Macroeconomics

Lecture 1

MEASURING ECONOMIC PERFORMANCE 1

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Associate professor

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Assistant lecturer
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.)
Calculating GDP

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.

The income approach and the expenditure approach do not deliver exactly the same estimate of GDP, there is a statistical discrepancy.

Expenditures not in GDP: Used goods, Financial assets
Other Measures of Income

Gross National Product (GNP) = \( GDP + \) income that nationals earn abroad - income earned within a country by foreigners.

Net National Product (NNP) = GNP - Depreciation

National Income = NNP - Indirect business taxes

Personal Income = National Income
   - corporate profits
   - social insurance contributions
   - net interest
   + dividends
   + government transfers to individuals
   + personal interest income

Disposable Personal Income = Personal Income - Personal tax and nontax payments
**Nominal GDP**: Value of goods and services measured at current prices.

\[ nGDP = P_x Q_x + P_y Q_y \]

**Real GDP**: the value of goods and services measured at constant prices.

\[ rGDP = P_{x_0} Q_{x_1} + P_{y_0} Q_{y_1} \]

**GDP deflator**: The ratio of nominal GDP to real GDP

\[
\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} = \frac{P_{x_1} Q_{x_1} + P_{y_1} Q_{y_1}}{P_{x_0} Q_{x_1} + P_{y_0} Q_{y_1}}
\]

**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.

\[
\text{CPI} = \frac{P_{x_1} Q_{x_0} + P_{y_1} Q_{y_0}}{P_{x_0} Q_{x_0} + P_{y_0} Q_{y_0}}
\]
Other Influences on the Standard of Living

• 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.

• 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.

• Underground production (grey and black economy) is unreported, it is omitted from GDP.

• 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.
Macroeconomics

Lecture 2

MEASURING ECONOMIC PERFORMANCE 2

Andrea Gubik Safrany, PhD
Associate professor

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<td>P3: Final consumption expenditure</td>
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<td>P4: Domestic capital formation</td>
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<td>D1V_A: Agriculture, forestry and fishing (ISIC rev4)</td>
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Gross domestic product, current prices
National currency Billions

[Graph showing the Gross domestic product for different countries (Czech Republic, Hungary, Poland, Slovak Republic) from 1990 to 2012. The x-axis represents years from 1990 to 2012, and the y-axis represents billions of the national currency. The graph illustrates the growth in GDP over time.]
Gross domestic product, constant prices
National currency (Billions)
Gross domestic product, current prices
U.S. dollars Billions
Gross domestic product based on purchasing-power-parity (PPP) valuation of country GDP
Current international dollar Billions

[Graph showing the GDP of Czech Republic, Hungary, Poland, and Slovak Republic from 1990 to 2012.]
Gross domestic product, constant prices
Percent change
Gross domestic product, deflator
Gross domestic product per capita, current prices
U.S. dollars
Gross domestic product based on purchasing-power-parity (PPP) per capita GDP
Current international dollar
GDP deflator and CPI, Hungary
GDP deflator and CPI, Hungary
Percent change

CPI percent change
GDP deflator percent change
What is the Big Mac Index?

The Big Mac index, also known as Big Mac PPP, is a survey done by The Economist magazine.

It is used to measure the purchasing power parity (PPP) between nations, using the price of a Big Mac as the benchmark.
# The Big Mac Index

**THE ECONOMIST BIG MAC INDEX, MARCH 2016**

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<tr>
<th>Country</th>
<th>Value</th>
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<td>Switzerland</td>
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<td>Euro area</td>
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<td>Estonia</td>
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The Big Mac Index

> Big Mac's price by country (January 2014)

Norway $7.80
France $5.15
Germany $4.96
USA $4.62
Russia $2.62
India $1.54

Contrary to what we may think, even in France, Big Mac's price may vary depending on cities. For example: 3.90 € in Rennes, 3.95 € in Rodez, 4.00 € in Paris, 4.30 € in Marseille.

