

MACRO I

Class1. The Gross Domestic Product

February 21nd, 2014

Course Info

Lecturer: Renata Ivanova

Classes: Friday, 12:00-15:00, room S6

Consultation: Fridays (after the class) or by appointment

Course page: http://is.muni.cz/el/1456/jaro2014/BPE_MAC1/

Textbook: Mankiw, N. G. (2012). Principles of Macroeconomics (**any edition**)

Class Policies

- Class is a laptop and cell phones free zone
- Late arrivals **will not** be tolerated
- Active participation is **encouraged**

Assignments

- ✓ Four homework assignments
- ✓ Term project

Grading

Final grade (100 %) = Midterm (20 %) + HW (20 %) +
+Term Paper (15 %) + Final (40 %) + Class

Introduction

Macroeconomic goals

- Economic growth (increase in output)
- Price-level stability (low inflation)
- Full employment (low unemployment rate)
- External balance (avoiding trade deficit)

Policy tools

- Monetary policy: interest rate and money supply
- Fiscal policy: taxes and government spending

Time Dimension

What determines the level of economy's output ?

Short run: several years

- Changes in demand

The **IS-LM model** (goods + financial markets)

Medium run: a decade

- Supply of factors
- Aggregate supply- Aggregate demand model (AD-AS)

Long run: several decades/ half a century and more

- Technological progress and factors' accumulation

Czech Republic
Gross Domestic Product
(in current prices)

N!B!

Million = 1,000,000

Billion = 1,000,000,000

Trillion = 1,000,000,000,000

In 2012, GDP of Czech Republic (\$):

