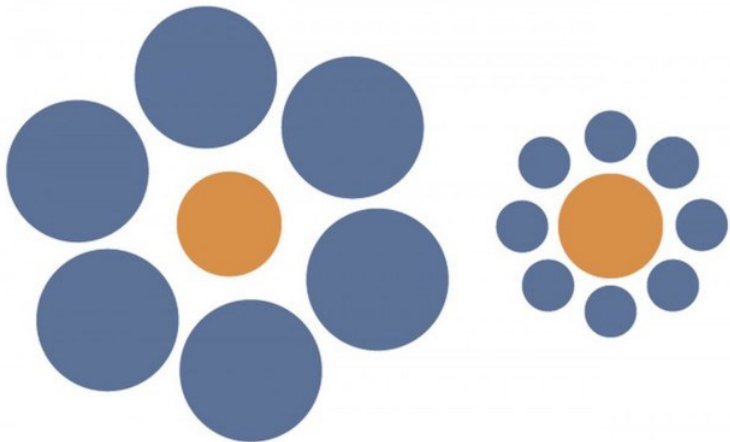


Macroeconomics

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February 8, 2018

Which circle is larger?



About the course

- What does it mean to "study"?
- Marginal cost vs marginal benefit
- Role of expectations in learning process
- Knowledge PPF and role of this course
- Circle: gut feeling vs. measuring is like believing vs knowledge

Structure of the course

- Lecturer: Justas Mundeikis
- Email: justas.mundeikis@evaf.vu.lt
- Lectures in aud: 101
 - Wednesday 09:00-10:30 (bi-weekly)
 - Thursday 09:00-10:30
- Course homepage: www.lithuanian-economy.net/teaching
- Also materials on moodle
- Time schedule - in excel
- Participation

Seminars, Quizzes and Exams

- Lecture has 4 blocks
- 4 seminars (tutorial lectures 90 min each)
- There are 4 quizzes (30 min each and 1 hour discussion afterwards)
- With their corresponding parts in exam (ca 2.5 hours)
- Grading formula:

$$\frac{\max(Q_1, E_1) + \max(Q_2, E_2) + \max(Q_3, E_3) + \max(Q_4, E_4) + E_P5}{5} + BP$$

- Max 20 bonus points can be earned through individual assignments.
- Course is in development mode, so things can/will change slightly

Literature

- N.G.Mankiw: "Macroeconomics" (9th edition)
- F.Lequiller and D. Blades: "Understanding National Accounts" (2nd edition)
- George A. Akerlof and Robert J. Shiller: "Phishing for Phools: The Economics of Manipulation and Deception"
- Additional literature will be provided when needed

Table of contents

- ① Introduction
- ② Main economic aggregates
- ③ The economy in long run: classical model with flexible prices
- ④ The economy in very long run : classical model, effects of technology, labor
- ⑤ The economy in short run : business cycle theory, not flexible prices
- ⑥ Special topics (optional)

What is economics about?

- Economics - is a social science concerned with the production, distribution and consumption of goods and services...
- But actually, economics is just about **decisions**.
- Microeconomics vs. Macroeconomics

Why economics?

Why do managers need economics in real (working) life? Few examples from my experience:

- Retail sector (trends)
- Insurance (investments, risks)

This course will not give you the instruments to answer such questions, but sharpen your mind, to understand the associations and improve your (critical) thinking abilities.

Economists

Economists as scientists:

- collect data
- analyze it by applying different statistical methods
- formulate general theories
- validate theories with the gathered data
- publish their knowledge in scientific articles

Positive vs. normative economics, role of economists:

- analysts
- politicians

But the same applies for managers

Core economic variables

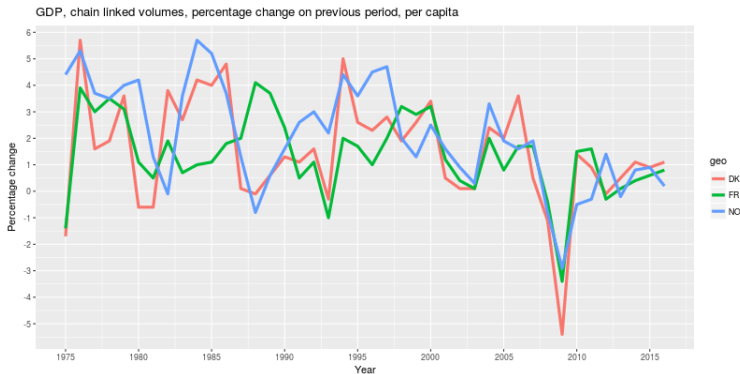
If an economist was asked, what are the core economic variables, he would probably answer:

- Annual growth rate or **real GDP** (annual change of economic activity adjusted for changes in price levels)
- **Inflation rate** (annual change of price level)
- **Unemployment rate** (share of labor force searching for work)

As we will see later during this course, all these three variables are tightly correlated (associated)

Core economic variables

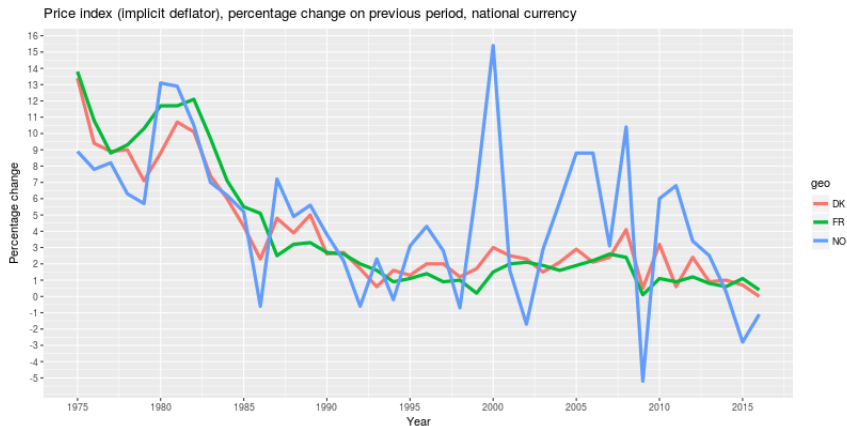
Figure 1: Real GDP per capita change over time in selected countries



Keywords: Expansion, Peak, Contraction, Trough, Recession (Depression) / Recovery