> How long to work to buy a Big Mac? (according to the minimum salary, August 2013)

Australia 18 min.
United Kingdom 24 min.
France 24 min.
Japan 30 min.
Canada 30 min.
USA 36 min.
South Korea 42 min.
Spain 48 min.
Poland 54 min.
Greece 54 min.
Portugal 1 h 06 min.
Argentina 1 h 12 min.
Russia 2 h 36 min.
Brazil 2 h 54 min.
China 3 h 06 min.
Philippines 4 h 24 min.
Mexico 4 h 42 min.
India 5 h 48 min.
Afghanistan 6 h 12 min.
Sierra Leone 136 h

Source: Big Mac Index - The Economist, Converging

http://hvg.hu/gazdasag/20160107_Big_Macindex_Magyarorszag_is_tovabra_is
It takes 627 hours of work to buy an iPhone in this city

Hours of work required to buy a 16G iPhone 6

- Kiev: 468 hours
- Jakarta: 360.3 hours
- Nairobi: 353.4 hours
- New Delhi: 349.4 hours
- Cairo: 334.2 hours
- Mumbai: 231.3 hours
- Manília: 219.1 hours
- Sofia: 217.8 hours
- Bucharest: 217.6 hours
- Beijing: 217.6 hours
- Mexico City: 217.6 hours
- Amsterdam: 49.8 hours
- Lyon: 47.2 hours
- Stockholm: 46.9 hours
- Brussels: 46.1 hours
- Nicosia: 44.9 hours
- Auckland: 44.6 hours
- Helsinki: 44.4 hours
- Dublin: 43.4 hours
- Berlin: 43.3 hours
- Paris: 42.2 hours
- Frankfurt: 41.6 hours
- London: 41.2 hours
- Munich: 40.9 hours
- Tokyo: 40.5 hours
- Vienna: 40 hours
- Oslo: 37.6 hours
- Toronto: 37.2 hours
- Sydney: 34 hours
- Montreal: 32.1 hours
- Chicago: 28.4 hours
- Luxembourg: 28.2 hours
- Los Angeles: 27.2 hours
- Miami: 27 hours
- New York City: 24 hours
- Geneva: 21.6 hours
- Zurich: 20.6 hours

Source: UBS

https://www.marketwatch.com/story/this-is-how-long-it-takes-to-pay-for-an-iphone-in-these-cities-2015-09-24
Joseph Stiglitz - Problems with GDP as an Economic Barometer

http://www.youtube.com/watch?v=QUaJMNtW6GA
LIMITS OF GDP

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Unpaid work

Figure 2: Total minutes worked, paid and unpaid, per day for the population aged 15-64 over the period 1998-2009 [Source and more information: OECD, ‘Cooking, caring and volunteering: Unpaid work around the world’.]
Figure 8  Life expectancy at birth vs average annual income

Infant mortality versus GDP per capita (PPS), 2011

(1) GDP per capita refers to Nominal Gross Domestic Product per capita
LU, LI, MK, TR: excluded
MT, HU, DE, EL, BE, ES, SI, CH: provisional data
EU-27 instead of EU-28 due to the lack of available data

Casting a long shadow

The underground economy has a significant presence in much of the world.

(percent of GDP, 2006)

Level of the shadow economy in OECD countries. 2015 (relative to GDP)

Source: IAW Tübingen

© DW
CORRECTED GDP

Measure of Economic Welfare (MEW) *(Nordhaus and Tobin, 1973)*

Economic Aspect of Welfare index (EAW) *(Zolotas, 1981)*

Index of sustainable welfare (ISEW) *(Daly and Cobb, 1989)*
CORRECTED GDP
an example: ISEW

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
INDEXES DEDICATED TO THE MEASUREMENT OF SUSTAINABILITY

Genuine savings indicator (World Bank)