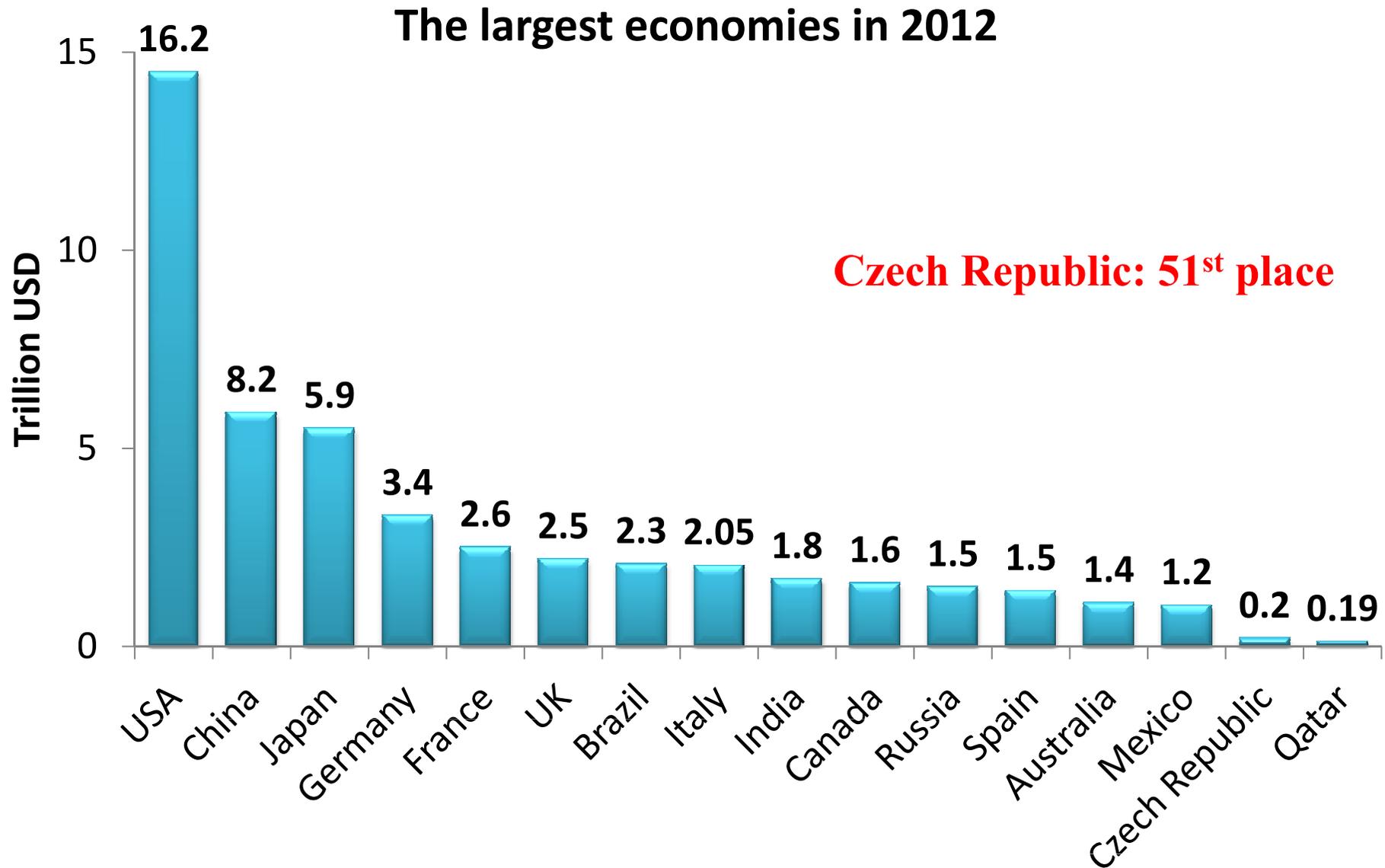
3,845,926/19.58 = \$196,4 billion

- **Size of the economy**

Source: Czech Statistical Office (CSU)

Year	GDP (mil CZK)
1990	632,691
1991	815,579
1992	925,476
1993	1,144,645
1994	1,323,328
1995	1,533,676
1996	1,761,575
1997	1,884,924
1998	2,061,583
1999	2,149,023
2000	2,269,695
2001	2,448,557
2002	2,567,530
2003	2,688,107
2004	2,929,172
2005	3,116,056
2006	3,352,599
2007	3,662,573
2008	3,848,411
2009	3,758,979
2010	3,799,547
2011	3,841,370
2012	3,845,926

How big is the Czech economy?



Source: IMF statistics database

Gross Domestic Product (GDP)

▪ Production approach

GDP is a market value of all final goods and services produced within an economy in a given period of time.

- GDP is a measure of **output**
- Is a single number expressed in **monetary units**

Why do we care?

Output is **correlated** with many important variables: standards of living, wages, unemployment, inflation, budget and trade deficit.

Adding Apples to Oranges

TE The US economy output in 2012: 2 airplanes + 5 hamburgers

GDP is a **market value** of all final goods and services produced within an economy in a given period of time

Market value = Market price

Goods	Quantity (Q)	Unit Price (P)
Airplanes	2	\$1,000,000
Hamburgers	5	\$1

$$GDP_{2012}^{USA} = 2 \cdot P^{Airplane} + 5 \cdot P^{Hamburger}$$

$$GDP_{2012}^{USA} = 2 \cdot \$1,000,000 + 5 \cdot \$1 = \$2,000,005$$

Multiple Counts

TE McDonald's hamburger costs \$1

Ingredients used for production (meat, veg., bread) cost \$0.5 per hamburger



Contribution to GDP: \$1 or \$1+\$0.5 ?

GDP is a market value of all **final goods and services** produced within an economy in a given period of time

Final good/service: consumed by the end user and does not require further processing

Intermediate goods: used as inputs for production of other goods

N!B! Some goods can be both final and intermediate

To GDP will be included **only \$1** (price of a hamburger)

The value of intermediate goods is **included** in the market price of a final good

Value Added

- Gross value added = Production – Intermediate consumption
- Increase in value that a business creates by undertaking the production process.

Producer	Price of output	Price of inputs	Value added
McDonalds	\$1	\$0.5	\$ 0.5
Farmer	\$ 0.5	\$0	\$ 0.5
Total	\$1.5	\$ 0.5	\$1

← **Contribution to GDP**

GDP is the **sum of value added** in the economy during a given period

- Firms pay taxes on the value added of their activities (VAT)
- Firms report sales

