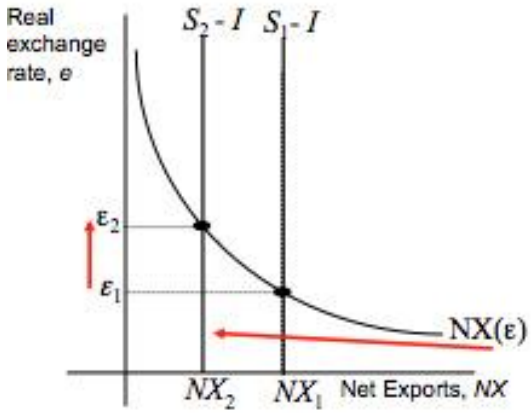


The law of one price applied to the international marketplace suggests that net exports are highly sensitive to small movements in the real exchange rate. This high sensitivity is reflected here with a very flat net-exports schedule.

The real exchange rate is determined by the intersection of the vertical line representing saving minus investment and downward-sloping net exports schedule.

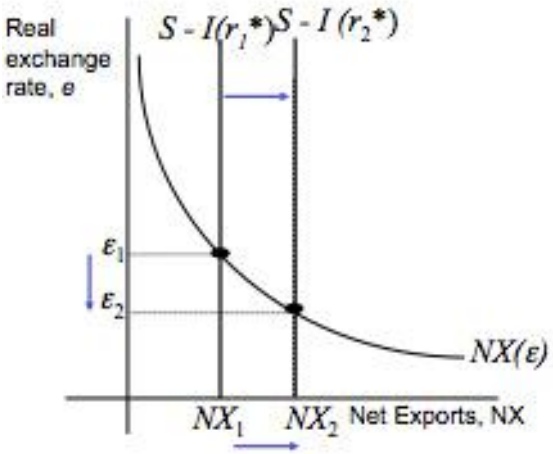
The Impact of Expansionary Fiscal Policy at Home on the Real Exchange Rate

Expansionary fiscal policy at home, such as an increase in government purchases *G* or a cut in taxes, reduces national saving. The fall in saving reduces the supply of dollars to be exchanged into foreign currency, from S_1-*I* to S_2-*I*. This shift raises the equilibrium real exchange rate from e_1 to e_2. A reduction in saving reduces the supply of dollars, which causes the real exchange rate to rise and causes net exports to fall.

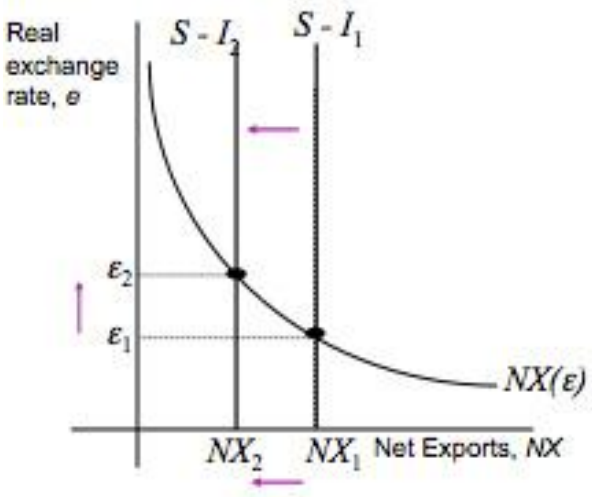


Expansionary fiscal policy abroad reduces world saving and raises the world interest rate from

r_1* to r_2*. The increase in the world interest rate reduces investment at home, which in turn raises the supply of dollars to be exchanged into foreign currencies. As a result, the equilibrium real exchange rate falls from *e*1 to *e*2.

