MACROECONOMICS I

Class 2. National Accounts (Cont).

Introduction to Economic Growth

February 28th, 201

Class Outline

- Real GDP: Chain-weighted approach

- GDP deflator

- Introduction to economic growth

GDP: Three Equivalent Approaches

1. Production approach (value-added)

2. Income approach

3. Expenditure approach

Why are they equivalent ?

THE CIRCULAR FLOW MODEL OF MARKET ECONOMY

Expenditure ($)

Bicycles

Firms

Households

**Total production =
=Total income =
=Total expenditure**

Labor
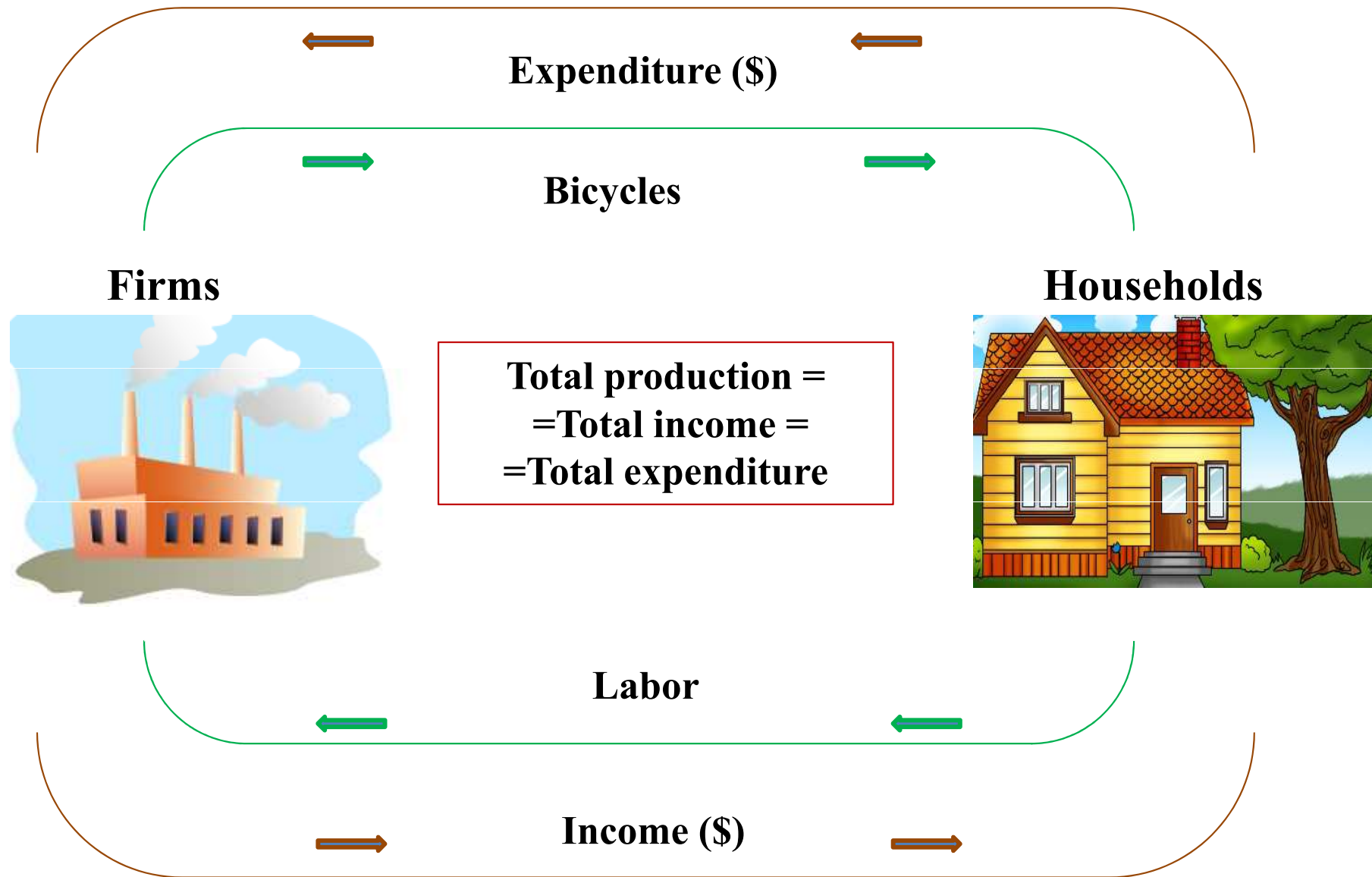
Income ($)