Used Goods

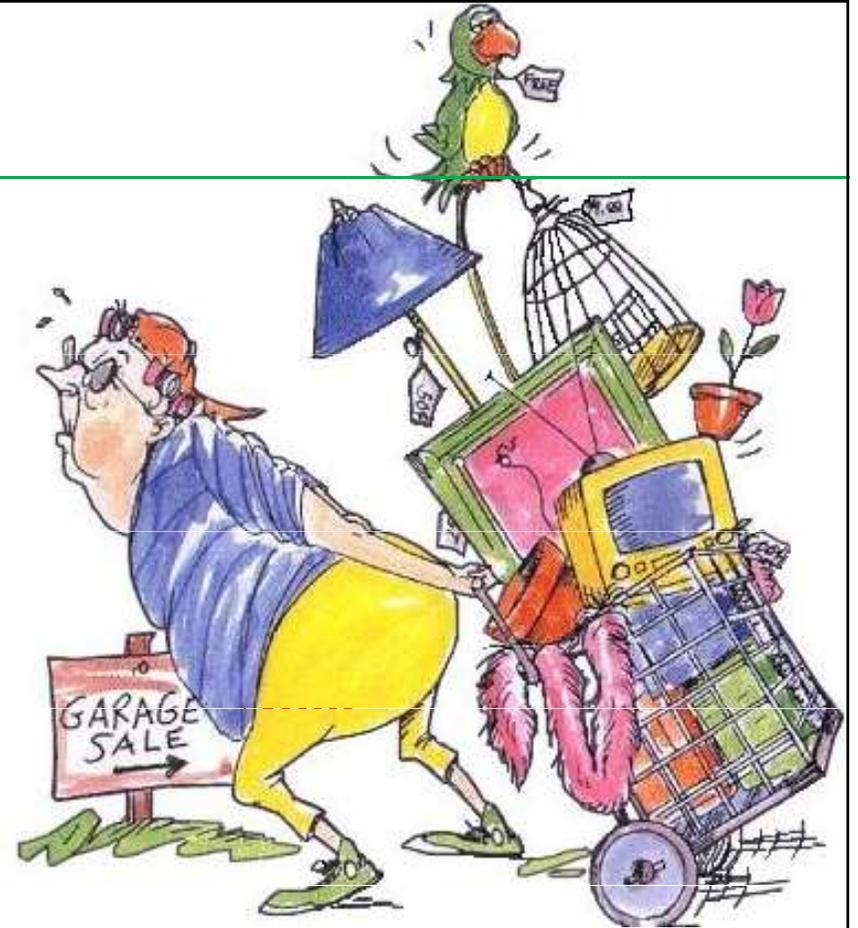
- You are buying a Rembrandt's painting from another collector at the price of 1,000,000 Euros
- You are buying stuff at your neighbor's garage sale for 20 CZK

What is the contribution to GDP?

GDP is a market value of all final goods and services **produced** within an economy **in a given period of time**

GDP includes only the value of **currently produced** goods and services

- Resale of goods represents a transfer of an asset



GDP vs. GNP (Output vs. Location)

TE Czech Beer Factory operating in Slovakia



GDP is a market value of all final goods and services produced

within an economy in a given period of time

- within a country's boarder
- Output of Volkswagen operating in CR is counted in Czech GDP

Gross national product (GNP) is a market value of all final goods and services produced in a given period of time using factors of production owned by the

residents of a country

GDP Accuracy

Does **not** account for

- Goods and services not sold in the market (home production, child care)
- Underground economy: legal activities hidden from government and illegal activities
- Imputed values

Assumption: The level of inaccuracy in GDP calculations is roughly constant
from year to year