Core economic variables

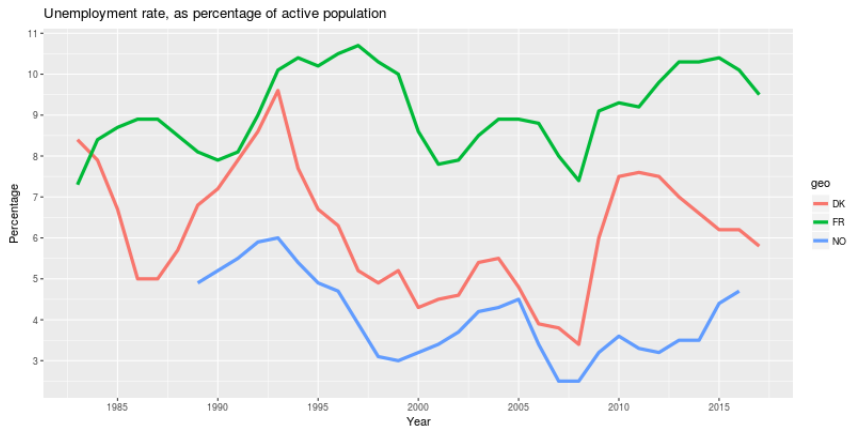
Figure 2: Inflation rate, change over time in selected countries



Keywords: Inflation, Deflation

Core economic variables

Figure 3: Unemployment rate in selected countries



Economists love models

- Models illustrate in mathematical term the relationships among variables
- Exogenous, endogenous variables
- A simple model:
 - Supply is a function $S()$ of P and P_m , $Q^s = S(P, P_m)$, example:
 $Q^s = 10P - 5P_m$
 - Demand is a function $D()$ of P and Y , $Q^d = D(P, Y)$, example:
 $Q^d = 100 - 5P + 2Y$
 - Model of the market: $Q^s = Q^d$
 - Change in exogenous variables P_m, Y affects endogenous variables Q^s, Q^d and thus the market equilibrium Q, P
 - Assumptions: market clearing implies flexible prices (sometimes are sticky)
- Microeconomic decisions underly all economic models, but in many models the optimizing behavior (firms, households, government) is implicit and not explicit

Suggested readings

- Chapter 1, Mankiw
- Chapter 1, Akerlof & Shiller
- Chapter 1, Tim Harford

Main macroeconomic aggregates

In this part of the course:

- Main macroeconomic aggregates
- Nominal vs. real growth, inflation
- Unemployment
- Comparing different countries
- Production side of GDP (optional)
- Final uses of GDP (optional)

Main macroeconomic aggregates

	2014	2015	2016	2017	2018	2019
	Current prices EUR billion	Percentage changes, volume (2010 prices)				
GDP at market prices	36.6	2.0	2.3	3.6	3.0	2.8
Private consumption	22.8	4.0	4.9	4.2	3.6	3.5
Government consumption	6.1	0.2	1.3	1.6	1.2	1.1
Gross fixed capital formation	6.9	4.8	-0.5	5.7	6.1	4.6
Final domestic demand	35.8	3.5	3.3	4.1	3.7	3.3
Stockbuilding ¹	0.1	0.5	-0.1	-0.4	0.0	0.0
Total domestic demand	35.8	7.2	2.3	2.6	3.4	3.3
Exports of goods and services	29.7	-0.4	3.5	7.5	4.2	4.2
Imports of goods and services	28.9	6.2	3.5	8.8	2.2	4.9
Net exports ¹	0.8	-5.2	-0.1	-0.8	1.6	-0.5
<i>Memorandum items</i>						
GDP deflator	—	0.3	1.0	4.3	3.5	3.0
Harmonised index of consumer prices	—	-0.7	0.7	3.8	2.9	3.0
Harmonised index of core inflation ²	—	1.9	1.7	2.8	2.8	3.0
Unemployment rate (% of labour force)	—	9.1	7.9	7.2	6.6	6.1
Household saving ratio, net (% of disposable income)	—	-3.9	-4.3	-4.1	-3.9	-3.8
General government financial balance (% of GDP)	—	-0.2	0.3	0.1	0.5	0.5
General government gross debt (% of GDP)	—	53.8	51.7	53.3	48.2	46.7
General government debt, Maastricht definition (% of GDP)	—	42.6	40.1	41.7	36.6	35.1
Current account balance (% of GDP)	—	-3.0	-1.1	-1.2	-1.4	-1.8

Figure 4: OECD Economic Outlook - Lithuania (November 2017)

Main macroeconomic aggregates

Economic growth will remain robust

Supportive financial conditions and an increase in EU-funded projects will keep investment solid, while favourable external conditions will benefit exports. A falling unemployment rate and increasing wages will support private consumption, but growth will be curbed by a shrinking labour force. The inflationary impact of higher commodity prices and excise duty increases will fade over the projection period. Buoyant demand along with labour market tightening, however, will continue to push up prices.

Weaker-than-anticipated growth in the euro area and intensified geopolitical risks would hurt exports and investment. A shrinking labour force could limit employment growth more than projected. Moreover, wage increases could lead to a higher-than-foreseen increase in unit labour costs, reducing competitiveness. On the other hand, stronger activity in the euro area would improve Lithuania's growth prospects. The implementation of the new labour code and progress with structural reforms in other areas could result in higher productivity and investment growth.

The circular flow diagram

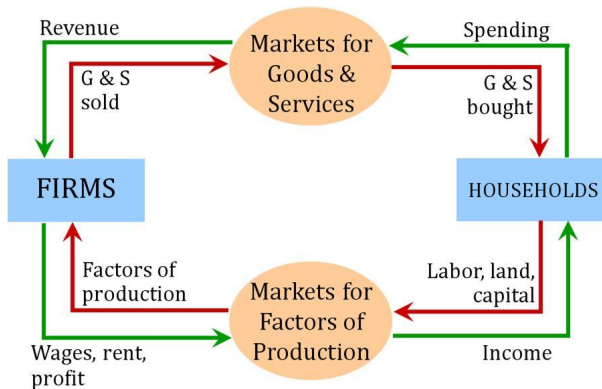


Figure 5: Circular flow of money and G/S in a simple two sectors' economy

Defining GDP

Gross domestic product (GDP)

- combines in a single figure,
- with no double counting,
- all the final output (production)
- carried out by all the firms, non-profit institutions, government bodies and households
- in a given country
- during a given period,
- regardless of type of goods and services produced,
- provided that the production takes place within the country's economic territory

Nominal vs Real GDP

- Nominal GDP, also called GDP "at current prices"
- $GDP_{N,t} = \sum_i^n (P_{i,t} \times Q_{i,t})$
- Real GDP, also called GDP "in volumes" with prices of the base year, where a base year is arbitrary selected and denoted as b
- $GDP_{R,t} = \sum_i^n (P_{i,b} \times Q_{i,t})$
- The GDP deflator is defined as
- $GDP_{def,t} = \frac{GDP_{N,t}}{GDP_{R,t}} \times 100$
- So we can rewrite:
- $GDP_{R,t} = \frac{GDP_{N,t}}{GDP_{def,t}}$ this equation shows, why the deflator "deflates" the GDP at current prices

Nominal vs Real GDP

How much did the economy grow?

