MACROECONOMICS

GTGKG1122BNA

WEEK 1 & 2

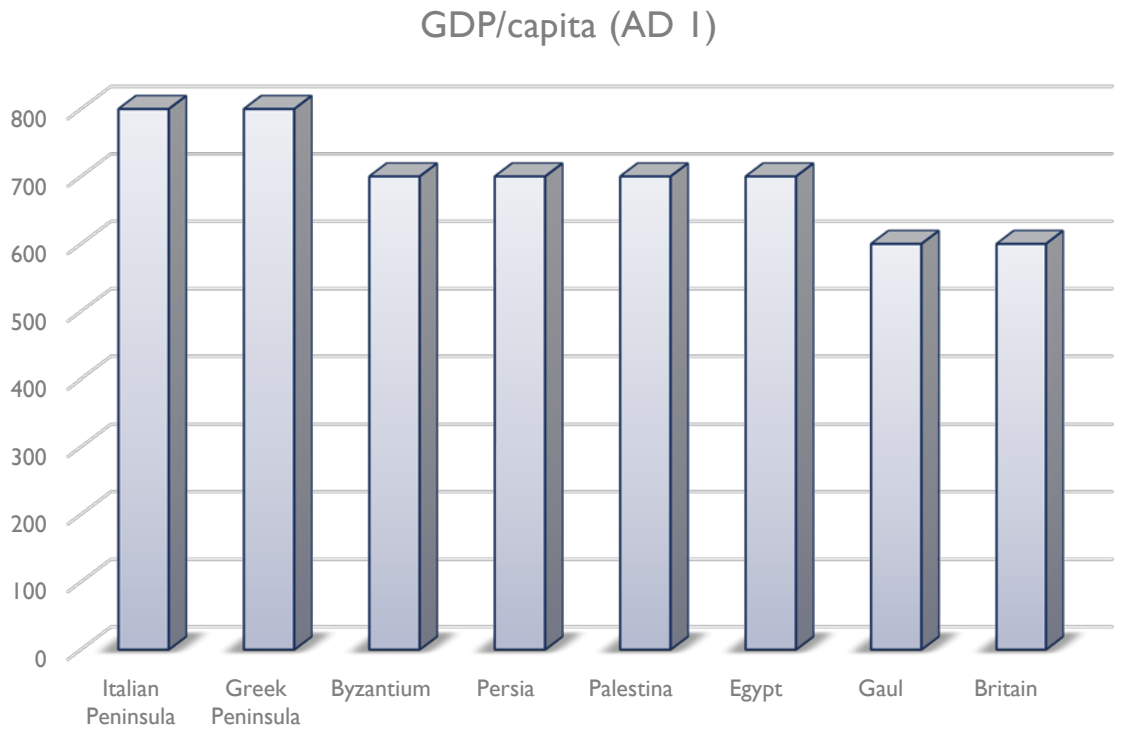
INTRODUCTION

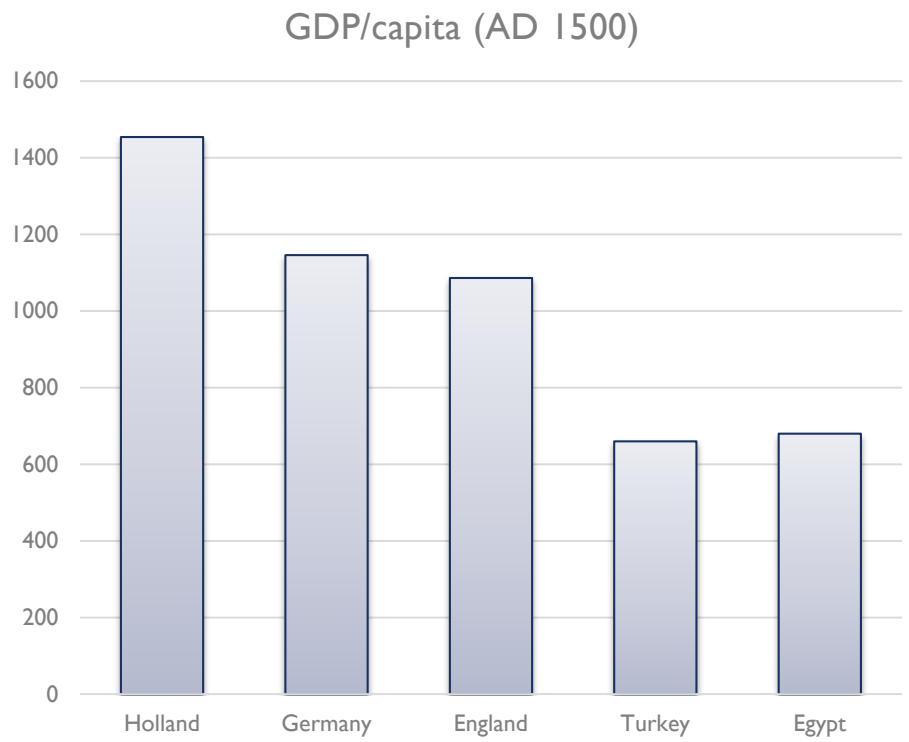
MEASURING THE ECONOMIC PERFORMANCE: GDP

THE WEALTH OF NATIONS

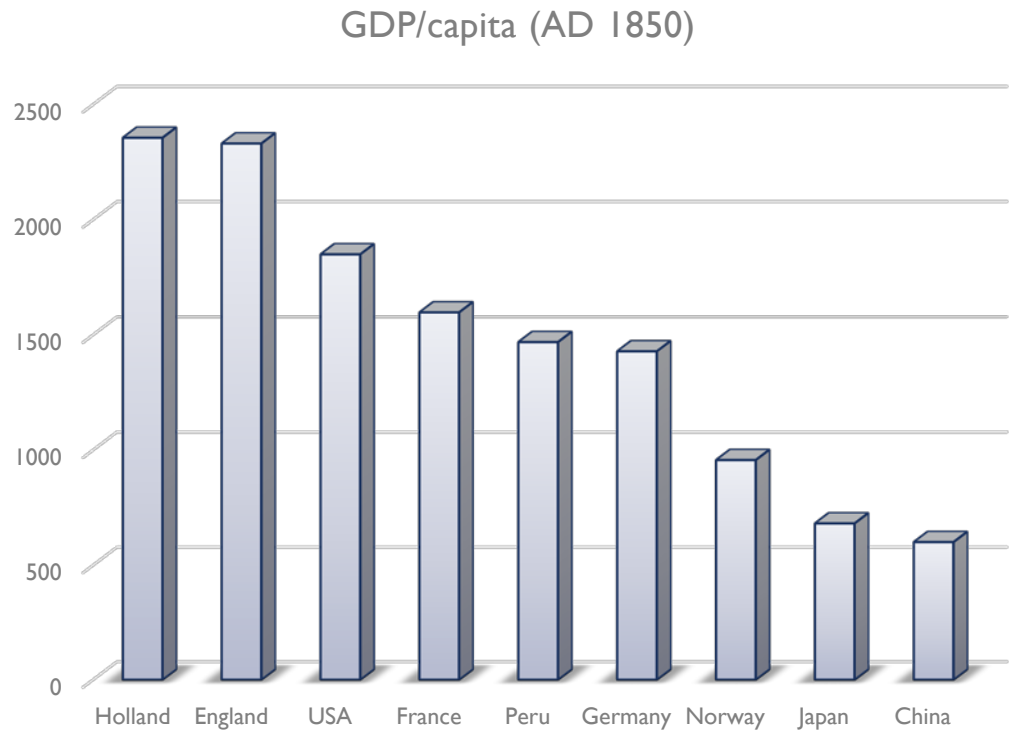
- What makes a country rich?
  - Relevant because: resources are limited, and ~99% of the people want more than they can have
- Why are not all the countries rich?
- How do you measure richness/wealth?
- Can you increase the wealth artificially, by intervening into the economy?
- Is there an upper limit to wealth? What is the maximum level of wealth a country can reach in a certain timeframe?