=> **Inaccuracy can be neglected**

GDP: Three Equivalent Approaches

Fundamental identity

Total production = Total income = Total expenditure

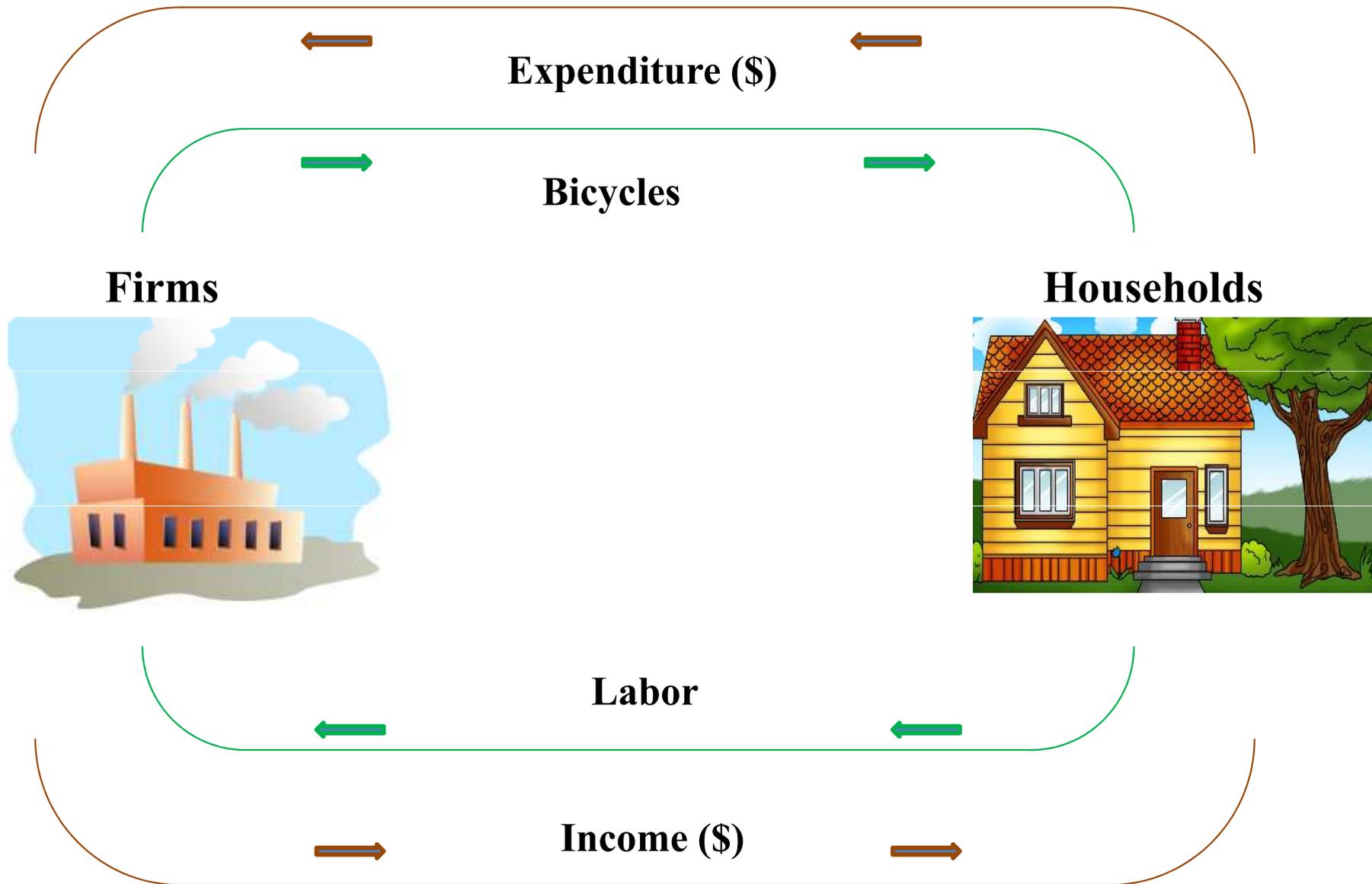
2. Income method

Def III: GDP is a nation's total income

3. Expenditure method

GDP is the total expenditure on national output of goods and service

THE CIRCULAR FLOW MODEL OF MARKET ECONOMY



The rule of accounting: Expenditure of buyers = Income of sellers

The Circular Flow Model

Assumptions

- A closed economy (no international trade)
- No government
- No savings

Injections

- Government spending (G)
- Exports (EX)
- Investments (I)

Leakages

- Taxation (T)
- Imports (IM)
- Savings (S)

GDP: Expenditure Approach

- **Group I: Households**



- **Group II: Businesses**



- **Group III: Government**



- **Group IV: Foreign sector**



GDP: Expenditure Approach (Cont.)

- The National Income Account Identity for an **open economy**



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



Y – total output (production)

GDP of Czech Republic: Expenditure Approach

Expenditure category	Czech Republic	?
Consumption	71.1%	26.9%
Investment	23.3%	35.3%
Net export	5.6%	37.8%
GDP	100%	100%

Source: Czech Statistical Office. Ministry of development planning and statistics

GDP: Three Equivalent Approaches (Cont.)

TE Consider an economy consisting of two firms

Firm 1: Steel producer

Revenues from sale: €100

Wages: €80

Profit: €20

Firm 2: Car manufacturer

Revenues from sale cars: €200

Wages: €70

Profit: €30

What is the GDP?