Table 1: GDP change

	P_1	Q_1	P_2	Q_2	Output	Growth
Year_1	1	100	1	100		
Year_2	2	100	1	100		
Year_3	2	100	1	200		

Growth rate in percent: $\frac{\Delta X}{X} = \frac{X' - X}{X}$

Nominal vs Real GDP

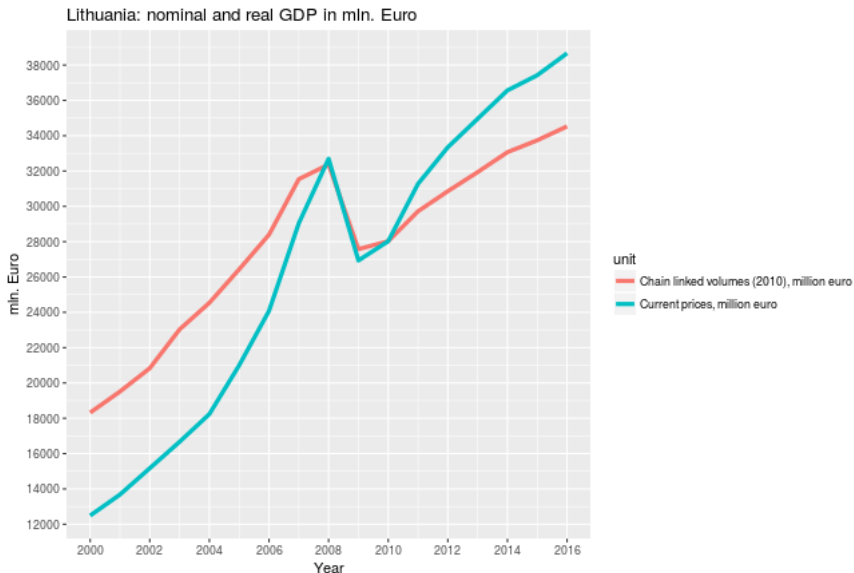
Bringing everything together:
(use year1 as base year)

Table 2: Nominal and real GDP, GDP deflator

	P	Q	P	Q	GDP_N	GDP_R	GDP_{def}	$\Delta\%GDP_N$	$\Delta\%GDP_R$	$\Delta\%GDP_{def}$
Year_1	1	100	1	100						
Year_2	2	100	1	100						
Year_3	2	100	1	200						

- Movements of GDP "at current prices" can be separated into:
 - an indicator of the change in quantity (the real GDP or GDP in volume)
 - an indicator of the change in prices (GDP deflator)
- $1 + \left(\frac{\Delta\%GDP_N}{100}\right) = 1 + \left(\frac{\Delta\%GDP_R}{100}\right) \times 1 + \left(\frac{\Delta\%GDP_{def}}{100}\right)$
- $1 + \left(\frac{33.33\%}{100}\right) = 1 + \left(\frac{50\%}{100}\right) \times 1 + \left(\frac{-11.11\%}{100}\right)$

Example: Lithuania nominal and real GDP 2000-2016



GDP - Production approach

Table 3: GDP calculation, IC

	Firm_A		Firm_B		GDP
	Price	Quantity	Price	Quantity	
Year_1	-	-	1	100	
Year_2	0,3	100	1	100	

Does the output increase by 30% due to split of $Firm_B$ into $Firm_A$ and $Firm_B$?

GDP - Production approach

Table 4: GDP as sum of value added

	Firm_A	Firm_B	Total
Output			
Intermediate consumption			
Value added			

- Calculating the contribution of each firm not as its output, but as its value added
- The products consumed in the production process during the period are known as **intermediate consumption**. By deducing their value from that of output, one eliminates the double counting.
- Adding up all the value added by all producers results in an indicator that is independent of the way firms are organized.

GDP - Production approach

- GDP is equal to the sum of the value added of each firm, government institution and producing household in a given country.
- $GDP = \sum \text{gross values added}$
- $GDP = \sum \text{output} - \sum IC$
- $GDP = 30 + 70 = 100$
- "Gross" means the consumption of fixed capital is not deducted

GDP - Expenditure approach

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

Private consumption (C)

- Private consumption includes household consumption expenditure and also expenditure by "non-profit institutions serving households" (NPISHs).
- This variable covers all purchases made by consumers: food, clothing, housing services, energy, durable goods (cars, fridges), spending on leisure etc.
- Consumption expenditure does not include households' purchases of dwellings, which are counted as households GFCF
- Private consumption represents in general about 60 % or more of the GDP
- Purchased goods can be divided into durable / non-durable goods

Government purchases (G)

- Are goods and services bought by general government
- General government = local government (municipalities) + central government
- Does not include financial transfers like Social Security, welfare

Investment (I)

- Investment or **gross capital formation (GCF)** is divided into two categories:
 - ① Gross fixed capital formation (GFCF)
 - ② Changes in inventories
- Gross fixed capital formation (GFCF) is itself divided into three categories:
 - ① Total Construction
 - ② Machinery and equipment and weapons systems
 - ③ Other machinery and equipment and weapons systems
- GFCF measures total expenditures on products intended to be used for future production
- Here again "gross" means, that the expenditure is measured without deducting the consumption of fixed capital

Net Exports (NX)

- Exports (EX) is the value of goods and services sold to other countries
- Imports (IM) is the value of goods and services bought from other countries
- Net exports = Exports - Imports or $NX = EX - IM$

GDP - Expenditure approach

- Supply=Demand
 - Supply = Production + Imports
 - Demand = Consumption + Government purchases + Investment + Exports
- $GDP + IM = C + G + I + EX$
- $GDP = C + I + G + I + EX - IM$
- $GDP = C + I + G + I + NX$
- GDP=Sum of final demand aggregates
- Economic activity=Final uses
- Economist write Y instead of GDP , thus
- $Y = C + I + G + I + NX$

GDP - Expenditure approach

Table 5: Components of expenditure, Lithuania vs Germany

Codes / Aggregates		Lithuania		Germany	
		mIn Eur	% GDP	mIn Eur	% GDP
B1GQ	Gross domestic product at market prices	38.668,3	100,0	3.144.050,0	100,0
P3	Final consumption expenditure	31.500,2	81,5	2.289.840,0	72,8
P3.S13	<i>Final consumption expenditure of general government</i>	6.636,9	17,2	615.446,0	19,6
P31.S14	<i>Final consumption expenditure of households</i>	24.771,1	64,1	1.619.138,0	51,5
P31.S15	<i>Final consumption expenditure of NPISH</i>	92,2	0,2	55.256,0	1,8
P5G	Gross capital formation	6.668,2	17,2	603.591,0	19,2
P51G	<i>Gross fixed capital formation</i>	7.314,2	18,9	630.034,0	20,0
P52.P53	<i>Changes in inventories and acquisitions less disposals of valuables</i>	-646,0	-1,7	-26.443,0	-0,8
B11	External balance of goods and services	499,9		250.619,0	
P6	<i>Exports of goods and services</i>	28.789,1	74,5	1.450.012,0	46,1
P7	<i>Imports of goods and services</i>	28.289,2	73,2	1.199.393,0	38,1