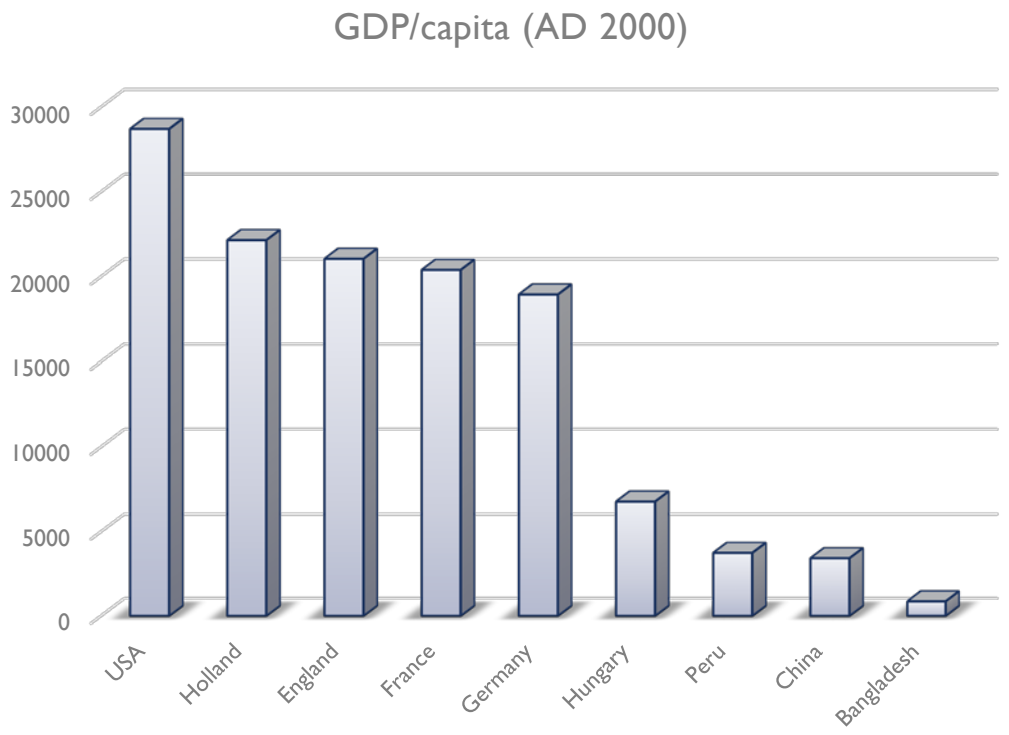
COMPARING THE WEALTH OF NATIONS #1 (HTTP://WWW.GGDC.NET/MADDISON/MADDISON-PROJECT/HOME.HTM)



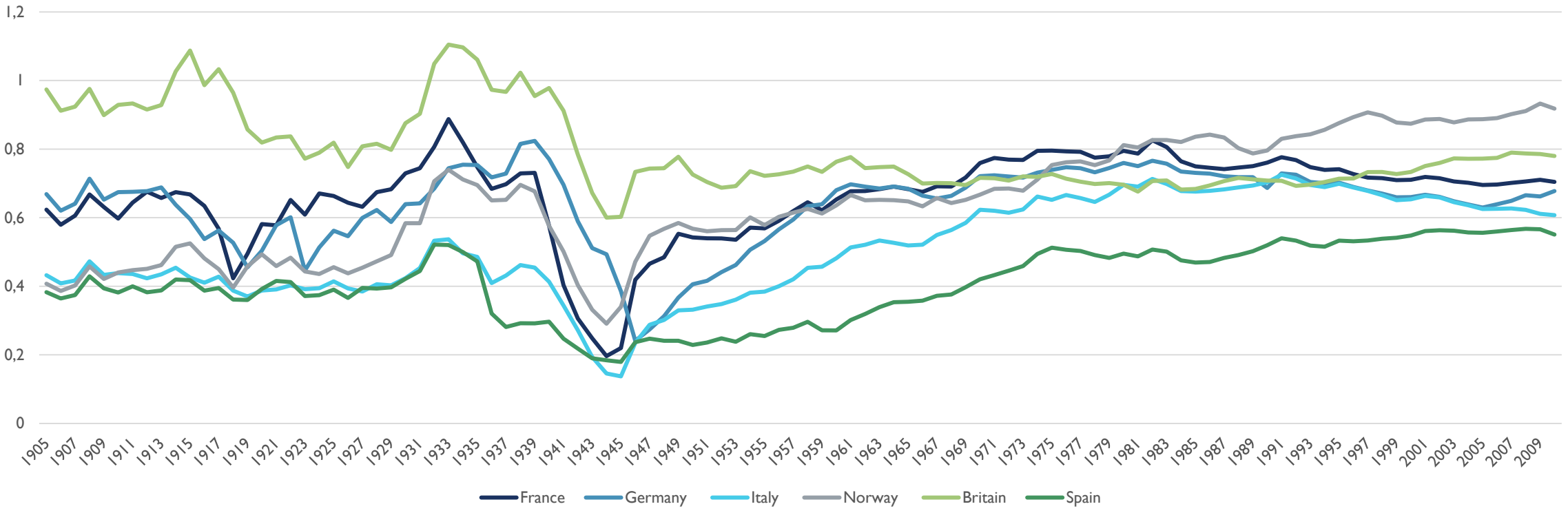


COMPARING THE WEALTH OF NATIONS #2 (HTTP://WWW.GGDC.NET/MADDISON/MADDISON-PROJECT/HOME.HTM)

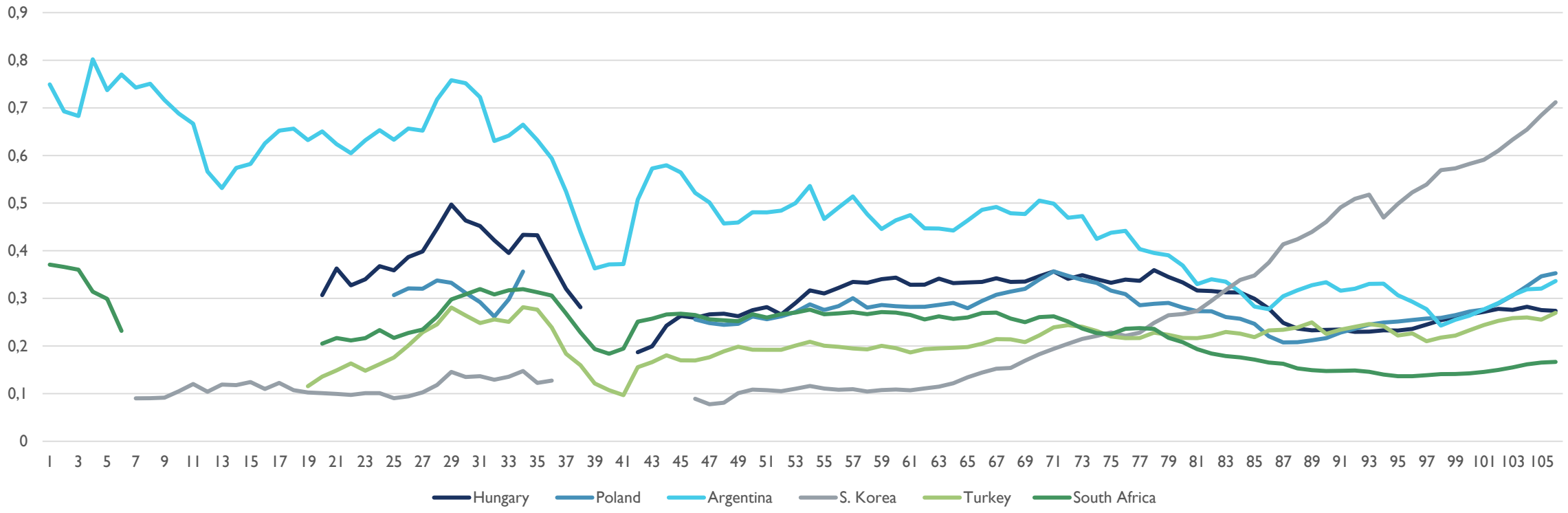




COMPARING THE WEALTH OF NATIONS #3 USA GDP/CAPITA=100% (HTTP://WWW.GGDC.NET/MADDISON/MADDISON-PROJECT/HOME.HTM)



COMPARING THE WEALTH OF NATIONS #4 USA GDP/CAPITA=100% (HTTP://WWW.GGDC.NET/MADDISON/MADDISON-PROJECT/HOME.HTM)



CALCULATING THE WEALTH OF NATIONS

- The **Output Approach** sums the gross value added of various sectors, plus taxes and less subsidies on products. Gross value added is defined as the value of all newly generated goods and services less the value of all goods and services consumed in their creation.

- The **Expenditure Approach** calculates GDP by adding together the four components of spending (C, I, G, and EX - IM).
  - Personal Consumption Expenditures (C) are expenditures by consumers on final goods and services.
  - Investment (I) is the purchase of new capital goods.
  - Government Consumption (G) includes expenditures by the government for final goods and services.
  - Net Exports (EX-IM) is the difference between exports and imports.

- The **Income Approach** adds income items to obtain national income. It is the sum of compensation of employees (wages and salaries), proprietor's income, rental income, corporate profits, net interest, indirect taxes minus subsidies, net business transfer payments, and the surplus of government enterprises.