Production approach: €200

Income approach: €80+ €20 + €70+ €30 = €200

Expenditure approach: €200

Value added approach: €100+ (€200- €100) = €200

Treatment of Inventories

- Goods produced in a certain period but not sold

TE A farm fails to sell milk and the milk spoils

Is GDP affected? NO

- Spoiled milk is not sold – no effect on consumer expenditure
- The farm does not obtain additional revenue
- The farm's revenue after subtracting wages shrinks
=> Neither total expenditure, nor total income are affected

TE The milk is put into inventory to be sold later

Is GDP affected? NO

- The farm “purchases” milk for its inventory – total expenditures are affected
- The farm gets additional revenue => additional profit => income is affected
- Later sale out of inventory is treated as a sale of used goods



Services and Imputations

- **Housing services**

- Home owners pay a “rent” to themselves
- Included in homeowner expenditures and income

Imputed rent: how much it would cost to rent out the owner’s dwelling unit

In the case of no imputations, what effect would the increase in house ownership have on GDP? **GDP would decline**

- **Government services** (Police officers, politician, etc.)
- Wages are used as a value of service

Summary

- ✓ GDP is a measure of aggregate output
- ✓ Approaching from production or income side
- ✓ **Aggregate production = Aggregate income = Aggregate expenditure**

THREE EQUIVALENT APPROACHES

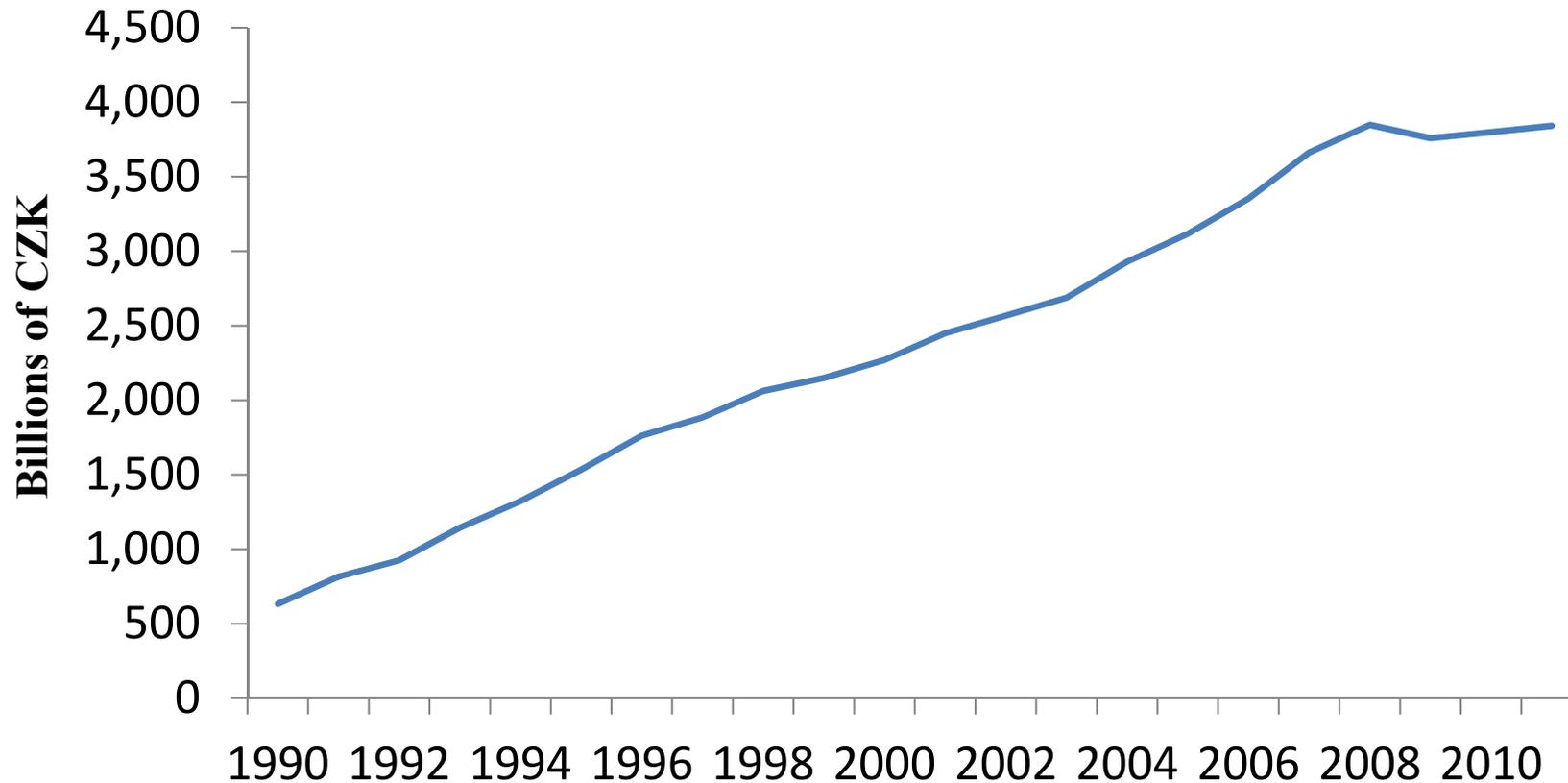
- ✓ GDP as the total *expenditure* on final goods output
- ✓ GDP as a sum of *value added*
- ✓ GDP as a sum of *income*
 - In a given period of time
 - In a particular economy