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

GDP by the Expenditure Approach

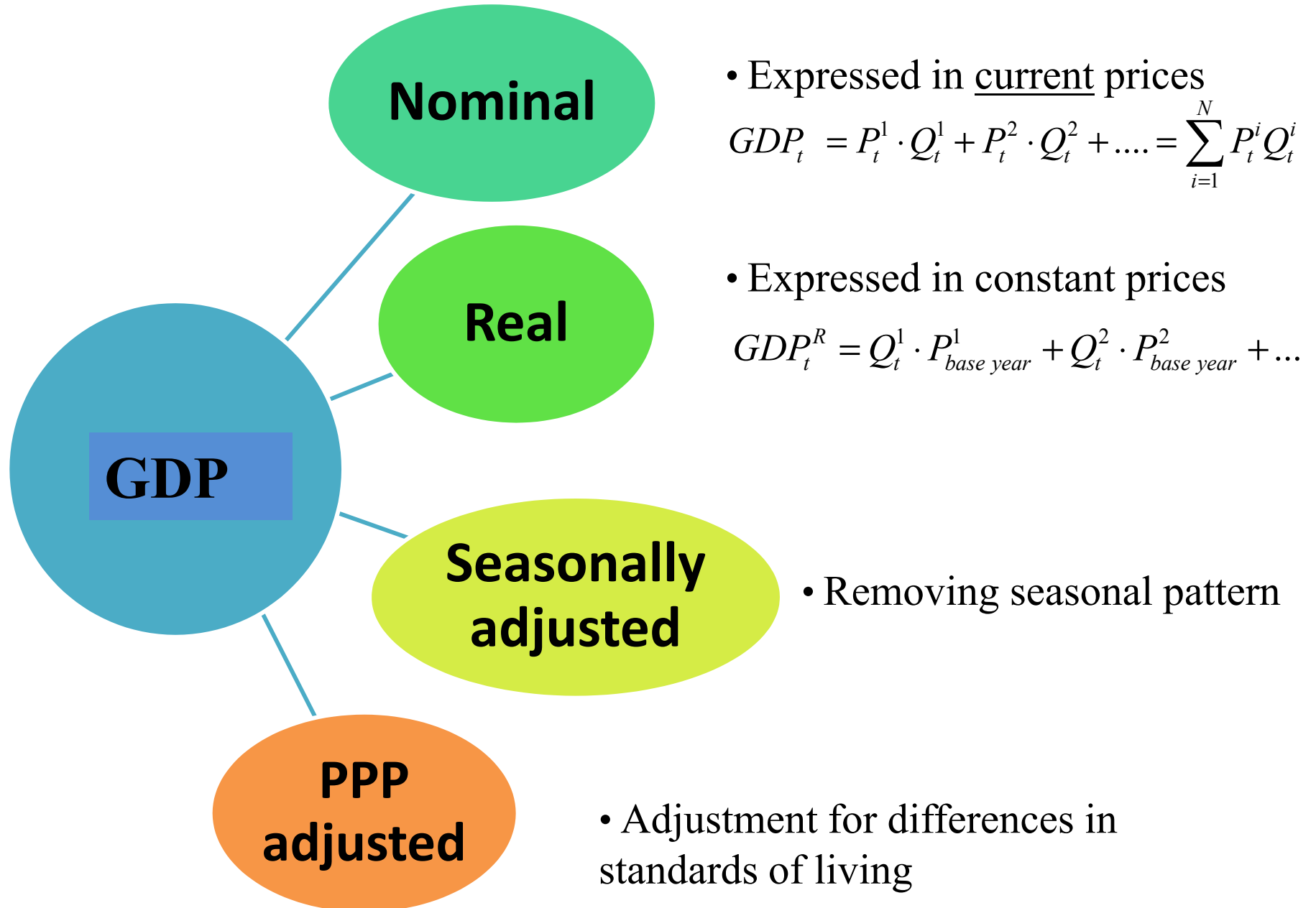| Expenditure category	Czech Republic	Qatar	China
Consumption	71.1%	26.9%	?
Investment	23.3%	35.3%	?
Net export	5.6%	37.8%	?
GDP	100%	100%	

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

GDP by the Expenditure Approach

Expenditure category	Czech Republic	Qatar	China
Consumption	71.1%	26.9%	49.1%
Investment	23.3%	35.3%	48.3%
Net export	5.6%	37.8%	2.6 %
GDP	100%	100%	100%

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

GDP Variations

Nominal

- Expressed in <u>current</u> prices

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

Real

- Expressed in constant prices

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

GDP

Seasonally adjusted

- Removing seasonal pattern

PPP adjusted

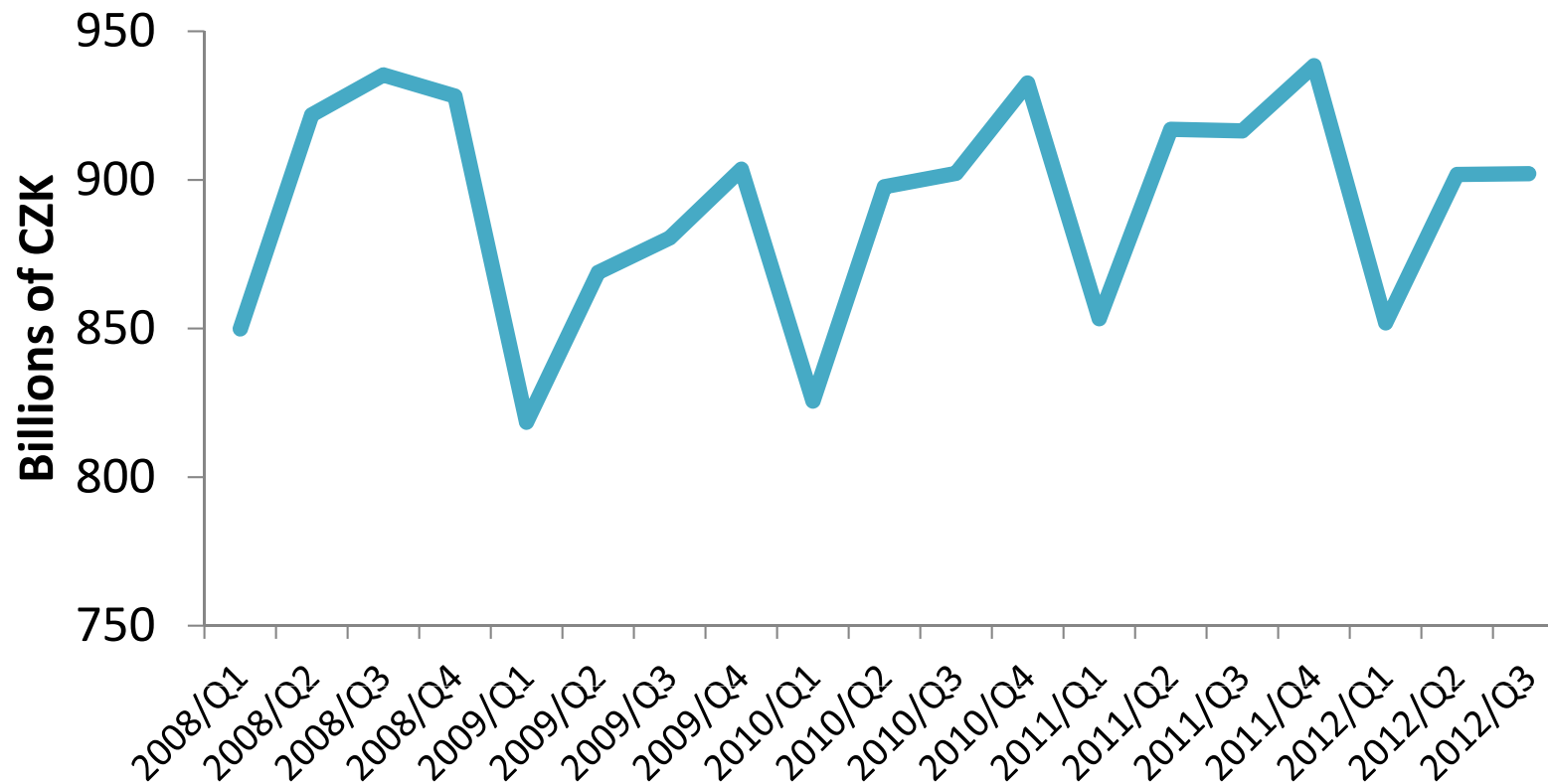- Adjustment for differences in standards of living