GDP - Income approach

- Any production activity generates income that is shared between the three "factors of production":
 - Labour
 - Capital
 - Intermediate consumption
- Because we are looking at GDP and not the true output, IC is subtracted
- $GDP = \text{total output} = \text{total income}$
- GDP is equal to total income, thus:
- $GDP = \text{Compensation of employees} + \text{Operating surplus \& mixed income} + \text{Taxes}$

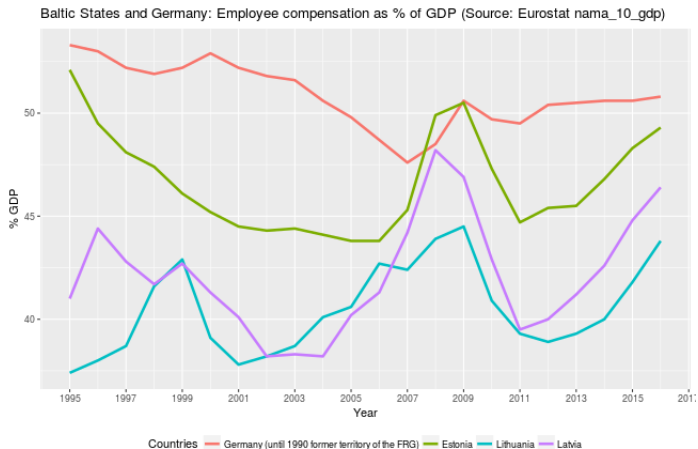
GDP - Income approach

Table 6: Components of GDP, in current prices

Code / Aggregate		2005		2016	
		% GDP	mln Eur	% GDP	mln Eur
B1GQ	GDP (output approach)	100,0	21.002,4	100,0	38.668,3
B1G	Value added, gross	90,5	19.009,7	90,0	34.789,4
	Taxes less subsidies on products	9,5	1.992,6	10,0	3.879,0
B1GQ	GDP (expenditure approach)	100,0	21.002,4	100,0	38.668,3
P3	Final consumption expenditure	83,2	17.469,5	81,5	31.500,2
P5G	Gross capital formation	24,1	5.051,8	17,2	6.668,2
P6	Exports of goods and services	53,8	11.308,1	74,5	28.789,1
P7	Imports of goods and services	61,1	-12.827,1	73,2	-28.289,2
B1GQ	GDP (income approach)	100,0	21.002,4	100,0	38.668,3
D1	Compensation of employees	40,6	8.520,0	43,8	16.929,1
B2A3G	Operating surplus and mixed income, gross	49,8	10.468,9	45,9	17.732,1
D2X3	Taxes on production and imports less subsidies	9,6	2.013,5	10,4	4.007,2

Employee compensation as % of GDP

Figure 6: Employee compensation as % of GDP, source: Eurostat



GDP and GNI

- GDP measures the total production occurring within the country's economic territory
- **Gross National Income** (GNI) (previously GNP) measures the total income (excluding capital gains and losses) of all economic agents residing within the territory (households, firms and government institutions)
- $GNI = GDP + \text{Factor payments from abroad} - \text{Factor payments to abroad}$
- Difference between GDP and GNI are small for big economies, but rather big for small, capital intensive economies like Luxembourg

Gross vs Nett Domestic product

- At least three factors are required for production:
 - Labour (labour force)
 - Capital (machinery)
 - Intermediate consumption (goods and services)
- In order to calculate the new wealth created during a period, a deduction has to be made for the cost of using up capital.
- This is called **consumption of fixed capital**
- $NDP = GDP - \text{consumption of fixed capital} = \sum \text{net values added}$
- $NNI = GNI - \text{consumption of fixed capital}$
- Though NDP is better representation of economic performance, GDP is more broadly used, because:
 - Calculation methods of consumption of fixed capital are complex and differ among countries
 - Usually the difference is not significant and does not change the conclusions

Comparing GDP across countries

Given this information: can we compare these three countries? Why, why not?

Table 7: Average annual % GDP growth, 1980-2012, current prices

Country	$GDP_{N,1980-2012}$
Netherlands	6.1
Mexico	43.8
Turkey	74.2

What additional information might be needed to adjust the table? See Subsection "International comparisons"

Comparing GDP across countries

Separating annual growth rates into volume growth rate and price (inflation)

Table 8: GDP, volume and price indexes, annual growth rate 1980-2012

Country	$GDP_{R,1980-2012}$	$GDP_{def,1980-2012}$
Netherlands	3.1	2.9
Mexico	3.6	38.8
Turkey	6.3	63.8

Still anything left to adjust for?

Comparing countries

Is the standard of living (here: income per capita) 4x bigger in Netherlands than in Mexico?

Table 9: GDP per capita in USD, 2012

	$GDP_{N,cap,USD}$	Index, Netherlands=100
Netherlands	45970	100
Mexico	10648	23.2
Turkey	10525	22.9

What could be useful to adjust for?

Comparing countries

Countries might have different price levels. Example: renting $50m^2$ flat in Paris vs Istanbul. Therefore we have to adjust for different price levels.

Table 10: GDP per capita in PPP, 2012

Netherlands	43146	100
Mexico	18288	42.4
Turkey	18114	42.0

Purchasing Power Parity (PPP) is an economic theory that compares different countries' currencies through a market "basket of goods" approach. According to this concept, two currencies are in equilibrium or at par when a market basket of goods is priced the same in both countries.

Inflation

- The increase in overall price level is called **inflation** and the percentage change in the price level from one period to another is called **inflation rate**
- GDP deflator is one measure of price level
- Consumer Price Index (CPI) is another indicator of inflation, that is calculated on monthly basis and relates to the aggregate consumption.
- CPI is based on typical basket of goods and services purchased by typical consumer in a selected country
- CPI is the price of this basket relative to the price of the same basket in some base year
 - $$CPI_t = \frac{\sum_i^n (P_{i,t} \times Q_{i,b})}{\sum_i^n (P_{i,b} \times Q_{i,b})} \times 100$$
 - for goods i to n , in period t and base year b
- Example...