Which of the following will be counted in GDP?

- A purchase of the “Principles of Economics” textbook for our course. After the course, you sell your text book to a friend who will take the course next semester.
- The value of the teaching service provided by a lecturer to students
- Your haircut made by a friend
- A purchase of aprons by restaurant chefs
- A house constructed in 1950 and sold in 2012
- Sale of the last year fashion collection by ZARA
- A purchase of tires by an automobile manufacturer for the installation on a new line of cars

Comparison Over Time

Czech Nominal GDP 1990-2011, CZK



What are the reasons for such increase in GDP?

$$GDP_t = P_t^1 \cdot Q_t^1 + P_t^2 \cdot Q_t^2 + \dots = \sum_{i=1}^N P_t^i Q_t^i$$

Real GDP

Nominal values: expressed in **current** prices

Nominal GDP in 2011-2012

$$GDP_{2012}^{Italy} = Q_{2012}^{Pizza} \cdot P_{2012}^{Pizza}$$

$$GDP_{2011}^{Italy} = Q_{2011}^{Pizza} \cdot P_{2011}^{Pizza}$$

=> Changes in **quantity** produced **or/and** **prices** of goods

Real values: expressed in **constant** prices

The base year approach: Fixing prices by choosing a **base year (2011)**

$$GDP_{2012}^{real} = Q_{2012}^{Pizza} \cdot P_{2011}^{Pizza}$$

$$GDP_{2011}^{real} = Q_{2011}^{Pizza} \cdot P_{2011}^{Pizza}$$

N!B! Nominal GDP = Real GDP in the **base year**

GDP of Czech Republic

What is the base year?

Year	Nominal GDP	Real GDP
2000	2,269,695.00	2,550,148.00
2001	2,448,557.00	2,629,135.00
2002	2,567,530.00	2,685,643.00
2003	2,688,107.00	2,786,789.00
2004	2,929,172.00	2,918,955.00
2005	3,116,056.00	3,116,056.00
2006	3,352,599.00	3,334,815.00
2007	3,662,573.00	3,526,071.00
2008	3,848,411.00	3,635,344.00
2009	3,758,979.00	3,471,494.00
2010	3,790,880.00	3,557,216.00
2011	3,823,401.00	3,621,908.00
2012	3,845,926.00	3,584,924.00

Real GDP (Cont.)

TE Consider again the pizza-producing economy

Year	Q	P (\$)	Nominal GDP	Real GDP (100=2005)	Real GDP (100=2000)
2000	10	5	50	80	50
2005	10	8	80	80	50
2012	15	10	150	120	75

- **Real GDP (100=2005):** Real GDP in 2005 prices

N!B! Change in the base year will lead to different levels of real GDP

GDP Growth Rate

- Percentage change in the quantity of goods produced from year to year

- Growth rate $g_t = \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}}$

Year	Q	P (\$)	Nominal GDP	Growth rate (%)
2010	10	5	50	--
2011	10	8	80	60
2012	15	10	150	87.5

$$g_{2011}^N = \frac{\$80 - \$50}{\$50} = 0.6 \text{ or } 60\%$$

$$g_{2012}^N = \frac{\$150 - \$80}{\$80} = 0.875 \text{ or } 87.5\%$$

- Nominal GDP growth rates reflect changes **in both** Q & P

GDP Growth Rate (Cont.)