Seasonally Adjusted GDP

- Quarter-to-quarter fluctuations

- A pronounced seasonal pattern:

  Steady growth over the year - peaking in Q4 - sharp drop in Q1

Czech Republic Real GDP, Q1/2008-Q3/2012

PPP Adjusted GDP

- Comparing the standards of living (GDP per capita) across countries

- Converting GDP into common currency using currency exchange rates

Issues:

1. Variation of exchange rates

2. Difference in prices of basic goods

Solution: using a common set of prices which reflects the **purchasing power**

Purchasing power parity: The price of a typical basket of goods is equal across countries being converted into the common currency

Real GDP: The Chain-Weighted Approach

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

- GDP growth rate:
$$g_t = \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}}$$

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

What year to choose?

Real GDP: The Chain-Weighted Approach

TE

	Popcorn		Movies	
Year	Q	P ($)	Q	P($)
2010	10	5	5	3
2011	15	10	10	5
2012	10	15	12	10

Real GDP (100=2010)?

$$GDP_{2010}^{R}(100 = 2010) = \$5 \cdot 10 + \$3 \cdot 5 = \$65$$

$$GDP_{2011}^{R}(100 = 2010) = \$5 \cdot 15 + \$3 \cdot 10 = \$105$$

$$GDP_{2012}^{R}(100 = 2010) = \$5 \cdot 10 + \$3 \cdot 12 = \$85$$

Real GDP growth rate?

Real GDP: Example (Cont.)

	Popcorn		Movies		Real GDP growth rate
Year	Q	P ($)	Q	P($)	
2010	10	5	5	3	---
2011	15	10	10	5	60 %
2012	10	15	12	10	-20%

Real GDP (100=2011)

$$GDP^{R}_{2010}(100 = 2011) = \$10 \cdot 10 + \$5 \cdot 5 = \$125$$

$$GDP^{R}_{2011}(100 = 2011) = \$10 \cdot 15 + \$5 \cdot 10 = \$200$$

$$GDP^{R}_{2012}(100 = 2011) = \$10 \cdot 10 + \$5 \cdot 12 = \$160$$

Real GDP: Example (Cont.)

	Popcorn		Movies		Real GDP growth rate
Year	**Q**	**P ($)**	**Q**	**P($)**	
2010	10	5	5	3	---
2011	15	10	10	5	62 %
2012	10	15	12	10	-16%

Real GDP (100=2012)

$$GDP^R_{2010}(100 = 2012) = \$15 \cdot 10 + \$10 \cdot 5 = \$200$$

$$GDP^R_{2011}(100 = 2012) = \$15 \cdot 15 + \$10 \cdot 10 = \$325$$

$$GDP^R_{2012}(100 = 2012) = \$15 \cdot 10 + \$10 \cdot 12 = \$270$$

Real GDP: The Chain-Weighted Approach

Three step procedure: Step 1

Year	Real GDP growth rate (100=2010)	Real GDP growth rate (100=2011)	Real GDP growth rate (100=2012)
2010	---	---	---
2011	61 %	60%	62%
2012	-19%	-20%	-16%

Real GDP: The Chain-Weighted Approach

Three step procedure: Step 2

Year	Real GDP growth rate (100=2010)	Real GDP growth rate (100=2011)	Real GDP growth rate (100=2012)
2010	---		
2011	61 %	60%	62%
2012	-19%	-20%	-16%

$$g_{2011}^{R} = \frac{g_{2011}^{R}(100 = 2010) + g_{2011}^{R}(100 = 2011)}{2} = \frac{61\% + 60\%}{2} = 60.5\%$$

$$g_{2012}^{R} = \frac{g_{2012}^{R}(100 = 2011) + g_{2012}^{R}(100 = 2012)}{2} = \frac{-20\% - 16\%}{2} = -18\%$$

Three step procedure: Step 3

$$GDP^{CW}_{2011} = GDP_{2010} \, (1 + g^R_{2011})$$

$$GDP^{CW}_{2012} = GDP^{CW}_{2011} \, (1 + g^R_{2012})$$

• In order to calculate next year real GDP, we need to know the previous year figure

• If we start from year 2011, real GDP for 2010 is

$$GDP^{CW}_{2010} = GDP_{2011} \, / (1 + g^R_{2011})$$

The GDP Deflator

- Changes in the **overall price level** between the base year and the current year

- The price of output relative to ithe price in a base year

GDP Deflator(t) = Nominal GDP (t)/Real GDP(t)

- It is an index

- Equals to 1 or 100 in the base year

- Its **level** has no economic interpretation

- Removes the inflation out of nominal GDP

$$GDP_t^R = \frac{GDP_t^N}{GDP\ Deflator_t}$$

The GDP Deflator (Cont.)