CPI, PPI, Core inflation

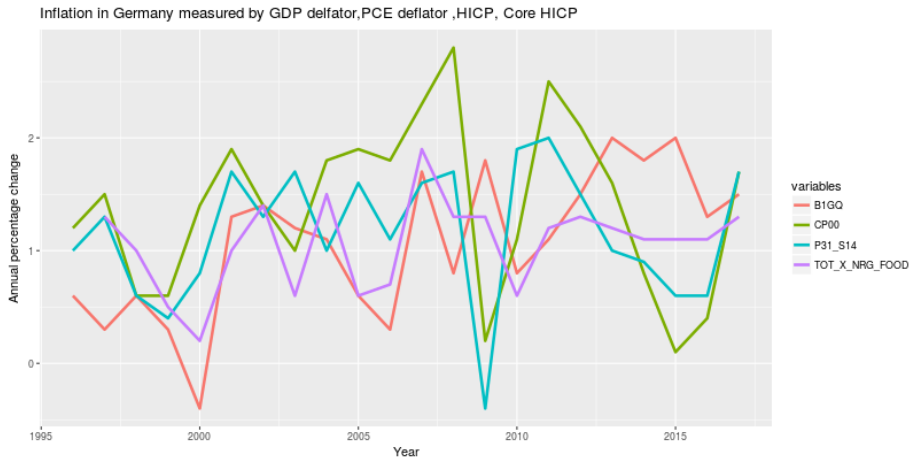
- CPI is the consumer price index, reflecting the changes in the price level for consumers
- Core inflation is the increase of CPI, but excluding food, energy, alcohol and tobacco products
- PPI is the producer price index, reflecting the changes in the price level for consumers

CPI vs GDP deflator

- Three differences between CPI and GDP deflator
 - ① GDP deflator measures the prices of all goods and services produced, CPI measures the prices of goods and services that are consumed (CPI does not include prices of goods consumed by government, firms)
 - ② GDP deflator measures the prices of all goods and services produced domestically and does not reflect the prices of imported goods and services (oil prices)
 - ③ CPI assigns fixed weight to the prices of different goods, GDP deflator allows the basket of goods to change, as the GDP composition changes
- (more about different calculations later)
- Harmonised Index of Consumer Prices (HICP) is compiled according to a methodology that has been harmonised across EU countries across EU countries
- In the USA: often used measuer is personal consumption deflator (PCE)

Example: inflation in Germany

Figure 7: HICP, Core HICP, GDP deflator and PCE deflator



Unemployment

- Unemployment is measured by national bureau of statistics
- It surveys randomly selected households every month
- The survey is called the Labour Force Survey (LFS)
- Based on the answers to the survey questions, each adult (15-16+ aged) is placed into one of three categories
 - Employed
 - Unemployed (actively searching for work)
 - Not in the labor force (children, pensioners, discouraged persons)

Unemployment

- The concepts and definitions used in the survey follow the guidelines of the International Labour Organisation (ILO).
- **Employed (E)** covers persons
 - aged 15 years and over (16 and over in Spain, Italy and the United Kingdom, 15-74 years in Estonia, Latvia, Hungary, Finland, Sweden, Norway and Denmark, and 16-74 years in Iceland)
 - living in private households
 - who during the reference week performed work, even for just one hour, for pay, profit or family gain, or were not at work but had a job or business from which they were temporarily absent, for example because of illness, holidays, industrial dispute or education and training

How is unemployment measured?

- **Unemployed (U)** covers persons who
 - were not employed during the reference week
 - were currently available for work
 - had either been actively seeking work in the past four weeks or had already found a job starting within the next three months
- **Long-term unemployed** covers persons unemployed for one year or more
- **Youth unemployment** is unemployment of persons aged 15 to 24
- **Labor force = active persons** ($LF = U + E$) is the total number of workers, including both the employed and the unemployed
- **Not in the labor force** or **inactive persons** neither employed nor unemployed
- **Population** (POP) persons 15+ ($LF +$ inactive persons)

How is unemployment measured?

- **Unemployment rate** is the percentage of the labor force that is unemployed $u = \frac{U}{LF} \times 100$
- **Employment rate** is the percentage of the labor force that is employed $e = \frac{E}{LF} \times 100$
- **Labor-force participation rate** is the percentage of the population (15+) that is in the labor force $p = \frac{LF}{POP} \times 100$

Example population by labor status, 2016, source: Eurostat

Table 11: Population labor status

wstatus	DE	LT
ACT	43041.4	1477.5
EMP	41267.3	1361.4
INAC	27509.5	971.5
POP	70550.9	2449.1
UNE	1774.1	116.2

Calculations:

- $u = \frac{U}{LF} \times 100$
- $e = \frac{E}{LF} \times 100$
- $p = \frac{LF}{POP} \times 100$

Unemployment in Lithuania

- **Natural rate of unemployment** is the normal rate of unemployment around which the unemployment rate fluctuates
- **Cyclical unemployment** is the deviation of unemployment from its natural rate

Unemployment

- In "ideal" economy, wages would adjust to balance the quantity of labour supplied and the quantity of labour demanded and ensure that all workers are always fully employed. In real world, unemployment never falls to 0
- **Frictional unemployment** is unemployment that results because it takes time for workers to search for the jobs that best suit their tastes and skills
- **Structural unemployment** is unemployment that results because the number of jobs available in some labour markets is insufficient to provide a job for everyone who wants one

Frictional unemployment

- **Job search** is the process by which workers find appropriate jobs given their tastes and skills
- Public policy attempts to reduce the magnitude of frictional unemployment:
 - Public and private employment agencies
 - Public training (vocational training)
 - Regressive unemployment insurance

Structural unemployment

After a fundamental shift in the economy (exacerbated by factors such as technology, competition and government policy), wages do not achieve balance between supply and demand because of:

- **Minimum-wages** act as price floors [GRAPH]
- **Union** is a worker association that bargains with employers over wages, benefits, and working conditions
 - **Collective bargaining** is the process by which unions and firms agree on the terms of employment
 - **Strike** the organized withdrawal of labour from a firm by a union
- **Efficiency wages** are above-equilibrium wages paid by firms to increase worker productivity
 - Health
 - Turnover
 - Quality
 - Effort

Still to mention

- **Household saving ratio** = $\frac{\text{Savings by households}}{\text{Disposable income}}$ and is equal to portion of household income, that is not consumed
- **General government financial balance** is called "net lending / net borrowing of general government". And is the difference between the sum of all general government revenues and the sum of general government expenditures
- **General Government gross debt**: Government gross debt comprise all financial liabilities of general government, typically mainly in the form of government bonds.

Still to mention

- **General government debt**, Maastricht definition: first, gross debt according to the Maastricht criterion does not include, in the terminology of the SNA, trade credits and advances. Second, there is a difference in valuation methodology in that government bonds are to be valued at nominal values according to the Maastricht definition, but at market value or at issue price plus accrued interest according to SNA rules.
- **Current account balance**: The balance of payments is a record of a country's international transactions with the rest of the world. Transactions are organized in two different accounts, the current account and the capital and financial account. The current account includes all the transactions (other than those in financial items) that involve economic values and occur between resident and non- residents entities. Also covered are offsets to current economic values provided or acquired without a quid pro quo.