Ecological Footprint (Wackernagel and Rees, 1995)
Top 10 countries with the biggest ecological footprint per person

1. Qatar
2. Kuwait
3. UAE
4. Denmark
5. USA
6. Belgium
7. Australia
8. Canada
9. Netherlands
10. Ireland

Top 10 African countries with the biggest ecological footprint per person

1. Mauritius
2. Mauritania
3. Botswana
4. South Africa
5. Egypt
6. Namibia
7. Tunisia
8. Chad
9. Mali
10. Gabon

*United Arab Emirates
Source: WWF
COMPOSITE INDEXES

Human Development Index (HDI)
(*UNDP*, 1990)

Index of Social Health (ISH)
(*Miringoff* 1999)

Environmental Performance Index (EPI)
(*Estes et al.*, 2005)

Index of Economic Well-Being (IEWB)
(*Osberg and Sharpe*, 2002)
COMPOSITE INDEXES
an example: HDI

• GDP per capita in PPP (purchasing power parities)
• Life expectancy at birth, in years
• Educational achievement (average of adult literacy rate (2/3) and student enrolment rate at first-, second- and third- level (1/3).
Calculating the human development indices—graphical presentation

<table>
<thead>
<tr>
<th>Human Development Index (HDI)</th>
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<tbody>
<tr>
<td>DIMENSIONS</td>
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<tr>
<td>INDICATORS</td>
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</table>

**Long and healthy life**
- Life expectancy at birth
- Life expectancy index

**Knowledge**
- Mean years of schooling
- Expected years of schooling
- Education index

**A decent standard of living**
- GNI per capita (PPP $)
- GNI index

Human Development Index (HDI)
# Ranking HDI vs GDP

## Top 15 Countries measured by HDI:

<table>
<thead>
<tr>
<th>Ranking HDI</th>
<th>Ranking GDP per capita 2013 (2011 PPP$)</th>
<th>Country</th>
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<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>Norway</td>
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<td>2</td>
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<td>Australia</td>
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<td>United States</td>
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<td>6</td>
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<td>14</td>
<td>27</td>
<td>United Kingdom</td>
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<tr>
<td>15</td>
<td>11</td>
<td>Hong Kong, China (SAR)</td>
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</table>

## Bottom 15 Countries measured by HDI:

<table>
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<td>Burkina Faso</td>
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<td>Sierra Leone</td>
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<td>Chad</td>
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<td>Central African Republic</td>
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<td>176</td>
<td>177</td>
<td>Congo (Democratic Republic of the)</td>
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<tr>
<td>177</td>
<td>173</td>
<td>Niger</td>
</tr>
</tbody>
</table>

[https://www.slideshare.net/omarhamieh/economics-presentation-47765131](https://www.slideshare.net/omarhamieh/economics-presentation-47765131)
Ecological footprint (hectares per person per year)

'Very high human development'

EU-28 Member State

South Africa
Brazil
Russia
India
Indonesia
China

World biocapacity
Sustainability

Ecological deficit

SUBJECTIVE APPROACHES

Happy Life Expectancy index (HLE)
(Veenhoven, 1990)

Advanced Quality of Life index (AQL)
(Diener, 1995)

Inequality-Adjusted Happiness (IAH)
(Veenhoven and Kalmijn)
EASTERLIN PARADOX

In spite of a 30% increase in the American GDP per head, the share of individuals that declare to be “very happy” in the General Social Survey did not increase between 1972 and 1993.

In the long run and at the macro level, happiness and subjective well-being are not correlated with income or GDP.
Several explanations have been proposed to account for the “Easterlin paradox” (Clark et al., 2007):

• Life satisfaction is reported on a bounded scale.
• Once an individual income rises above a certain threshold, the main driver of higher well-being are friends or a good family life rather than income.
• Norms and aspirations change over time. Aspirations change with the information and situation reached by individuals.
• Richer people spend more time in activities that are associated with higher tension and stress such as work, shopping, childcare activities, and active leisure (Kahneman et al., 2006).
Conclusion

There is no single indicator that can capture something as complex as our society.