• US GDP deflator (100=2005)

GDP Deflator (2006) = 103

⇒ Increase in overall prices by 3 % relative

to the **base year**

• **GDP Deflator (2000) = 88.7**

⇒Increase in overall prices between 2000

and 2005 by 11.3 % compared

N!B! Deflator shows the change in prices **relative to the base year**

Year	Deflator
2000	88.723
2001	90.727
2002	92.196
2003	94.135
2004	96.786
2005	**100**
2006	103.231
2007	106.227
2008	108.582
2009	109.529
2010	110.993
2011	113.359
2012	115.36

The GDP Deflator (Cont.)

$$Inflation_t = \frac{GDP\ Deflator_t - GDP\ Deflator_{t-1}}{GDP\ Deflator_{t-1}}$$

•**Inflation** – a change in aggregate price

level from one year to another

Year	Deflator	Inflation rate
2000	88.723	2.17
2001	90.727	2.26
2002	92.196	1.62
2003	94.135	2.10
2004	96.786	2.82
2005	**100**	3.32
2006	103.231	3.23
2007	106.227	2.90
2008	108.582	2.22
2009	109.529	0.87
2010	110.993	1.34
2011	113.359	2.13
2012	115.36	1.77

GDP as a Measure of Well-Being

GDP does **not** account for:

• Non-marker transactions

• Leisure

• Improved product quality

• Distribution of income

• Quality of environment

• Depletion of resources

▪ Developed by Simon Kuznets in 1930 for BEA as a tool which allows to monitor the effect of government policy

Data Sources

Czech Republic: Czech statistical office

Český statistický úřad (CSU)

www.czso.cz

Czech National Bank: Global Economics Outlook

USA

U.S. Bureau of Economic Analysis (BEA)

www.bea.gov

European Union

Directorate General on Economic and Financial Affairs of the European Commission

http://ec.europa.eu/economy_finance/eu/index_en.htm

OECD

www.oecd.org

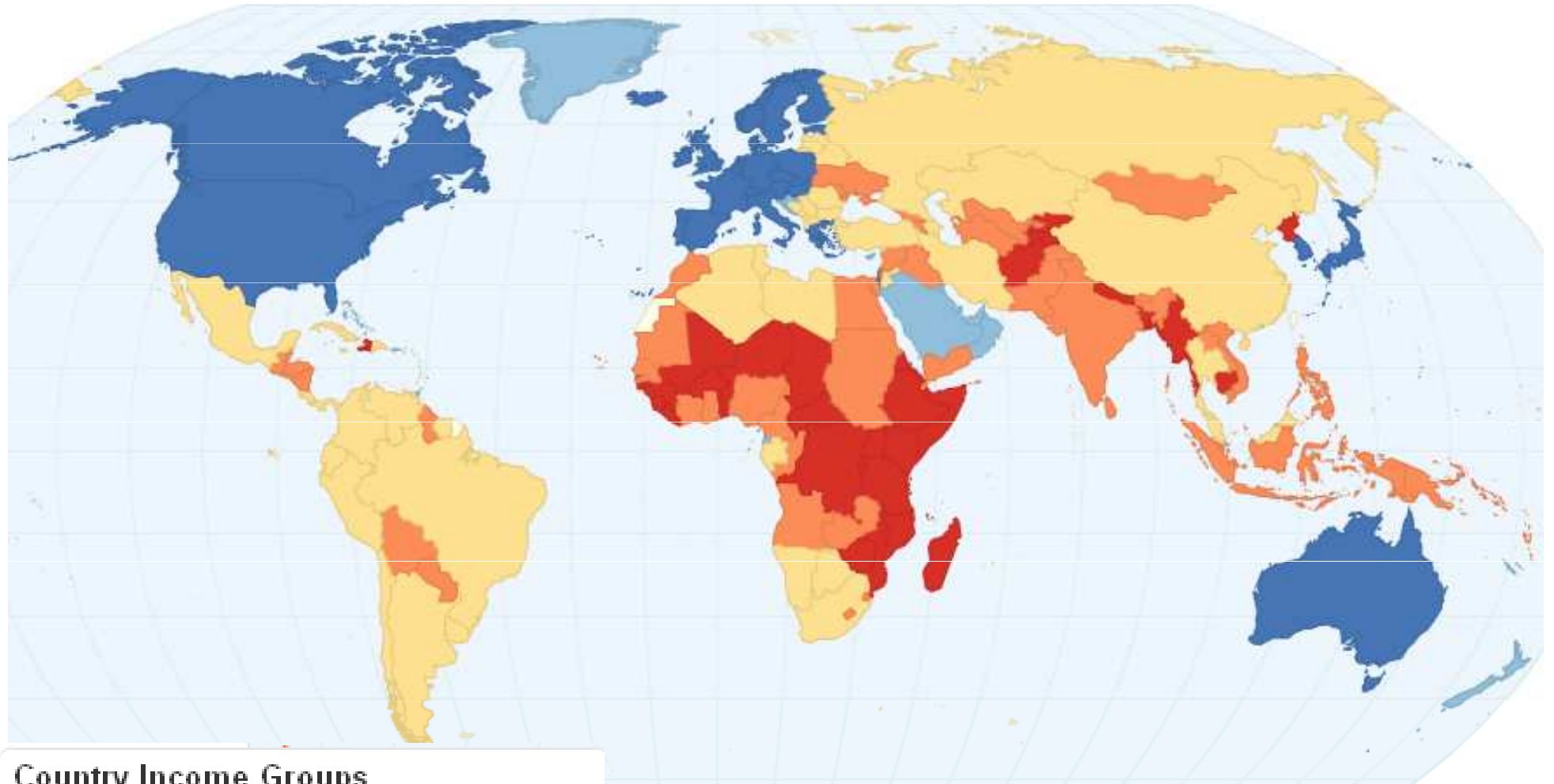# Long Run: Economic Growth

Definition: Increase in real GDP per capita

Two aspects

- Changes in GDP per capita within one country over time

- Tremendous differences in GDP per capital across countries

The World Bank Classification based on **GNP per capita**

- Low income: < $1,005

- Middle income: $1,006 –$12,000

- High income: >$12,000

Cross-Country Income Differences

Country Income Groups

- ■ Low income - $1,005 or less
- ■ Lower middle income - $1,006-$3,975
- ■ Upper middle income - $3,976-$12,275
- ■ High income: nonOECD - $12,275 or more
- ■ High income: OECD - $12,275 or more