Year	Q	P	Nominal GDP	Growth rate (%)	Real GDP (100=2005)	Growth rate (%)
2010	10	5	50	--	80	--
2011	10	8	80	60	80	0
2012	15	10	150	87.5	120	50

$$g_{2005}^R = \frac{\$80 - \$80}{\$80} = 0 \text{ or } 0\%$$

$$g_{2012}^N = \frac{\$120 - \$80}{\$80} = 0.5 \text{ or } 50\%$$

Will the real GDP **growth rates** be affected by the change in the base year? **NO**

GDP Growth Rate (Cont.)

TE Multiple goods

	Pizza		Haircuts		Nominal GDP (\$)
Year	Q	P (\$)	Q	P(\$)	
2011	10	5	5	3	65
2012	15	10	10	5	200

TE Real GDP

$$GDP_{2012}^R (100 = 2011) = \$5 \cdot 15 + \$3 \cdot 10 = \$105$$

$$GDP_{2011}^R (100 = 2012) = \$10 \cdot 10 + \$5 \cdot 5 = \$125$$

TE Real GDP growth rate

$$g_{2012}^R (100 = 2011) = \frac{\$105 - \$65}{\$65} = 0.62 \text{ or } \boxed{62\%}$$

$$g_{2012}^R (100 = 2012) = \frac{\$200 - \$125}{\$125} = 0.6 \text{ or } \boxed{60\%}$$

\neq

Real GDP: The Chain-Weighted Approach

- The value of output expressed in **base year (constant) prices**

$$GDP_t^R = Q_t^1 \cdot P_{base\ year}^1 + Q_t^2 \cdot P_{base\ year}^2 + \dots$$

⇒ Any changes in real GDP are due to changes in **quantity** of the output only

- Issues with the base year approach

- The GDP growth rate **is affected** by the choice of the base year

What year to be used as the base year?

- In practice, the base year is changed every 5 years and GDP is recalculated

What are the consequences? ⇒ Economic performance is different

C-W approach updates prices **every year** ⇒ **more accurate**

Real GDP: The Chain-Weighted Approach (Cont

Three steps procedure

Calculating change in real GDP between year t and year t+1

Step 1.

- Use year t as a base year => Real GDP => growth rate
- Use year t+1 as a base year => Real GDP => growth rate

$$g_{2012}^R (100 = 2011) = 0.62 \text{ or } 62\%$$

$$g_{2012}^R (100 = 2012) = 0.6 \text{ or } 60\%$$

Step 2. Calculate the **average of two** growth rates

$$g_{2012}^R = \frac{g_{2012}^R (100 = 2011) + g_{2012}^R (100 = 2012)}{2} = \frac{60\% + 62\%}{2} = 61\%$$

=> **Chain-weighted real GDP growth rate**

Real GDP: The Chain-Weighted Approach (Cont

Step 3. Construct the real GDP index

- Chose an arbitrary base year: 2011
- Nominal GDP in the base year is equal to real GDP
- **Chain-weighted real GDP** in the following year

$$GDP_{2012}^R = GDP_{2011}^R (1 + g_{2012}^R)$$

$$GDP_{2013}^R = GDP_{2012}^R (1 + g_{2013}^R)$$

N!B! For the years before the base year

$$GDP_{2010}^R = GDP_{2011}^R / (1 + g_{2011}^R)$$

Chain to the base year: in order to calculate next year real GDP, we need to know the previous year figure