GROSS DOMESTIC PRODUCT (GDP)

- **Gross Domestic Product** is the total market value of a country's output. It is the market value of all final goods and services produced in a country during a calendar year by factors of production located within that country.
- **Final Goods and Services** mean those that are not produced for either resale or for use in the production of other goods.
- **Intermediate goods** are produced by one firm for use by another firm to produce a final good (or another intermediate good). Intermediate goods are not added separately in order to avoid double counting. Double counting can also be avoided by adding up national income using the value added approach.
- **Value added** is the difference between a firm's total revenue and what it pays other firms for intermediate goods. Value added includes wages and salaries, rent, interest, and profits. (Ignore taxes for the moment.)

SYSTEM OF NATIONAL ACCOUNTS HTTP://UNSTATS.UN.ORG/UNSD/NATIONALACCOUNT/SNA.ASP

- Value added = Gross output – Intermediate consumption → **GDP**
  - The value added includes values created with fixed capital (e.g. machines, buildings), but these items lose a certain part of their value when they are used to produce goods and services: depreciation (~consumption of fixed capital)
  - Net version of the indicator: Net Domestic Product (**NDP**) = GDP – depreciation
  - Depreciation or the consumption of fixed capital is extremely difficult to measure
- In an open economy the residents of a country may have acces to less/more income than the value added: some of the income can come from abroad, or can go outside the country
  - **GNI** (Gross National Income): the sum of gross primary incomes receivable by resident institutional units or sectors.
  - GNI = GDP – primary incomes payable to non-resident units + primary incomes receivable from non-resident units
  - Typical primary incomes: wages and capital incomes (profits, interest payments, earnings per share)
  - Net National Income (**NNI**) = GNI – depreciation
- Some of the primary incomes can be used to pay transfers to non-residents (e.g. foreign aid, contributions to the EU budget)
  - **GNDI:** the income available to the total economy for final consumption and gross saving
  - Gross National Disposable Income (GNDI) = GNI – current transfers payable to non-resident units + current transfers receivable by resident units from the rest of the world
  - **NNDI** = GNDI – Depreciation

DIFFERENT VERSIONS OF THE GDP: NOMINAL AND REAL

- **Nominal GDP**: Value of goods and services measured at current prices.
- nGDP=$P_xQ_x + P_yQ_y$
- **Real GDP**: the value of goods and services measured at constant prices.
- rGDP= $P_{x0}Q_{x1} + P_{y0}Q_{y1}$
- **GDP deflator**: The ratio of nominal GDP to real GDP

$$\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} = \frac{P_{x1}Q_{x1} + P_{y1}Q_{y1}}{P_{x0}Q_{x1} + P_{y0}Q_{y1}}$$

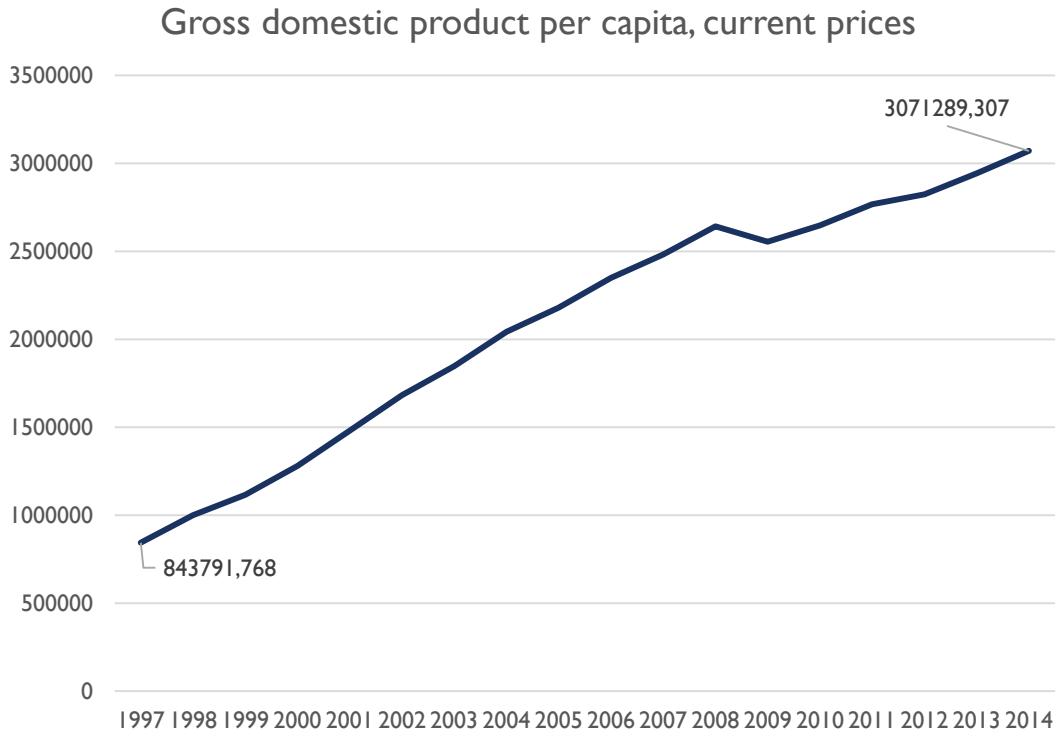
- **Consumer Price Index** (CPI): tells us how much it costs now to buy a basket relative to how much it cost to buy the same previously.

$$\text{CPI} = \frac{P_{x1}Q_{x0} + P_{y1}Q_{y0}}{P_{x0}Q_{x0} + P_{y0}Q_{y0}}$$

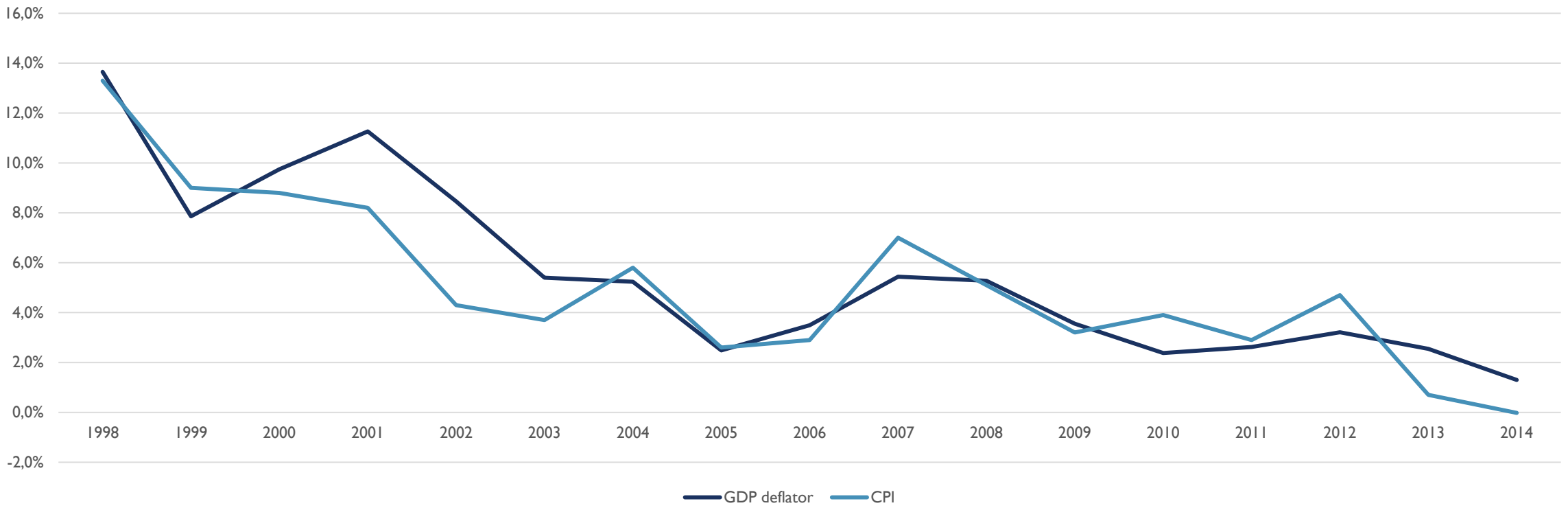
DIFFERENT VERSIONS OF THE GDP: NATIONAL CURRENCY AND USD OR EURO

- Typically, the standard of living of two countries is compared by calculating the GDP per capita values
- The GDP per capita are only comparable if they were calculated
  - the same way,
  - in the same currency.
- The USD is the usual common currency, however European countries use the Euro as well
- Hungary's GDP was 30,000 billion HUF in 2013. If 1€=300HUF, Hungary's GDP was 100 billion Euro in that year
- Problem with the above:
  - These comparisons are made to assess the standard of living of a country – roughly speaking standard of leaving = how much you can buy with your income
  - Exchange rates often do not reflect the price levels of the countries (less developed countries tend to have lower price levels)
  - E.g. an Erasmus student gets €300/month to cover the living costs in Hungary. €300 buys him at least 300 beers in Hungary, but less than 200 beers in Germany
- Purchasing Power Parity (PPP): to counter this problem, statistical offices calculate the differences in price levels, and recalculate the GDP to reflect those differences
  - The GDP of a less developed country will be higher when calculated with PPP