Year: July 2011

Source: The World Bank Group

Economic Growth

Changes over time

Country	Period	Real GDP per Person at Beginning of Period*	Real GDP per Person at End of Period*	Growth Rate (per year)
Japan	1890–2008	$1,504	$35,220	2.71%
Brazil	1900–2008	779	10,070	2.40
Mexico	1900–2008	1,159	14,270	2.35
Germany	1870–2008	2,184	35,940	2.05
Canada	1870–2008	2,375	36,220	1.99
China	1900–2008	716	6,020	1.99
United States	1870–2008	4,007	46,970	1.80
Argentina	1900–2008	2,293	14,020	1.69
United Kingdom	1870–2008	4,808	36,130	1.47
India	1900–2008	675	2,960	1.38
Indonesia	1900–2008	891	3,830	1.36
Pakistan	1900–2008	737	2,700	1.21
Bangladesh	1900–2008	623	1,440	0.78

Source: Mankiw (2011)

Economic Growth (Cont.)

- Distribution of countries according to PPP-adjusted real GDP per capita

Distribution shift to the right => Increasing inequality across countries
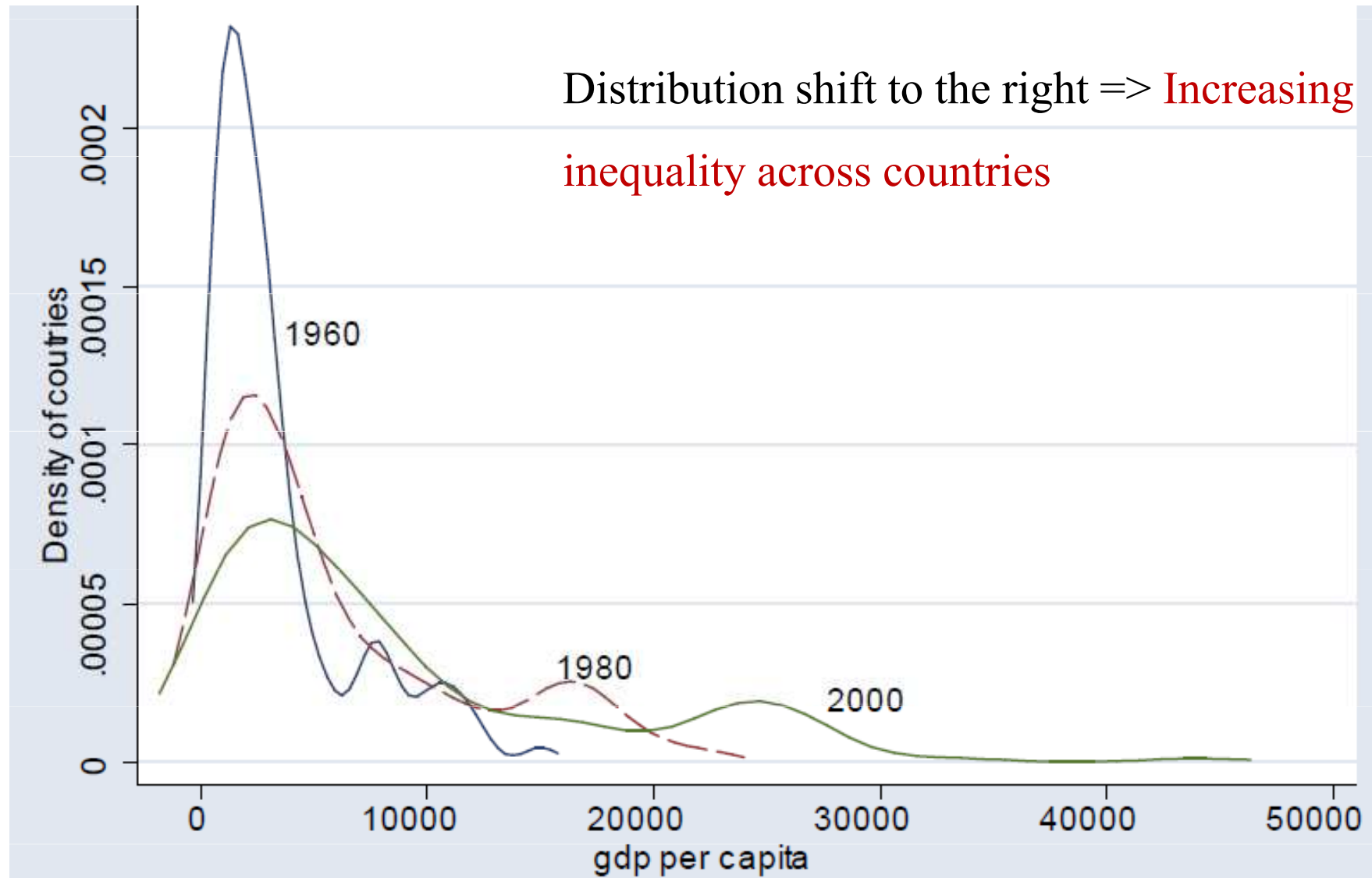
Source: Acemoglu, D. (2009)

Economic Growth (Cont.)

How can the US be 32 times richer than Bangladesh?