More detailed knowledge on volume indices and price indices

Volume indices and price indices

- A **volume index** is a weighted average of the changes between two periods in the quantities of a given set of goods and services
- There are two most commonly used indices: Laspeyres and Paasche .
- Laspeyres index is used to calculate changes in volumes
- Paasche index is used to calculate changes in prices
- Let $v_{it} = p_{ij} \times q_{ij}$ denote the value of product i in period j with price p and quantity q

Laspeyres volume index

- Laspeyres volume index is defined as:
- $L_q = \sum_i \frac{p_{i0}(q_{it}/q_{i0})}{\sum_i p_{i0}q_{i0}}$ L_q is the average of the changes in quantity of the various products weighted by the values at current prices in the base year
- and is equivalent to:
- $L_q = \frac{\sum p_{i0}q_{it}}{\sum p_{i0}q_{i0}}$, here L_q is the the amount of quantites ini period t multiplied by the prices in the base year divided b the value at current prices in the base year
- Example:...

Paasche price index

- Paasche price index is defined as:
- $P_p = \frac{\sum v_t}{\sum v_t (p_0/p_t)}$ prices in period t as weights and using harmonic mean of the price and ratio quantities
- and is equivalent to:
- $P_p = \frac{\sum p_t q_t}{\sum p_0 q_t}$
- Example:

Volume indices and price indices

- The product of Laspeyres volume index and Paasche price index is equal to the change on the value at current prices of the goods and services between period 0 and period t
- $$L_q P_p = \frac{\sum p_0 q_t}{\sum p_0 q_0} \frac{\sum p_t q_t}{\sum p_t q_0} = \frac{\sum p_t q_t}{\sum p_0 q_0} = \frac{v_t}{v_0}$$
- This equation is often used to deflate the nominal GDP by the Paasche price index in order to derive the GDP in volumes: $L_q = \frac{v_t}{P_p}$

Constant prices

- given the chronological series of Laspeyres volume indices:
- $\frac{\sum p_0 q_0}{\sum p_0 q_0}, \frac{\sum p_0 q_t}{\sum p_0 q_0}, \dots, \frac{\sum p_0 q_t}{\sum p_0 q_0},$
- If one multiplies all the item in the series by the common denominator $\sum p_0 q_0$, one obtains the "constant-price" series
- The relative movements are the same, as the two series differ only in the scalar equal to the denominator of the first term
- Additive series
- Unit of measurement: "accounts in [base year] [monetary units]"
- The choice of a fixed year means that one is using price structures that become more and more remote from the current structure, the further one moves away from the base year
- Solution: chain-linking

Chained accounts

- Chain linking method involves three stages:

- 1 The accounts are calculated at the prices of the previous period. These are used as weights for weighting the changes in quantity in current period.
- 2 These changes are chained (multiplied each one with subsequent one at aggregate level)
- 3 This series is multiplied with by the value of the accounts at the current prices of the refence year (base year, now. e.g. 2010)
- 4 Example:...
- 5 Advantage of this method, is that the previous period's price structure is more relevant then the price structure of a fixedperiod from further in the past
- 6 Chained volumes using the prevoui's years structure are described as Laspeyres chains, indices that use the average of the previous and the current period are described as "Fisher chains" (USA, Canada)
- 7 The disadvantage if thechain-linking volume levels is the loss of additivity i.e. $Y = C + I + G + NX$ is no more valid. This also affects the calculation of contribution to growth.

Contribution to growth

- The greek uppercase letter Δ (delta) means the "difference", i.e. $\Delta GDP_t = GDP_t - GDP_{t-1}$, where t can be arbitrary period (year, quarter etc.)
- Annual growth rate of GDP: $\frac{\Delta GDP}{GDP_{t-1}}$
- Starting point: $GDP_t = C_t + G_t + I_t + X_t$ taking differences:
- $\Delta GDP_t = \Delta C_t + \Delta G_t + \Delta I_t + \Delta X_t$
- Dividing by GDP_{t-1} results in:
- $\frac{\Delta GDP_t}{GDP_{t-1}} = \frac{\Delta C_t}{GDP_{t-1}} + \frac{\Delta G_t}{GDP_{t-1}} + \frac{\Delta I_t}{GDP_{t-1}} + \frac{\Delta X_t}{GDP_{t-1}}$
- Expanding each term on rhs by its value in $t-1$:
- $\frac{\Delta GDP_t}{GDP_{t-1}} = \frac{C_{t-1}}{GDP_{t-1}} \frac{\Delta C_t}{C_{t-1}} + \frac{G_{t-1}}{GDP_{t-1}} \frac{\Delta G_t}{G_{t-1}} + \frac{I_{t-1}}{GDP_{t-1}} \frac{\Delta I_t}{I_{t-1}} + \frac{X_{t-1}}{GDP_{t-1}} \frac{\Delta X_t}{X_{t-1}}$
- Note: this not fully valid when working with chain linked values as they are not additive

More detail knowledge on international comparisons

Comparison of growth rates

Table 12: My caption

	96-09	2010	2011	2012	2013	2014	2015	2016	2017
DE	1,1	4,1	3,7	0,5	0,5	1,9	1,7	1,9	2,2
LT	4,9	1,6	6,0	3,8	3,5	3,5	2,0	2,3	3,9
UK	2,2	1,7	1,5	1,5	2,1	3,1	2,3	1,9	1,8

- But demographic dynamics: 1996-2009 population change:
 - Germany: +0.23 %
 - Lithuania: -11.93 %
 - United Kingdom: +6.80 %
- Thus the need to adjust for demographic changes

Comparison of growth rates

Table 13: My caption

	Real GDP, average change 96-16	Difference visa-vis DE	Real GDP per capita, average change 96-16	Difference visa-vis DE
DE	1,40	0,00	1,33	0,00
LT	4,32	2,92	5,51	4,19
UK	2,12	0,73	1,52	0,20

Conclusions:

- Once adjusted for demographic changes, difference between DE and UK much smaller
- LT growth rate even higher after demographic adjustment

Comparison of growth rates

Given the SNA 2008 and ESA 2010 - high standard of comparability of such data when comparing growth rates between countries (Eurostat/OECD databases)

Comparison of ratios

The household saving ratio equals saving divided by disposable income (multiplied by 100) and represents the allocation of income between consumption and saving.