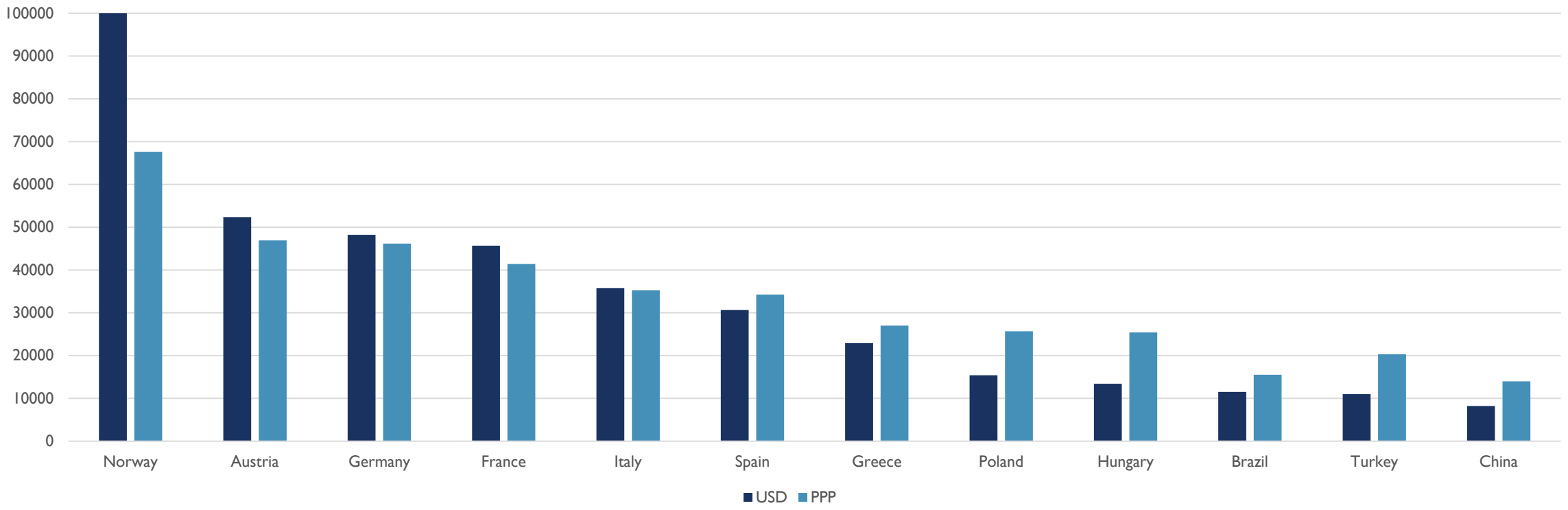
GDP/CAPITA OF HUNGARY (IN HUF)



GDP DEFLATOR AND CPI VALUES IN HUNGARY (CHANGES ON PREVIOUS YEAR)



GDP PER CAPITA CALCULATED WITH OFFICIAL EXCHANGE RATES AND WITH PPP



LIMITS TO GDP

- Most **nonmarket and domestic activities are not counted in GDP** even though they often involve production of a good or service. Real GDP omits household production, it underestimates the value of the production of many people, most of them women.
- **Underground production** (grey and black economy) is unreported, it is omitted from GDP.
- **Health and Life Expectancy**: Good health and a long life do not show up directly in real GDP.
- GDP seldom reflects losses or social ills and has nothing to say about the **distribution of output among individuals** in a society.
- GDP is neutral about the **kinds of goods** an economy produces.
- **Environment quality**: Pollution is not subtracted from GDP. We do not count the deteriorating atmosphere as a negative part of GDP. If our standard of living is adversely affected by pollution, our GDP measure does not show this fact. depreciation of natural resources
- Our working time is valued as part of GDP, but our **leisure time** is not.
- **Political Freedom** and Social Justice: A country might have a very large real GDP per person but have limited political freedom and social justice. A lower standard of living than one that had the same amount of real GDP but in which everyone enjoyed political freedom.

INDEX OF SUSTAINABLE WELFARE (ISEW) (DALY AND COBB, 1989)

- ISEW = Cadj + P + G + W - D - E - N

- where
  - Cadj = consumer spending adjusted for inequality
  - P = public expenditures excluding defensive expenditures
  - G = growth in capital and net change in international position
  - W = non monetarised contributions to welfare
  - D = defensive private expenditures
  - E = costs of environmental degradation
  - N = depreciation of the environmental capital base

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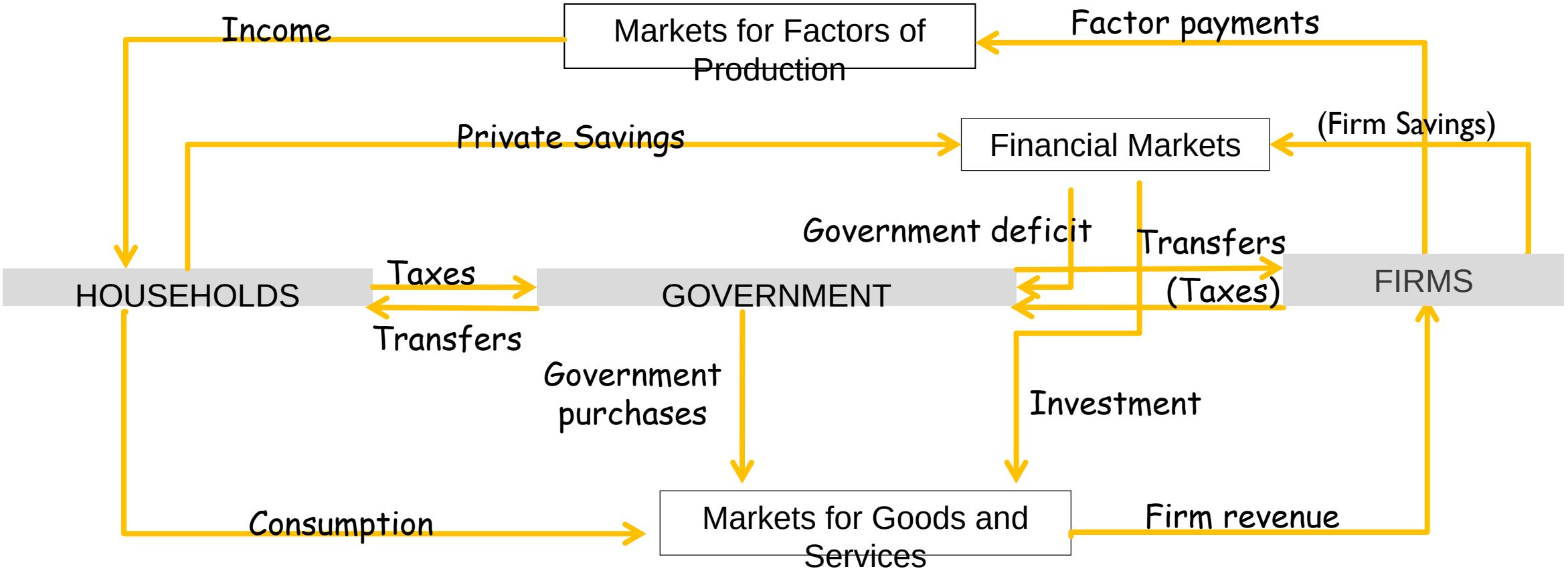
WEEK 3

PRODUCTION, DISTRIBUTION AND ALLOCATION OF THE NATIONAL INCOME

THE CIRCULAR FLOW OF INCOME

THE CIRCULAR FLOW OF INCOME



CONSUMPTION

- Income that the households receive=Y, the output of the economy
- Government taxes Y by an amount of T → **disposable income**: the income after the payment of all taxes, Y-T
- Disposable income is divided between consumption (C) and savings (S)
- Consumption is the function of disposable income → C=C(Y-T)
- **Consumption function**: the relationship between consumption and disposable income.
- **Marginal propensity to consume** (MPC): is the amount consumption changes when disposable income increases by one dollar. 0<MPC<1
- **Marginal propensity to save** (MPS): the amount savings changes when the disposable income increases by one dollar 0<MPC<1
- MPC+MPS=1
- The slope of the Consumption function tells us how much consumption increases when disposable income increases by 1 dollar → the slope of C function is MPC