• **Different growth rate**

TE If we take two countries with the same GDP per capita
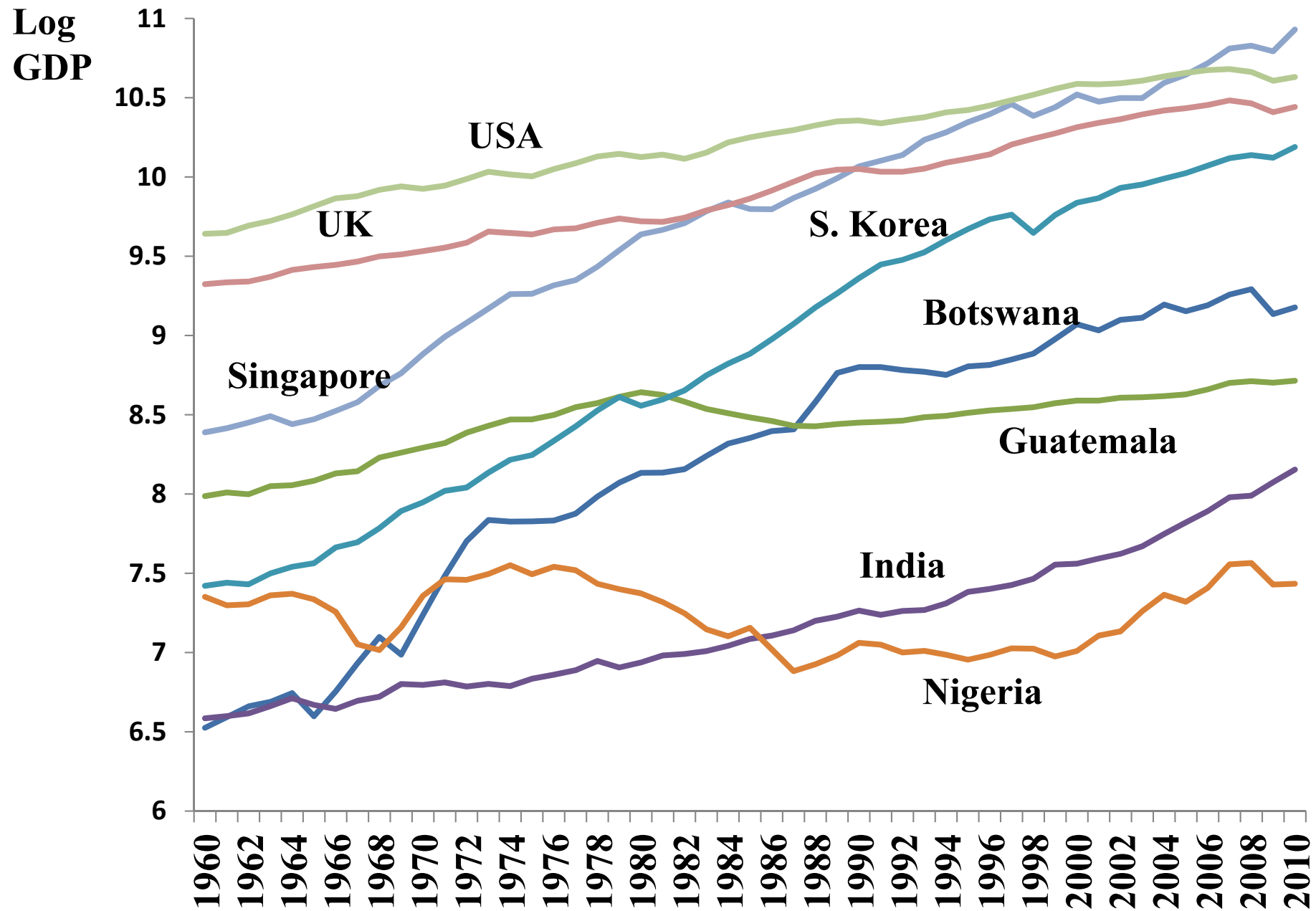
One country is growing at 2 % per year

Another country is not growing (0% per year)