The discussion of different alternatives will lead to more care in the use of each and better selection of the use of appropriate metrics for different purposes.
Overview

• Mankiw, G.: Macroeconomics Worth Publishers

• Stiglitz et al. Report by the Commission on the Measurement of Economic Performance and Social Progress

• ..and many other excellent sources
Macroeconomics

National Income: Its Production, Distribution and Allocation
(Mankiw: Macroeconomics, chapter 3)

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The circular flow diagram

Markets for Factors of Production

Private Savings

Financial Markets

Government deficit

Firm revenue

Markets for Goods and Services

Government purchases

Firm revenue

Government purchases

Private Savings

Income

Factor payments
1. CONSUMPTION

- Income that the households receive=\(Y\), the output of the economy
- Government taxes \(Y\) by an amount of \(T\) \(\Rightarrow\) **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 \(\Rightarrow C=C(Y-T)\)
- **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.* \(0<\text{MPC}<1\)
- **Marginal propensity to save (MPS):** *the amount savings changes when the disposable income increases by one dollar* \(0<\text{MPS}<1\)

- \(\text{MPC}+\text{MPS}=1\)
- The slope of the Consumption function tells us how much consumption increases when disposable income increases by 1 dollar \(\Rightarrow\) the slope of C function is MPC
2. 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 relationship between the interest rate and the quantity of investment demanded*. Its slope downwards because as the interest rate increases, the quantity of investment demanded decreases.
3. 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: $G - \overline{G}$ $T - \overline{T}$
- 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: \( Y = C(Y - T) + I(r) + G \)
- At the equilibrium interest rate, the demand for goods and services equals the supply.
FINANCIAL MARKET

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

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: Effects of Fiscal policy

**An Increase in Government Purchases:** increase government purchases by an amount $\Delta G$, the immediate impact is to increase the demand for goods and services by $\Delta G$. 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. $\rightarrow$ the interest rate must rise. $G$ rises $\rightarrow r$ increases $\rightarrow I$ decreases $\rightarrow$ Government purchases *crowd out* investment.

**A Decrease in Taxes:** by $\Delta T \rightarrow$ raise of disposable income by $\Delta T$ and consumption by an amount equal to $\Delta T$ 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 $I$, $\rightarrow$ 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.

![Diagram of investment and saving](image-url)
Identification problem

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

Economic Growth,
Solow Growth Model
(Mankiw: Macroeconomics, Chapter 4)

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I. ACCUMULATION OF CAPITAL

1. 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

2. 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.
3. 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: \( \Delta k = i - \delta k \)
- Investment equals savings: \( \Delta k = sf(k) - \delta k \)
- Depreciation is proportional to the capital stock.
4. 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 $\Rightarrow$
\[ \Delta k = 0 \rightarrow sf(k^*) - \delta k^* = 0 \rightarrow sf(k^*) = \delta k^* \]
5. Changes in Saving 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.
6. The Golden Rule Level of Capital

- The steady-state value of $k$ that maximizes consumption is called the **Golden Rule Level of Capital**. ($k^*_{\text{gold}}$)

- National income accounts identity: $y = c + i \Rightarrow c = y - i$

- Substitute steady-state values: Steady-state output per worker is $f(k^*)$; capital stock is not changing in the steady state, investment = depreciation $\delta k^*$. $\Rightarrow$ steady-state consumption per worker $c^* = f(k^*) - \delta k^*$

In the $k^*_{\text{gold}}$ the slope of the production function (MPK) is equal to the slope of the depreciation function ($\delta$) $\Rightarrow$ **At the Golden Rule level of capital**, the marginal product of capital equals the depreciation rate.