INVESTMENT

- The quantity of investment depends on the **interest rate**, which measures the cost of the funds used to finance investment. For an investment project to be profitable its return must exceed its cost.
- The interest rate is in inverse proportion to the investment goods demanded.
- **Nominal interest rate**: the rate of interest that the investors pay to borrow money.
- **Real interest rate** is the nominal interest rate corrected for the effects of inflation. Real interest rate=Nominal interest rate - inflation.
- Investment depends on real interest rate → I = I(r)
- **Investment function**: Shows the relationshipp between the interest rate and the quantity of investement demanded. Its slope downwards because as the interest rate increases, the quantity of investment demanded decreases

GOVERNMENT PURCHASE

- Transfers are opposite of taxes, because the households' disposable income is decreased by the tax, but increased by the transfers.
- T=tax-transfer (tax is income for the state but transfer is expenditure)
- 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** (government debt occurs)
- If G < T, then the government is running a **budget surplus**.
- We take the level of government spending and taxes as given. → exogenous variable → they are fixed:

$$\boxed{G = \overline{G}}$$

$$\boxed{T = \overline{T}}$$

- The endogenous variables in our model will be consumption, investment and interest rate.

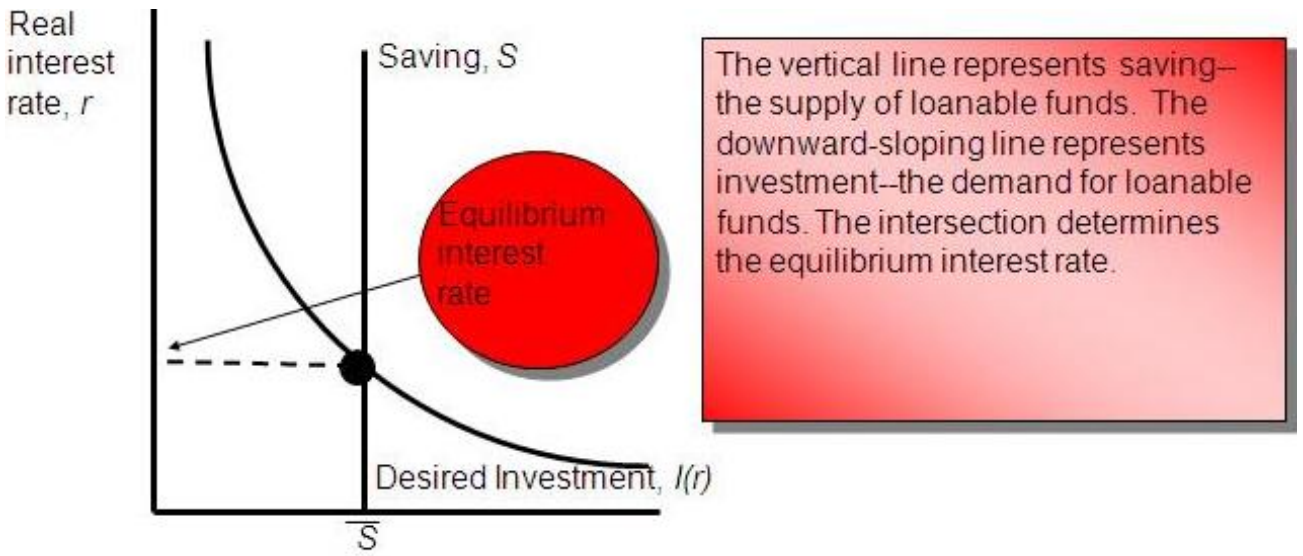
EQUILIBRIUM AND THE INTEREST RATE

- What Brings the Supply and Demand for Goods and Services Into Equilibrium?

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

- Substituting all of our equations into the national income accounts identity, we obtain: $Y = C(Y - T) + I(r) + G$
- As G and T are fixed, just like Y by the factors of production:
- $\overline{Y} = C(\overline{Y} - \overline{T}) + I(r) + \overline{G}$
- At the equilibrium interest rate, the demand for goods and services equals the supply.

- Interest rate is the cost of borrowing and the return to lending in financial markets
- Y-C-G=I → Y-C-G is the output that remains after the demands of the consumers and the government are satisfied = **national savings**
- Savings = Investments
- (Y-T-C)+(T-G)=I → private savings: Y-T-C, public savings: T-G
- National saving is the sum of private and public saving.
- $\overline{Y} - C\,\overline{(Y - T)} - \overline{G} = I(r)$
- $\overline{S} = I(r)$



CHANGES IN SAVINGS: EFFECTS OF FISCAL POLICY

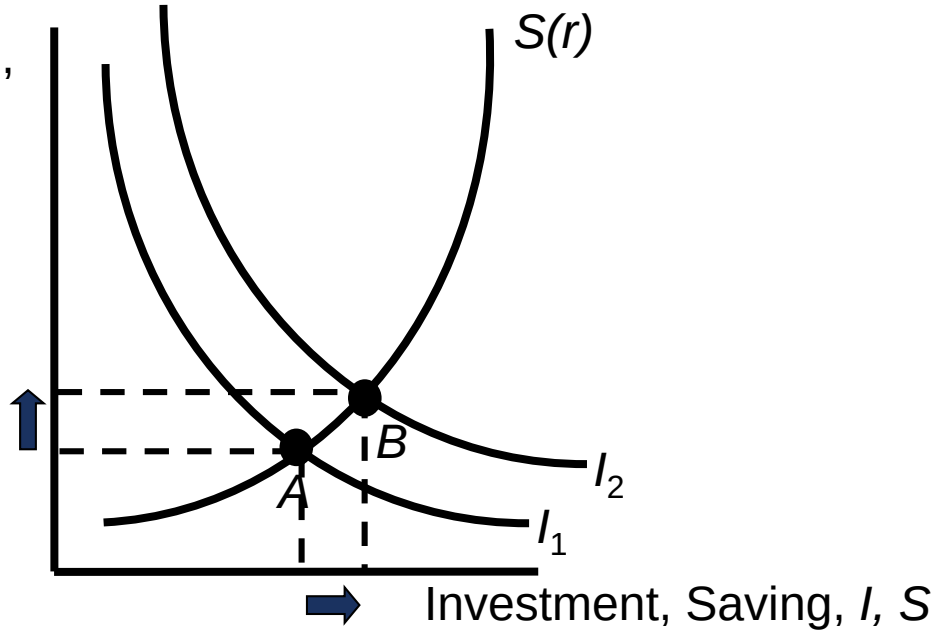
- An Increase in Government Purchases: increase government purchases by an amount DG, the immediate impact is to increase the demand for goods and services by DG. Total output is fixed by the factors of production, the increase in government purchases causes a decrease in some other category of demand. Because disposable Y-T is unchanged, consumption is unchanged. The increase in government purchases causes an equal decrease in investment. → the interest rate must rise.
- G rises → r increases → I decreases → Government purchases crowd out investment.

- A Decrease in Taxes: by DT → raise of disposable income by DT and consumption by an amount equal to DT times the MPC. The higher the MPC, the greater the impact of the tax cut on consumption. Output is fixed, G is fixed, so increase in C means a decrease in I, → Like an increase in government purchases, tax cuts crowd out investment and raise the interest rate.