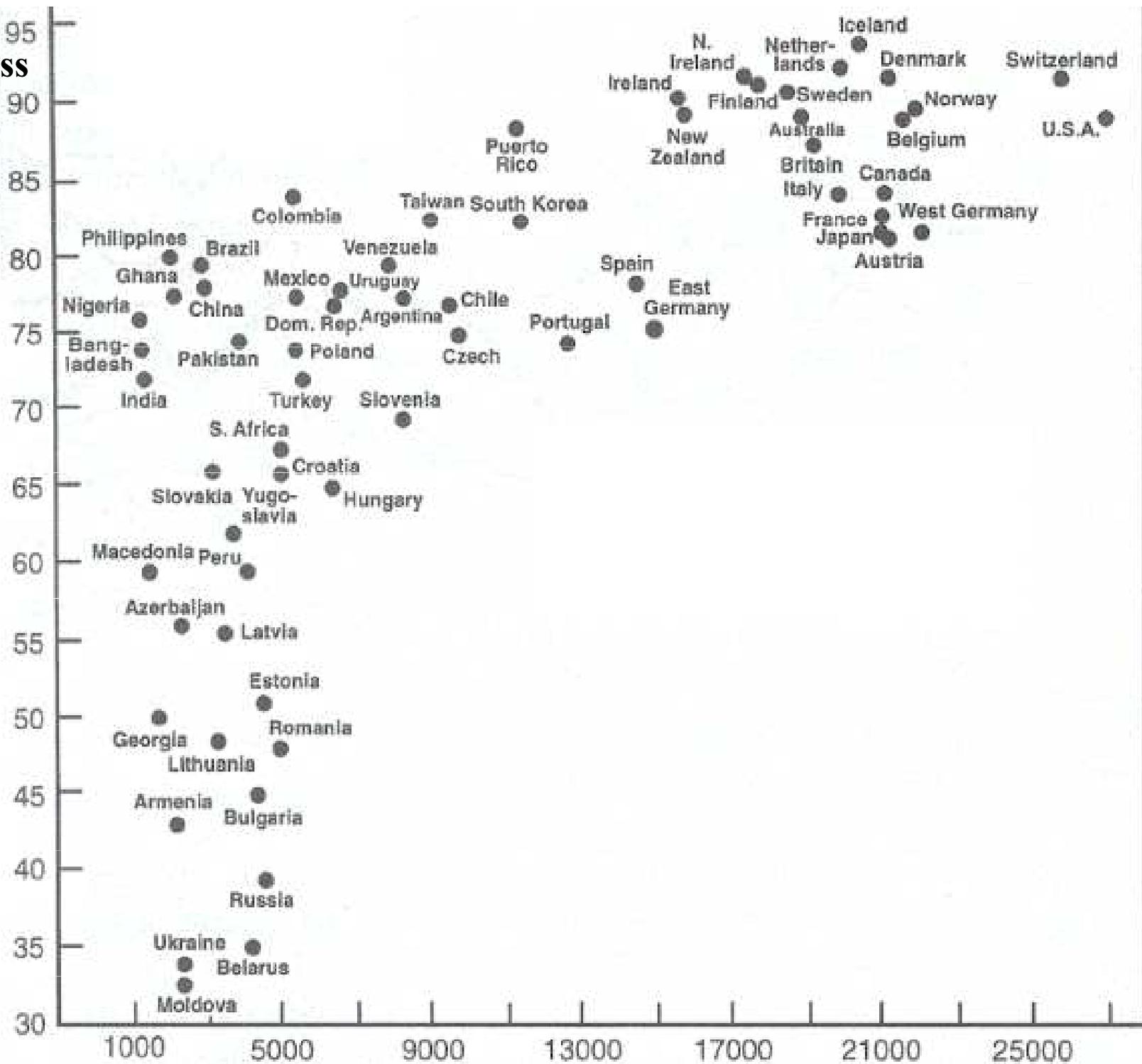
GDP as a Measure of Well-Being (Cont.)

Country	Real GDP per Person (2007)	Life Expectancy	Adult Literacy (% of population)	Internet Usage (% of population)
United States	\$45,592	79 years	99%	63%
Germany	34,401	80	99	45
Japan	33,632	83	99	67
Russia	14,690	66	99	15
Mexico	14,104	76	93	18
Brazil	9,567	72	90	19
China	5,383	73	93	9
Indonesia	3,843	71	92	7
India	2,753	63	66	3
Pakistan	2,496	66	54	7
Nigeria	1,969	48	72	4
Bangladesh	1,241	66	54	0.3

Source: Mankiw , G. (2011). Principles of Economics

N!B! GDP is correlated with a well-being indicators, but is an imperfect measure of the well-being itself

Happiness index



Income per capita (USD)

Next class: Economic Growth



N!B! Reading Assignment: Textbook + Handout