Comparison of ratios

Table 14: Household saving ratio in percentage (Net saving, unless otherwise indicated)

	2009	2010	2011	2012
Australia	9,8	11	11,7	10,5
Finland	4,2	3,6	1,3	0,9
Germany	10,9	10,9	10,4	10,3
Italy	7,1	4,9	4,3	3,6
Japan	2,3	2,1	2,6	0,5
UK*	7	7,3	6,7	7,2
US	6,4	5,9	5,9	5,8

* Gross saving

Comparison of ratios

Non-comparability sources:

- Net vs Gross saving ratio.
- "Net" approach deducts households' consumption of fixed capital (CFC) from savings (S) and disposable income (DI), thus
$$S_r = \frac{S - CFC}{DI - CFC}$$
- "Gross" includes the households' consumption of fixed capital (CFC), thus $S_r = \frac{S}{DI}$
- Mathematically net saving ratio is lower than gross saving ratio
- OECD prefers net / Eurostat gross
- Gross saving ratio corresponds more to financial flows, whereas "net" is artificial in sense that it incorporates an imputed flow of fixed capital
- Differences in how consumption of fixed capital is calculated makes "net" approach less comparable

Comparison of ratios

Table 15: Household net saving ratio in percentage

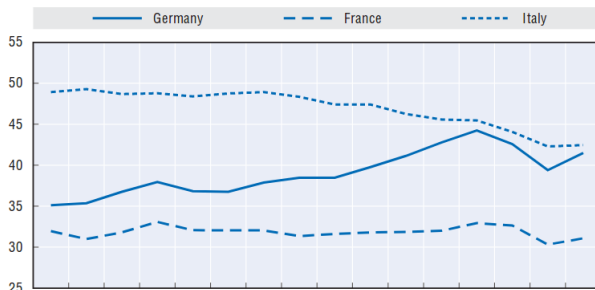
	2009	2010	2011	2012
Australia	9,8	11	11,7	10,5
finland	4,2	3,6	1,3	0,9
Germany	10,9	10,9	10,4	10,3
Italy	7,1	4,9	4,3	3,6
Japan	2,3	2,1	2,6	0,5
UK	2,3	2,9	2,2	2,8
US	6,4	5,9	5,9	5,8

Comparison of ratios

Economists use a ratio calculated as gross (net) operating surplus divided by gross (net) value added to derive an indicator of the profit rate of businesses.

Based on gross definition and using the sector of "non financial corporations" as the basis of comparison

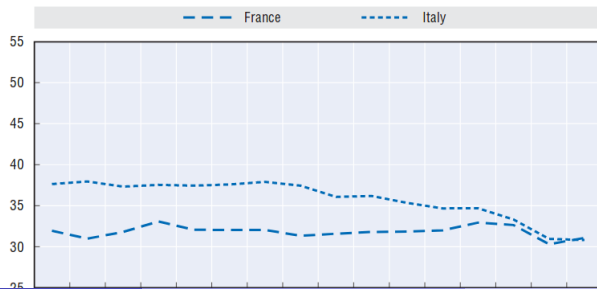
Figure 8: Profit rate for non-financial corporations (Gross operating surplus / gross value added, in %)



Comparison of ratios

Germany and Italy classify a significant number of "quasi-corporations" inside their non-financial corporation sector, including many non-salaried workers. This inflates the operating surplus. Adjusted for profit rate compiled excluding the estimated amount of the remuneration of non-salaried workers (not available for Germany)

Figure 9: Adjusted profit rate for non-financial corporations (Gross operating surplus / gross value added, in %)



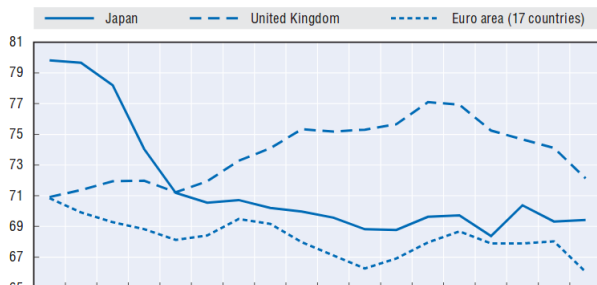
Comparison of ratios

Public debt is defined as public debt / GDP. But the definition "public" might differ across countries, though in Europe "public" means general government, but in some countries "public" might include market oriented public corporations controlled by the general government (see chapter 13 UNA for more details)

Comparison of levels of variables

Following chart is an ingenious comparison of absolute levels of GDP per head in certain countries with that of the United States, as well as a comparison of growth rates in GDP per head over time. It is important to understand, that it shows the comparison in volumes of GDP per head and not monetary values of GDP per head.

Figure 10: Real GDP per head relative to the United States (Indices, based on 2005 PPPs and 2005 prices (USA = 100))



PPP

- Purchasing power parities (PPP) is defined as $PPP = \frac{P_a}{P_b}$, where P_a and P_b define the price levels in countries a and b .
- Given that $GDP_a = P_a \times H_a$ and $GDP_b = P_b \times H_b$ where H_i defines the volume of output in country i
- Dividing country's b output by PPP, we obtain $P_a \times H_b$: GDP in volume of country b expressed in country's a prices.
- PPP:
 - PPP is a ratio of the price levels of identical products in two countries
 - deflating by PPP eliminates price level differences across countries.
 - If comparing countries with different currencies, deflating by PPP eliminates the differences between price levels and expresses the measure in the same unit of the base country.
 - The PPP is equal to the conversion rate that equalizes the the purchasing power of different countries
 - Cannot the exchange rate be used?

PPP vs exchange rate

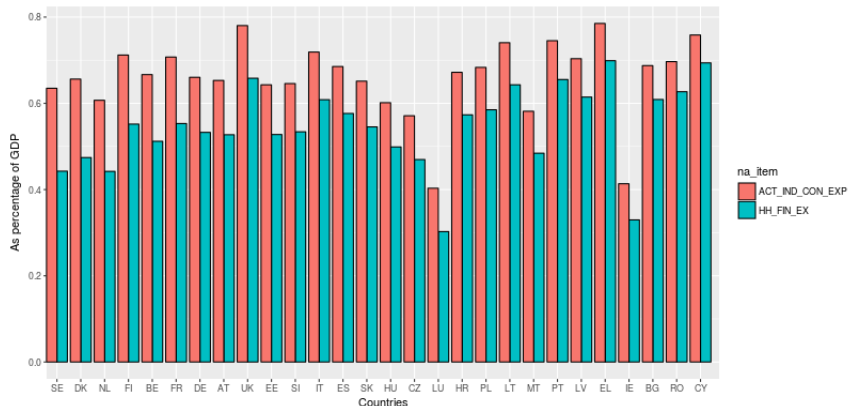
- PPP can be seen as equilibrium exchange rate
- Exchange rate depends on many factors such as trade, capital movements, whereas PPP is calculated for all goods and services , including ones not imported/exported (rents)
- But calculating PPP is difficult: the basket of goods has to be comparable and representative, but fluctuates over time [thus always use base year PPP]
- Using PPP instead of exchange rates increases the relative GDP of poorer countries, by adjusting for housing and other costs

Comparison of variables in absolute terms

- For some data comparison, institutions might pose a difficulty
- Example: Household final consumption expenditure corresponds to the purchase of goods and services by households
- Household actual individual consumption equals households consumption expenditure plus "individual consumption" which is the amount spent by general government and the NPISHs on things that directly benefit households (health care, education).
- Meaningful comparison across countries only for the latter.