- Both fiscal policy decisions shifts the saving schedule to the left

CHANGES IN INVESTMENT DEMAND

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



IDENTIFICATION PROBLEM

- Relationship between interest rate and investment:

1. fiscal policy → S is increasing (shifts to the right), r is decreasing, amount of I is increasing
2. tecnological innovation → I is shifting to the right, S unchanged, although the interest rate is increasing, the investment amount will increase
3. mixed situation → sometimes change in r is caused by the change in S, sometimes by the change in I → difficult to identify the relationship between r and I

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WEEK 4-5

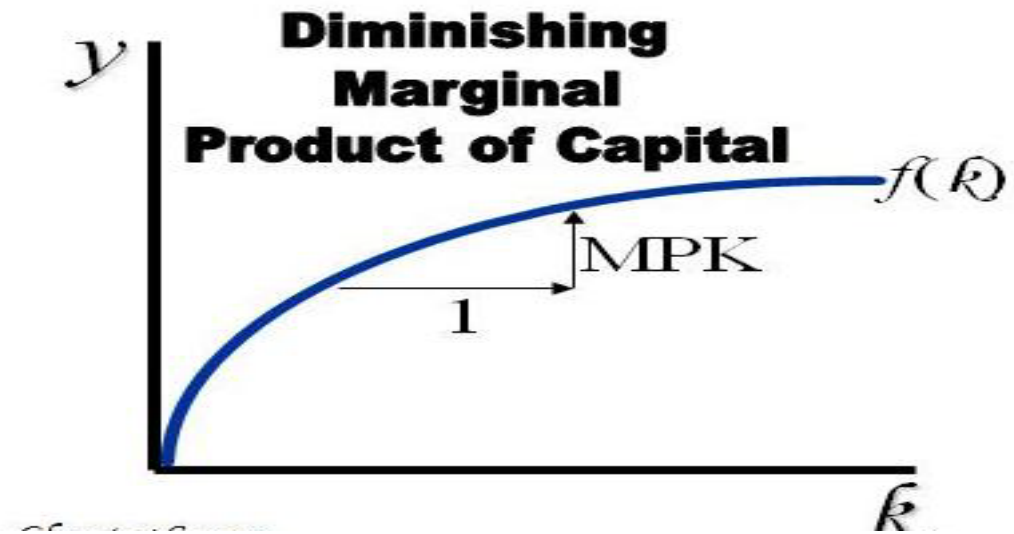
ECONOMIC GROWTH

THE SOLOW MODEL

ACCUMULATION OF CAPITAL

- Supply of Goods and Production Function
  - The production function: $Y = F(K, L)/L$
  - $Y/L = F(K/L, 1)$
  - Quantities per worker:
  - $y = f(k)$, the slope is MPK

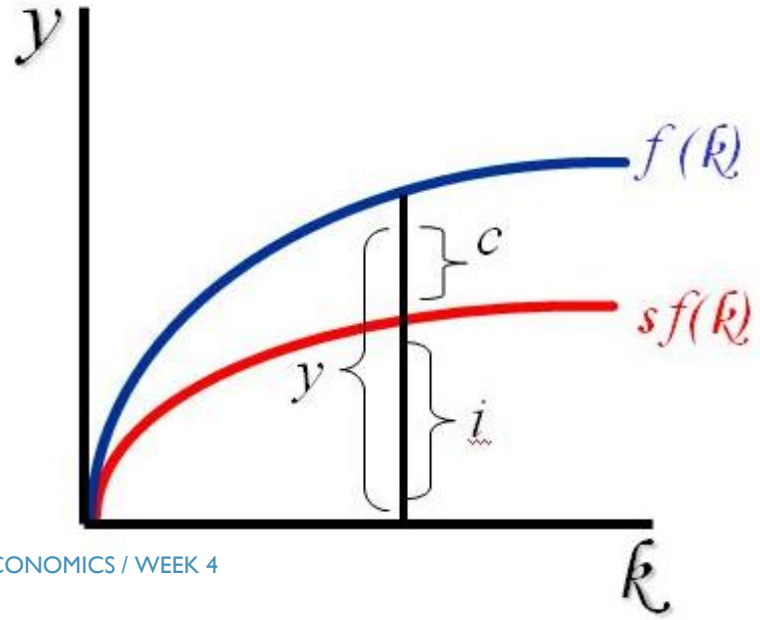
- Demand for Goods and Consumption Function
  - $y = c + i$
  - $c = (1-s)y$; consumption per worker depends on savings rate
  - $y = (1-s)y + i$ $(0<s<1)$
  - $i = sy$ → Investment = savings. The rate of saving (s) is the fraction of output devoted to investment.



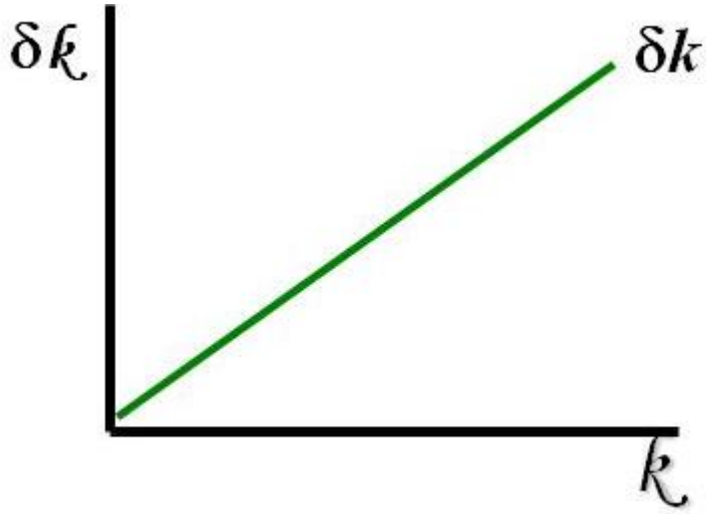
THE GROWTH OF CAPITAL

Two forces that influence the capital stock: Investment (increase) and depreciation (decrease)

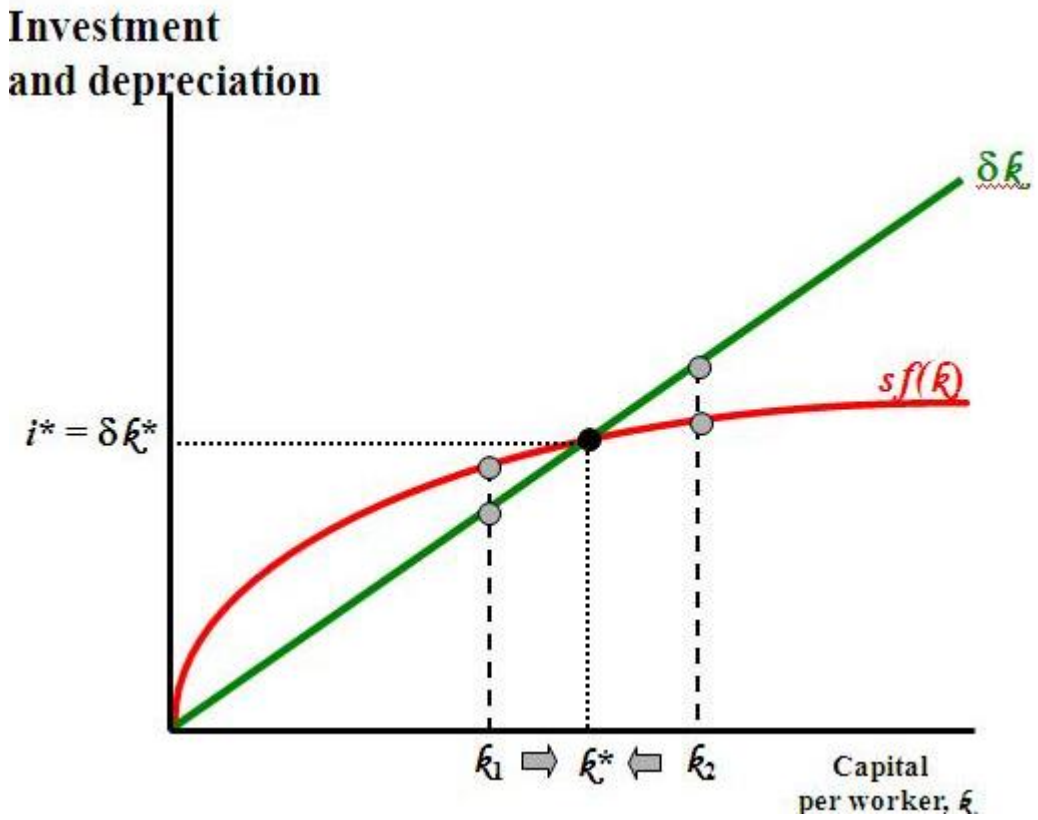
- **Investment**: i=sy → substitute the production function i=sf(k)
- Investment per worker as a function of the capital stock per worker.



- **Depreciation**: Impact of investment and depreciation on the capital stock: ***Dk = i –dk***
- Investment equals savings: ***Dk = s f(k) – dk***
  →Depreciation is proportional to the capital stock.