$\Rightarrow$ In 200 years

$$GDP_{200}^A = GDP_0^A (1 + 0.02)^{200} = GDP_0^A \cdot 52$$

$$GDP_{200}^B = GDP_0^B (1 + 0)^{200} = GDP_0^B \cdot 1$$

The evolution of GDP per capita, 1960-2010

Log GDP

USA
UK
S. Korea
Singapore
Botswana
Guatemala
India
Nigeria

11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6

1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010
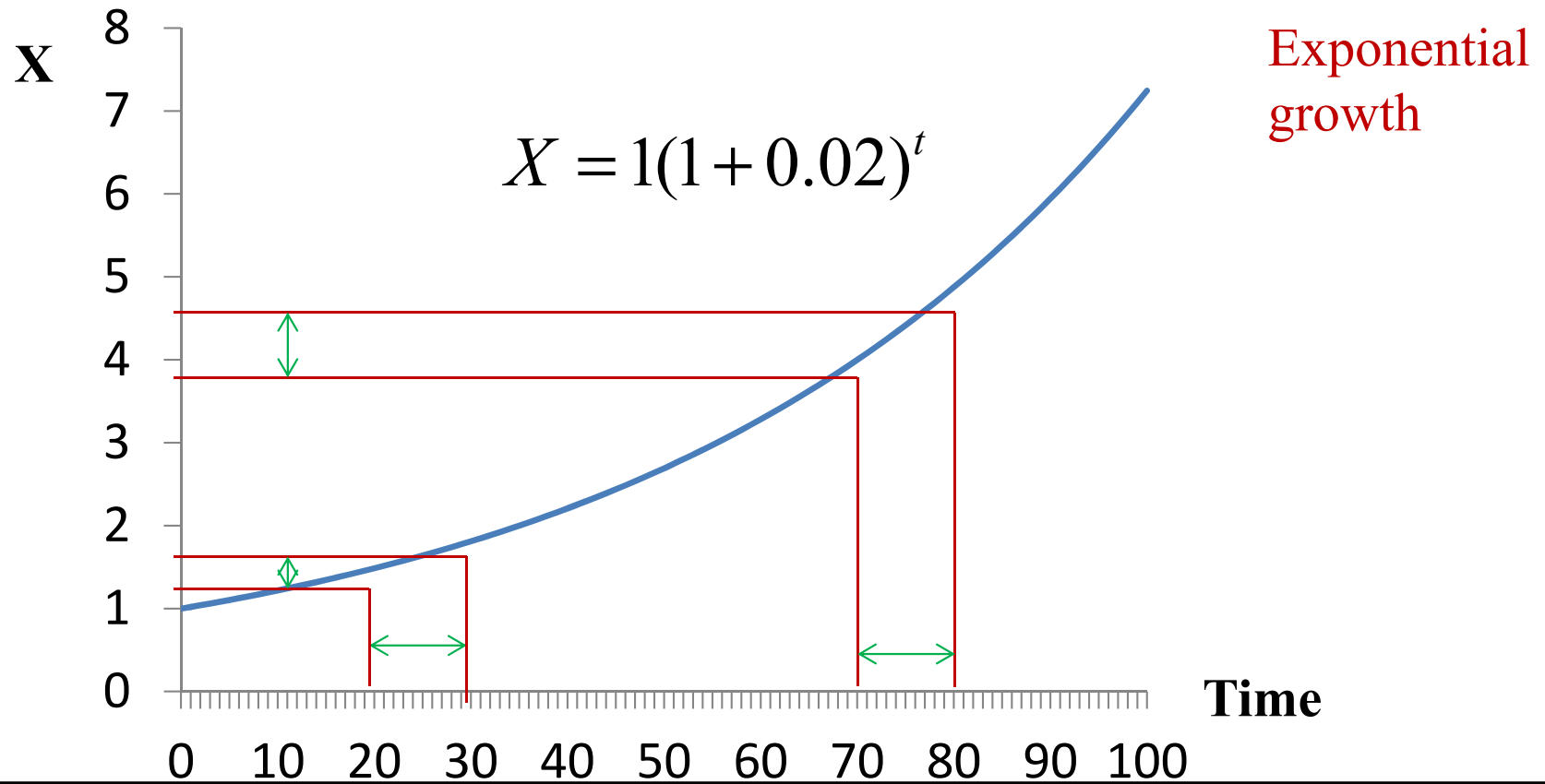
Logarithmic Scale

• If GPD per capita grows at a constant rate of 2 % per year, the value of GDP per capita increases by **larger and larger increments over time**

TE

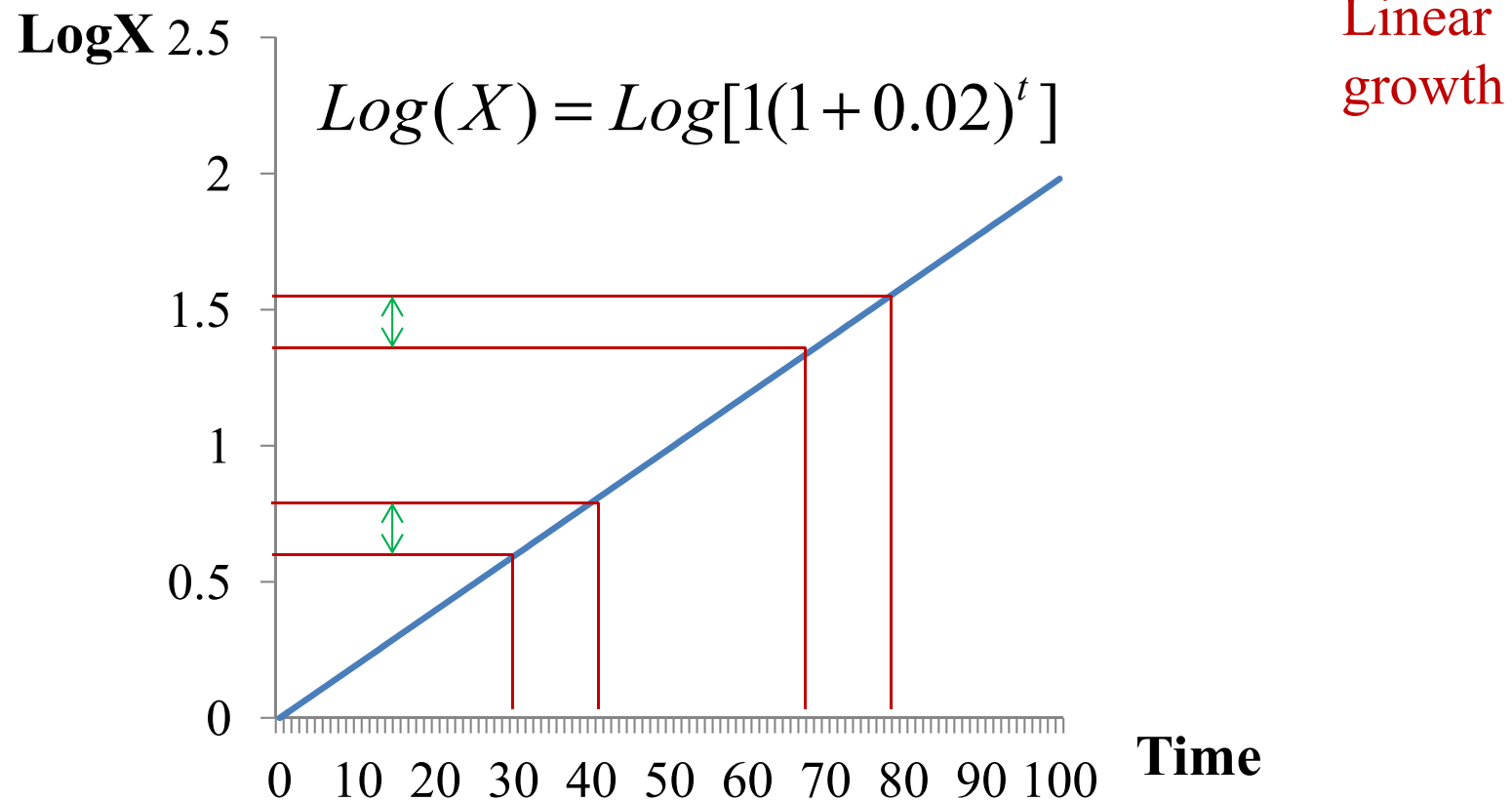$$GDP_1 = GDP_0^A(1+0.02) = GDP_0^A \cdot 1.02$$