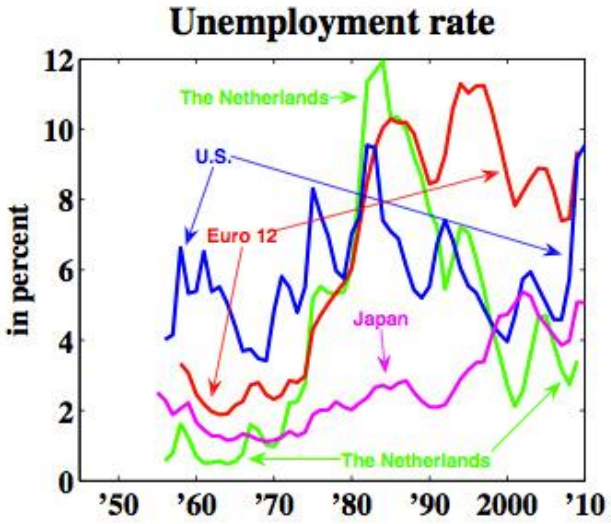


An increase in investment demand raises the quantity of domestic investment from I_1 to I_2. As a result, the supply of dollars to be exchanged into foreign currencies falls from $S - I_1$ to $S - I_2$. This fall in supply raises the equilibrium real exchange rate from e_1 to e_2.



Chapter 7: Unemployment

The average rate of unemployment around which the economy fluctuates is called the ***natural rate of unemployment.*** The natural rate is the rate of unemployment toward which the economy gravitates in the long run.



- U.S.: $u_n \approx 5-6\%$
- EURO 12: $u_n \approx 3\%$ until mid 1970's
  $u_n \approx 8-10\%$ from 1980's onwards

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Using the notation that the rate of unemployment is *U/L* we get:

$$L = E + U$$

labor force is composed of number of employed workers plus number of unemployed workers

Steady-state unemployment rate

$fU = sE \quad \Rightarrow$ *number of people finding jobs is equal to the number of people loosing jobs*

$$fU = s(L-U)$$

$$\Updownarrow$$

$$f\frac{U}{L} = s\left(1-\frac{U}{L}\right)$$

$$\Updownarrow$$

$$\frac{U}{L} = \frac{s}{(s+f)}$$

$$\Updownarrow$$

$$\frac{U}{L} = \frac{1}{\left(1+\frac{f}{s}\right)}$$

This equation shows that the steady-state rate of unemployment *U/L* depends on the rates of job separation *s* and job finding *f.*

Policy Implication
Any policy aimed at lowering the natural rate of unemployment must either reduce the ***rate of job separation*** or increase the ***rate of job finding***. Similarly, any policy that affects the rate of job separation or job finding also changes the natural rate of unemployment.

Job Search and Frictional Unemployment

- The unemployment caused by the time it takes workers to search for a job is called *frictional unemployment.*
- Economists call a change in the composition of demand among industries or regions a *sectoral shift.* Because sectoral shifts are always occurring, and because it takes time for workers to change sectors, there is always frictional unemployment.
- In trying to reduce frictional unemployment, some policies inadvertently increase the amount of frictional unemployment. One such program is called *unemployment insurance.* In this program, workers can collect a fraction of their wages for a certain period after losing their job.

Real-Wage Rigidity and Structural Unemployment

Wage rigidity is the failure of wages to adjust until labor supply equals labor demand. The unemployment resulting from wage rigidity and job rationing is called ***structural unemployment.*** Workers are unemployed not because they can't find a job that best suits their skills, but rather, at the going wage, the supply of labor exceeds the demand. These workers are simply waiting for jobs to become available.

Minimum-Wage Laws
The government causes wage rigidity when it prevents wages from falling to equilibrium levels. Many economists and policymakers believe that tax credits are better than increases in the minimum wage—if the policy goal is to increase the incomes of the working poor. The ***earned income tax credit*** is an amount that poor working families are allowed to subtract from the taxes they owe.

Economists believe that the minimum wage has the greatest impact on teenage unemployment. Studies suggest that a ***10-percent increase in the minimum wage reduces teenage employment by1 to 3 percent.***

Efficiency Wages

Efficiency-wage theories suggest that high wages make workers more productive. So, though a wage reduction would lower a firm's wage bill, it would also lower worker productivity and the firm's profits. The first efficiency-wage theory suggests that wages influence attrition. A second efficiency-wage theory contends that high wages reduce labor turnover. A third efficiency-wage theory holds that the average quality of a firm's workforce depends on the wage it pays its employees. A fourth efficiency-wage theory holds that a high wage improves worker effort.