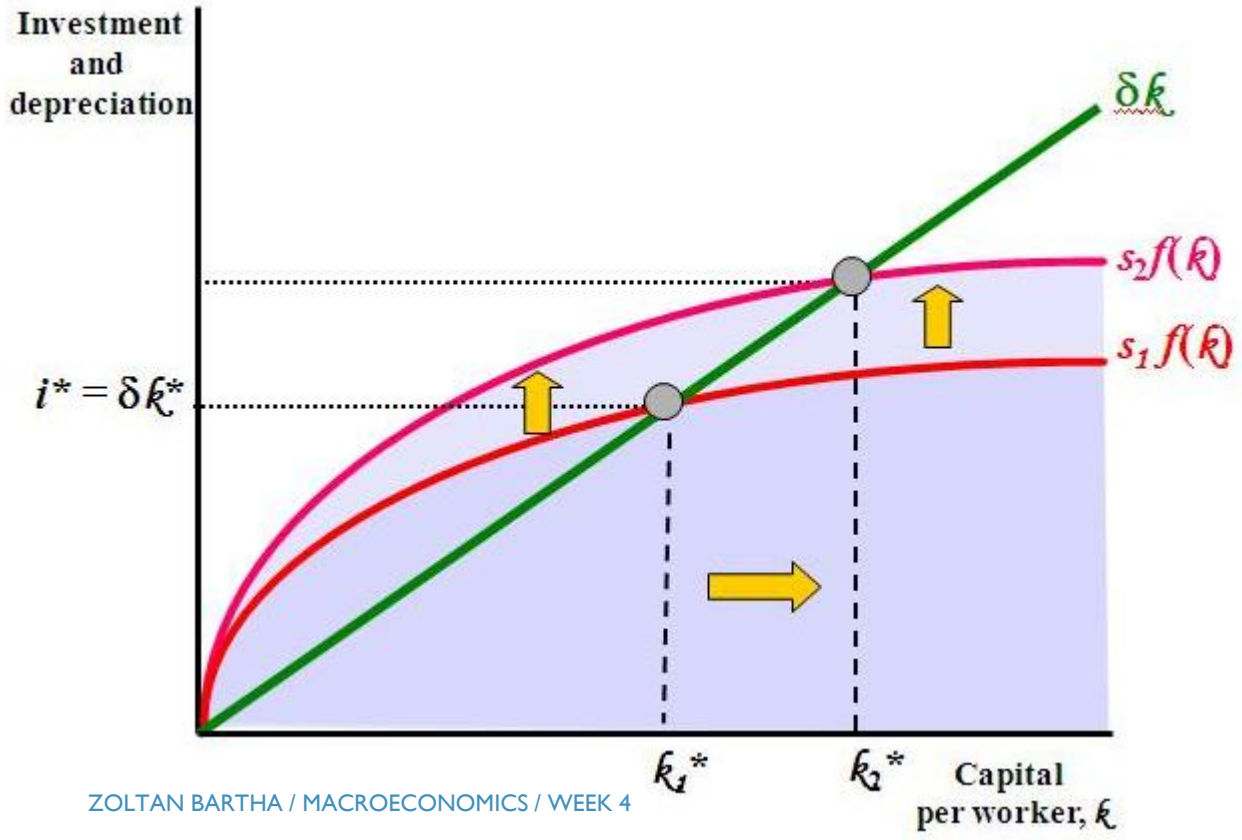
THE STEADY STATE (K*)
LONG-RUN EQUILIBRIUM OF THE ECONOMY



- At k*: Investment=depreciation, capital won't change
- Below k* (k_1): investment >depreciation, the capital stock grows.
- Above k* (k_2): depreciation > investment, the capital stock shrinks.

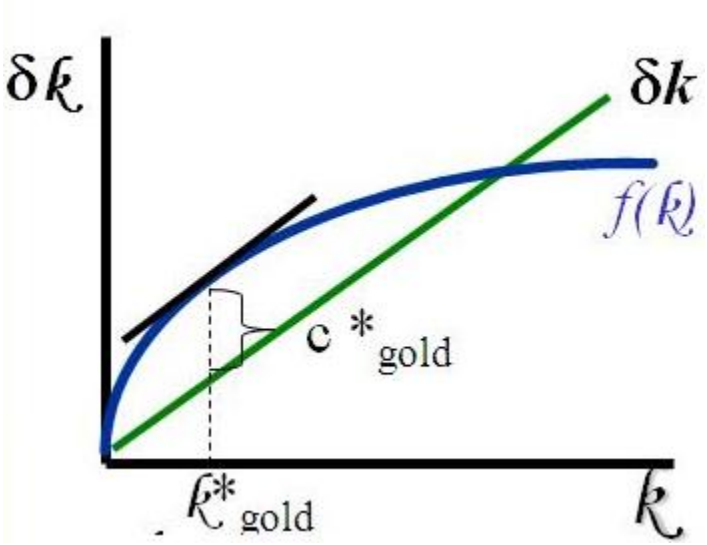
- $\Delta k = sf(k) - \delta k$; In the steady state capital is not changing→ $\Delta k = 0 \rightarrow sf(k^*) - \delta k^* = 0 \rightarrow \mathbf{sf(k^*) = \delta k^*}$

CHANGES IN THE SAVINGS RATE



- An increase in the saving rate → the capital stock grow to a new steady state.
- High saving rate → a large capital stock and high level of output.
- Low saving rate → a small capital stock and a low level of output.

THE GOLDEN RULE LEVEL OF CAPITAL



- *The steady-state value of k that maximizes consumption* is called the **Golden Rule Level of Capital**. (k^*_{gold})
- national income accounts identity: y = c+i → c = y-i
- Substitute steady-state values: Steady-state output per worker is **f (k*)**; capital stock is not changing in the steady state, investment =depreciation δk^*. → steady-state consumption per worker $c^* = f(k^*) - \delta k^*$
- In the k^*_{gold} the slope of the production function (MPK) is equal to the slope of the depreciation function (δ) → **At the Golden Rule level of capital**, the marginal product of capital equals the depreciation rate.
  - **MPK=δ**

THE TRANSITION TO THE GOLDEN RULE STEADY STATE

- Starting with MORE capital than in the Golden Rule
  - To reach Golden Rule Steady State „s" must be decreased
  - Immediate increase in consumption and decrease in investment
  - Reaching the Golden Rule → k, y, c, i fall to new steady state
  - Consumption is higher than before
  - produces higher c at all points of time
- Starting with LESS capital than in the Golden Rule
  - To reach Golden Rule Steady State „s" must be increased
  - Immediate decrease in consumption and increase in investment
  - Reaching the Golden Rule → k, y, c, i rise to new steady state
  - Consumption is higher than before
  - Reaching the Golden Rule requires reducing consumption today to increase consumption in the future

POPULATION GROWTH

- Assumption: the population and the labour force grows at a constant rate „n”
- Change in the stock of capital per worker: $\Delta k = sf(k) - (\delta+n)k$
  - $(\delta+n)k$ → **break-even investment**: *the amount necessary to keep constant the capital stock per worker (k).*

- **The steady state:** $\Delta k=0 \rightarrow sf(k^*) = (\delta+n)k^*$

- **Golden rule:** c is maximal if **MPK=δ+n** or MPK- δ= n
- **The effect of population growth:** if n increases, it reduces the steady state level of capital per worker→ the Solow model predicts that economies with higher rates of population growth will have lower levels of capital per worker and therefore lower incomes.
  - Change in the GDP = n
  - Change in the GDP/capita = 0

TECHNOLOGICAL PROGRESS

- Efficiency of labor: E → Y = F(K,L*E), where L*E measures labour force in efficiency units
  - g → rate of labor-augumenting technological progress
- Technological progress causes *E* to grow at the rate *g*, and *L* grows at rate *n* so the number of labour force efficiency *L*E* is growing at rate *n* + *g*.
- The change in the capital stock per worker is: $\Delta k = i - (\delta + n + g)k$, where $i = sf(k)$.
- **The steady-state:** $sf(k^*) = (\delta + n + g)k^*$

  In the steady state, investment *sf(k)* exactly offsets the reductions in *k* because of depreciation, population growth, and technological progress.
- **Golden rule:** $MPK = \delta + n + g$ or $MPK - \delta = n + g$
- The effect of technological progress:
  - Change in the GDP/capita = g

ECONOMIC POLICY IMPLICATIONS (1)

1. Evaluating the Rate of Saving
   - Golden Rule steady state, (MPK – d) = (n + g)
   - If the economy is operating with less capital than in the Golden Rule steady state, then (MPK–d) >(n+g) → saving rate must be increased
   - If the economy is operating with more capital than in Golden Rule steady state, then (MPK–d) <(n+g) → saving rate must be decreased

2. Changing the Rate of Saving
   - Public Saving=T-G → through fiscal policy, changing T or G
   - Private Saving
   - Through monetary policy: changing the rate of return (r)
   - Through fiscal policy: tax rate (eg. High tax rate on capital income)

ECONOMIC POLICY IMPLICATIONS (2)

3. Allocating the economy's investment
   - Traditonal types of capital, newer types (households and firms)
   - Infrastructure (government)
   - Human capital
   - Must encourage the type of investment with the highest MPK

4. Encouraging Technological Progress
   - Many policies encouraging technological innovation
   - Patent system → gives temporary monopoly to investors of new products
   - Government agencies subsidize basic research
   - Government encourages R&D