Comparison of variables in absolute terms

Figure 11: Household final consumption expenditure versus actual individual consumption (As percentage of GDP), 2016



Suggested reading

- Chapter 2, Mankiw
- Chapter 1,2,3 Lequiller & Blades

OPTIONAL MATERIAL

Output

Output results from three factors of production:

- 1 Labour
- 2 Capital
- 3 Intermediate consumption (inputs)

But in economics usually the value added is used instead of output, dispensing the intermediate consumption and resulting in

$$Y = f(L, K) \times MFP$$

with *MFP* as multi factor productivity also called the "technological progress".

Potential GDP and output gap

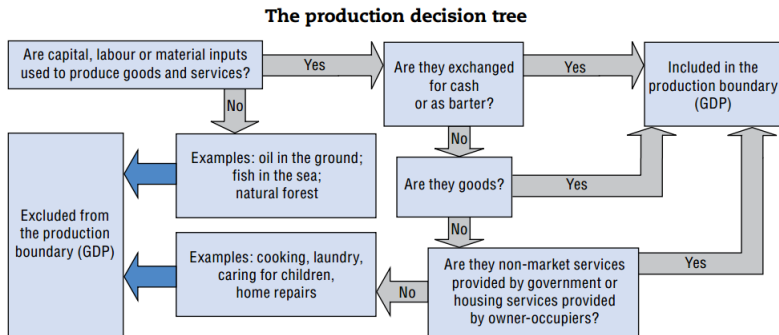
- Given the quantity of labor and capital available at a given moment, what is the maximum growth rate of GDP in volume that can be obtained without fueling inflation?
- Potential GDP
- Observed GDP - potential GDP = output gap ($2\%-4\%=-2\%$)
- Output gap can be positive and negative
- Depending on output gap - different economic / monetary policy actions

Defining Output

- What should be included in output?
- Output includes what creates the goods and services that households **buy** for their everyday needs and what firms buy to be able to produce these goods and services.
- Services of general government, though not sold, are included as output (value added) in NA and are called non-traded-output produced by general government or simply "non-market activities".
- "Non-traded output" of households like cooking, childcare are not included, exception the imputed housing rents by homeowners, else it would result in structural decline over time in GDP (upward trending homeownership and downward trending in actual rents would decrease GDP)
- Another imputation: goods that some households produce for their own consumption (important for developing / agricultural countries)

Defining Output

Figure 12: The production decision tree, ANA2014, p.108



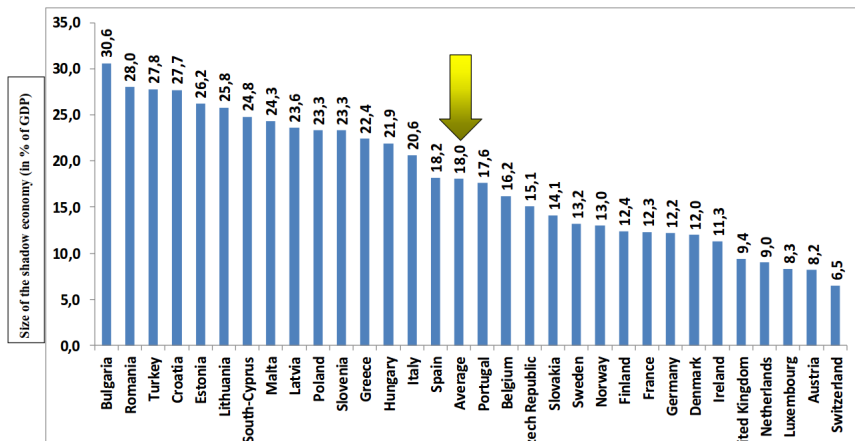
All legal and illegal activities are included:

- Illegal such as trading stolen goods, crime, prostitution (in some countries)
- Around 1% of GDP
- Legal but illegally conducted activities such as undeclared work (renovation, plumbing etc) in order to avoid taxation (shadow economy)
- Between 2-15 % of GDP
- Through different techniques estimated (eg. Friedrich Schneider)

Shadow economy

Figure 13: Size of the Shadow Economy of 31 European Countries in 2015 (in % of off. GDP), Source: F.Schneider 2015 (link)

Figure 1: Size of the Shadow Economy of 31 European Countries in 2015 (in % of off. GDP)



Measurement of output

- Output at current prices is usually measured by sales
- Part of the production may not be sold and thus increase the inventories or contrary
- Part of the output may not be completely finished ("work in progress")
- $\text{Output} = \text{Sales} - \text{change in inventories} - \text{change in "work in progress"}$
- Sales are calculated at basic prices not including taxes, but including subsidies (important for agricultural sector!)

Intermediate consumption

- Intermediate consumption represents the value of the basic materials, components going into the product as well as values for electricity, rents, services etc.
- Not all purchases materials are consumed, thus need to adjust for stocks
- Investment into machinery, software are not part of intermediate consumption, but part of GFCF
- $IC = \text{purchases} - \text{change in inventories}$

Value added in market sector

- Value added = Output - intermediate consumption
- Value added = Sales - (purchases + total inventory changes)
- applies for market sector (existing prices)

Value added in non-market sector

- Non-market producers are providers of goods and services free of charge or at prices less than half of the cost of production
- Police, army, health-care
- Non-market output is calculated as sum of:
 - the intermediate consumption
 - compensation of employees (including social contributions)
 - consumption of fixed capital
 - other taxes paid on production (rare case)

Value added in banking sector

- Banks invoice directly only a small portion of their services (commissions)
- The major part of income comes from lending money
- Financial intermediation output is calculated as sum of:
 - sales
 - difference between interest received from borrowers and interest paid to lenders

Value added in insurance sector

- Insurance premiums cover indemnities, claim management and profits
- The major part of income comes from lending money
- Financial intermediation output is calculated as sum of:
 - Difference between premiums received and indemnities paid
 - Plus the investment income from invested premiums
 - Value added = output - intermediate consumption

Value added in distribution (retail) sector

- Output for distribution = margin obtained on product sold
- Output = Value sales - value of products obtained for sale
- Value added output - intermediate consumption

Nomenclatures

- Classification of industries (branches)
- A branch of activity is defined as a group of homogenous production units, so a branch produces only goods and services described under a given heading of the product classification,
- International reference for branches is
- NACE (Nomenclature of Economic Activities) is the European statistical classification of economic activities
- International Standard Industrial Classification - ISIC
- Usually A10, A64