$\text{MPK}=\delta$
7. The Transition to the Golden Rule Steady State

a) 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 $\Rightarrow k, y, c, i$ fall to new steady state
   • Consumption is higher than before
   • produces higher $c$ at all points of time
b) **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 $\rightarrow$ $k$, $y$, $c$, $i$ rise to new steady state
- Consumption is higher than before
- Reaching the Golden Rule requires reducing consumption today to increase consumption in the future
II. POPULATION GROWTH

• the population and labor force grow at a constant rate $n$

• Change in stock of capital per worker: $\Delta k = sf(k) - (\delta + n)k$

• $(\delta + n)k \rightarrow$ break-even investment: *the amount necessary to keep constant the capital stock per worker (k)*.

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

• The effect of population growth: if $n$ increases, it reduces the steady state level of capital per worker $\rightarrow$ the Solow model predicts that economies with higher rates of population growth will have lower levels of capital per worker and therefore lower incomes.

• Golden rule: $c$ is maximal if $MPK = \delta + n$ or $MPK - \delta = n$
III. TECHNOLOGICAL PROGRESS

• Efficiency of labor: $E \rightarrow Y = F(K, L^*E)$, where $L^*E$ measures labor force in efficiency

• $g \rightarrow$ rate of labor-augmenting technological progress

• Technological progress causes $E$ to grow at the rate $g$, and $L$ grows at rate $n$ so the number of workers $L^*E$ 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 $MPK - \delta = n + g$
IV. SAVING, GROWTH and ECONOMIC POLICY

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

2. Changing the Rate of Saving
   • Public Saving = T-G \(\Rightarrow\) 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)
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
Macroeconomics

Unemployment
(Mankiw: Macroeconomics, Chapter 5)

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1. 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 = Labor 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.*
- **Rate of job finding** (f): *The fraction of unemployed individuals who find a job each month.*

- Steady-state in the labor market: \( fU = sE \) → \( fU = s(L-U) \) → \( \frac{U}{L} = s \left(1 - \frac{U}{L}\right) \)
- The rate of unemployment depends on \( s \) and \( f \).
  - The higher the \( s \) is, the higher the unemployment rate, the higher the \( f \) is, 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.
2. 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.
3. Real Wage Rigidity and Wait Unemployment

- **Wage rigidity** is the failure of wages to adjust until labor supply equals labor 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 labor 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 labor 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 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.

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 workers—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:
  1. wages influence nutrition
  2. high wages reduce labor turnover
  3. the average quality of a firm’s workforce depends on the wage it pays its employees
  4. a high wage improves worker effort
Macroeconomics

Money and Inflation
(Mankiw: Macroeconomics, Chapter 6)

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Mónika Kis-Orloczki
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• **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*
2. The Quantity Theory of Money

Money $\times$ Velocity  = Price $\times$ 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 $\times$ Velocity  = Price $\times$ Output

$M \times V = P \times Y$

- 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* $(M/P)^d = kY$
• 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 \( \rightarrow \) \( MV = PY \) \( \rightarrow \) 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 \( \rightarrow \) \( MV = PY \)

• In percentage change form:
  \[
  \% \text{ Change in } M + \% \text{ Change in } V = \% \text{ Change in } P + \% \text{ Change in } Y
  \]

• 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.

3. Inflation and Interest Rate

• *Interest rate that the bank pays* is the nominal interest rate
• *The increase in your purchasing power* the real interest rate

\[
 r = i - \pi
\]

• **The Fisher equation:** \( i = r + \pi \)

• The quantity theory and the Fisher equation together:

\[
\% \text{ Change in } M + \% \text{ Change in } V = \% \text{ Change in } P + \% \text{ Change in } Y
\]

\[
\% \text{ Change in } M + \% \text{ Change in } V = \pi + \% \text{ Change in } Y
\]

• *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.
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.
- 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 $\rightarrow$ beneficial for the debtor
  expected inflation > unexpected $\rightarrow$ beneficial for the creditor

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 for real variables is called monetary neutrality.