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WEEK 6

LABOUR MARKET

UNEMPLOYMENT THEORIES

LABOUR FORCE

- How can be counted as a member of the labour force?
- Population structure:
  - Total population
  - Working age population ←→ Population below or above working age
  - Labour force ←→ Inactive population
  - Employed labour force ←→ Unemployed labour force

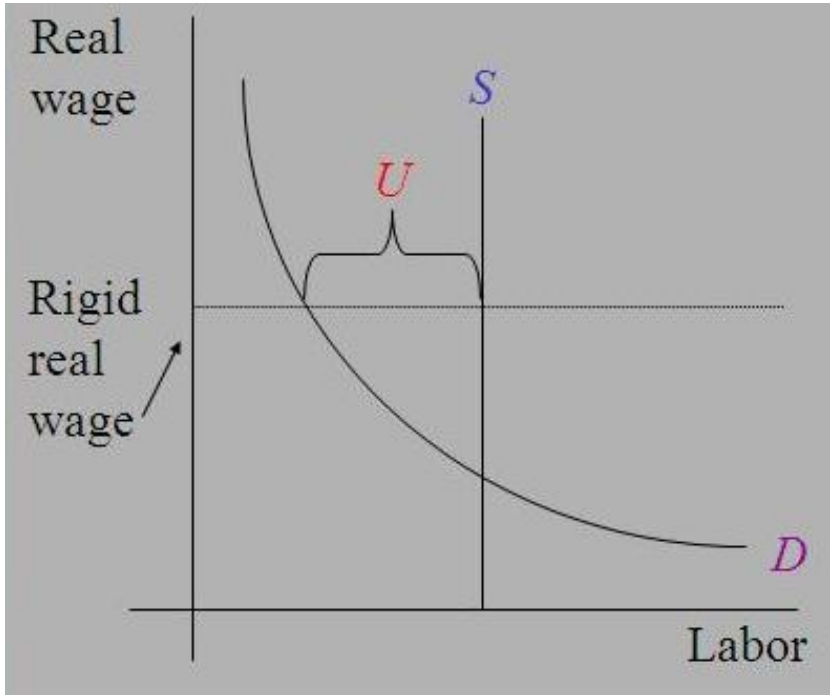
NATURAL RATE OF UNEMPLOYMENT

- The average rate of unemployment around which the economy fluctuates is called the natural rate of unemployment. The rate of unemployment toward which the economy gravitates in the long run.
- L=Labour force; E= Number of employed workers; U= Unemployed workers
- L=E+U → rate of unemployment: U/L
- Rate of job separation (s): The fraction of employed individuals who lose their job each month (period).
- Rate of job finding (f): The fraction of unemployed individuals who find a job each month (period).
- Steady-state in the labour market: f*U=s*E → f*U=s*(L-U)
- The rate of unemployment depends on s and f.
- The higher the s, the higher the unemployment rate, the higher the f, the lower the unemployment rate is.
- 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.

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.
- Economic policies to reduce frictional unemployment
- There are government programmes inadvertently increase the amount of frictional unemployment → 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 WAIT UNEMPLOYMENT



- Wage rigidity is the failure of wages to adjust until labour supply equals labour demand.
- Structural unemployment: the unemployment resulting from wage rigidity and job rationing. 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 labour exceeds the demand. These workers are simply waiting for jobs to become available.
- If the real wage is stuck above the equilibrium level, then the supply of labour exceeds the demand. Result: unemployment U.

MINIMUM WAGE LAWS

- The government causes wage rigidity when it prevents wages from falling to equilibrium levels.
- Set a legal minimum on the wages that firms pay their employees.
- Many economists and policymakers believe that tax credits are better than increases in the minimum wage — if the policy goal is to increase the income 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.

UNIONS AND COLLECTIVE BARGAINING

- The monopoly power of unions.
- Often, union contracts set wages above the equilibrium level and allow the firm to decide how many workers to employ. Result: a decrease in the number of workers hired, a lower rate of job finding, and an increase in structural unemployment.
- The unemployment caused by unions is an instance of conflict between different groups of the labour force — insiders and outsiders.

EFFICIENCY WAGES

- Efficiency-wage theories suggest that high wages make workers more productive. Though a wage reduction would lower a firm's wage bill, it would also lower worker productivity and the firm's profits.
- Efficiency-wage theories:
  - high wages reduce labour turnover
  - the average quality of a firm's workforce depends on the wage it pays to its employees
  - a high wage improves worker effort and incentives

MACROECONOMICS

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WEEK 7

MONETARY MARKET

INFLATION THEORIES

BASIC DEFINITIONS

- Inflation is an increase in the average level of prices
- Rate of inflation is the percentage change in the overall level of prices
- Money: Stock of assets used for that can be readily used to make transactions.
- Functions of money:
  - store of value
  - unit of account
  - a medium of exchange
- Types of money:
  - Fiat money: money that has no intrinsic value
  - Commodity money (economy on gold standard)
- Money supply: quantity of money available
- Control of money supply is called monetary policy, in an economy using fiat money the central bank controls money supply (eg. through open-market operations: purchase and sale of government bonds)
- Measures of the quantity of money:
  - Currency: sum of outstanding paper money and coins
  - Demand deposits: the funds people hold in their checking accounts

MEASURING INFLATION

- An average price level have to determined for each period (month or year)
- The average price would have to include the price millions of goods → Basket of goods (a representative shopping basket) is chosen instead
- Only the prices included in the basket is checked – the average of those will give the price level
- Change in prices is measured by a price index: $\frac{P_{current} - P_{previous}}{P_{previous}}$
- The most common price index is the Consumer Price Index (CPI)
- Types of infllation:
  - Price stability OR creeping inflation: a yearly change of 0-3%
  - Walking inflation: a yearly change of 3-9%
  - Gallopping inflation: a yearly change of 10-99%
  - Hyperinflation: 100% & above

THE QUANTITY THEORY OF MONEY

Money × Velocity = Price × Transactions

$$M \times V = P \times T$$

- T = Total **number of transactions** during some time , *the number of times in a year that goods or services are exchanged for money*
- V = Transactions **velocity** of money: *measures the rate at which money circulates in the economy*

Money × Velocity = Price × Output

$$\mathbf{M \times V = P \times Y}$$

- M/P= **real money balances***: it measures the purchasing power of the stock of money*
- **Money demand function:** *shows what determines the quantity of real money balances people wish to hold* $(M/P)^d = kYr$

QUANTITY THEORY IN THEORY

- 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).
- Assume that V is constant → $M\overline{V} = PY$ → a change in the quantity of money causes a proportional change in nominal GDP.
- if Y is fixed because it depends on the growth in the factors of production and on technological progress, and we made the assumption that velocity is constant →

$$M\overline{V} = P\overline{Y}$$

- In percentage change form:

  % Change in M + % Change in V = % Change in P + % Change in Y

- 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 raised through the printing of money is called seigniorage.
- The increase in the money supply causes inflation. Printing money to raise revenue is like imposing an inflation tax.

INFLATION AND INTEREST RATE

- *The interest rate that the bank pays* is the **nominal interest rate**
- *The increase in your purchasing power is* the **real interest rate**
  - $r = i - \pi$
- **The Fisher equation:** $i = r + \pi$
- The quantity theory and the Fisher equation together:
  - % Change in M + % Change in V = % Change in P + % Change in Y
  - $\uparrow$ % Change in M + % Change in V = $\uparrow \pi$ + % Change in Y
- *The one-to-one relationship between the inflation rate and the nominal interest rate* is the **Fisher effect.**
- *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.**

TWO FUNDAMENTAL ASPECTS OF ECONOMIC THEORY

- The separation of the determinants of real and nominal variables is called **the classical dichotomy**: a simplification of economic theory, it suggests that changes in the money supply do not influence real variables (Y or E).
- This irrelevance of money for real variables is called **monetary neutrality**.
- Is it true to the real economy?
  - Short term vs. Long term approach

COSTS OF EXPECTED INFLATION

- The inconvenience of reducing money holding is metaphorically called the Shoe-leather cost. 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.
- Higher variability in relative prices leads to inefficient resource allocations. Prices should tell information to firms (e.g. an increase in prices signifies an increase in demand), but if prices change too often, the information becomes uncertain → greater uncertainty in the economy
- Another cost is related to tax laws. Often tax laws do not take into consideration inflationary effects on income.

COSTS OF UNEXPECTED INFLATION

- Unanticipated inflation is unfavorable because it arbitrarily redistributes wealth among individuals
- Long-term loans:
  - expected inflation < unexpected → beneficial for the debtor
  - expected inflation > unexpected → beneficial for the creditor