$$GDP_2 = GDP_1^A(1+0.02) = GDP_0^A(1+0.02)(1+0.02) = GDP_0^A(1+0.02)^2$$

$$GDP_{100} = GDP_{99}^A(1+0.02) = GDP_0^A(1+0.02)^{100}$$

X

$$X = 1(1+0.02)^t$$

Exponential growth

Time

Logarithmic Scale (Cont.)

• The same proportional increase in GDP per capita is represented by the same **vertical distance** on the scale (constant growth rate)

$$Log(X) = Log[1(1+0.02)^t]$$

Linear growth

LogX

Time

Fundamental Causes

• The factors potentially affecting why societies make different technology and capital accumulation choices

✓ **Geographical differences**

      Nature, physical, ecological, and geographical environment

✓ **Institution**
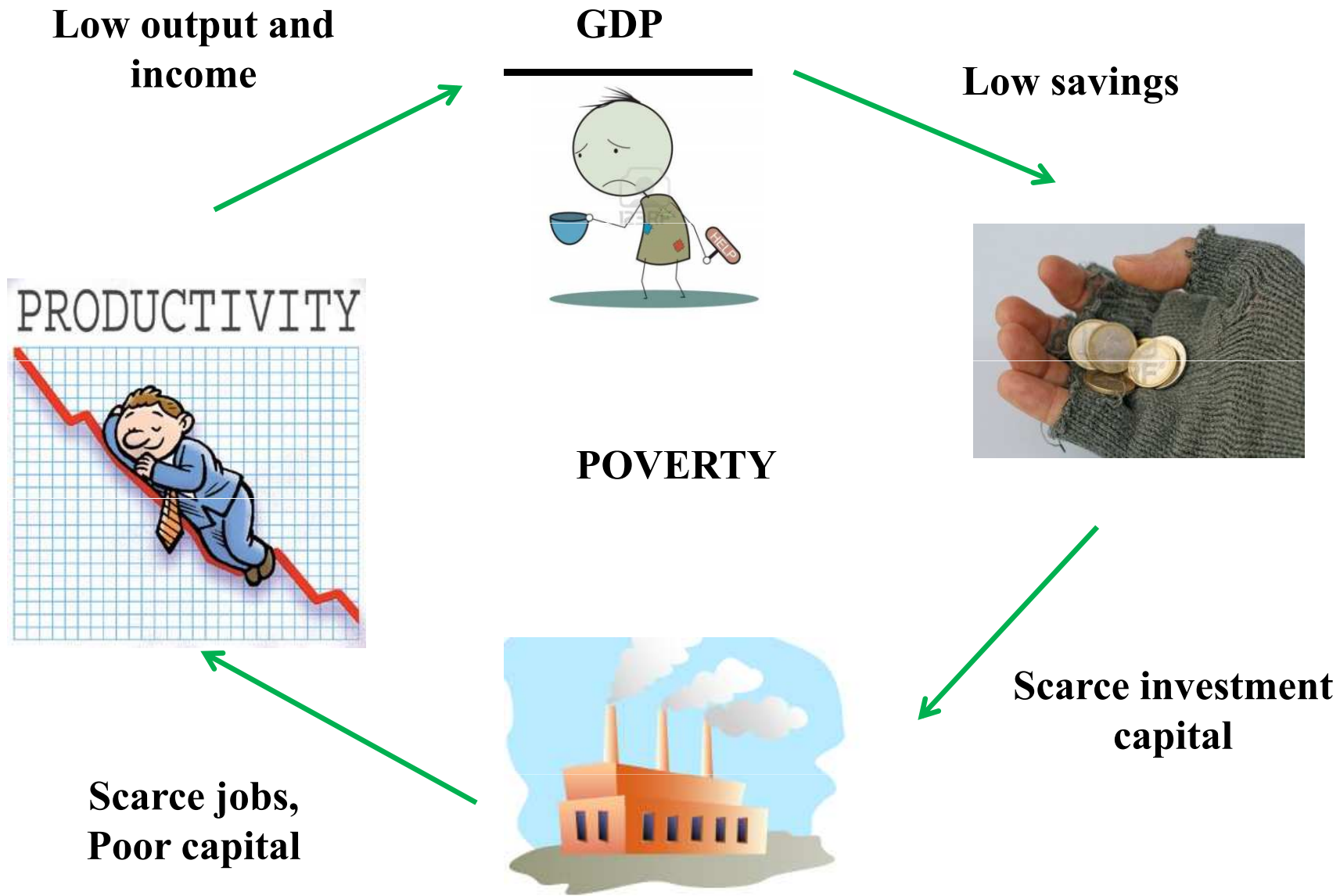
      Laws, regulations, enforcement of property rights

✓ **Culture**

      Values, preferences, and believes

✓ **Luck (multiple equilibrium)**: divergent passes of the economies which are otherwise identical

The Vicious Circle of Poverty

Low output and income

GDP

Low savings

PRODUCTIVITY

POVERTY

Scarce investment capital

Scarce jobs, Poor capital

Breaking the Cycle

Better institutions

Higher output

GDP

ECONOMIC GROWTH

Better jobs, Technology

Investment capital

The World Bank
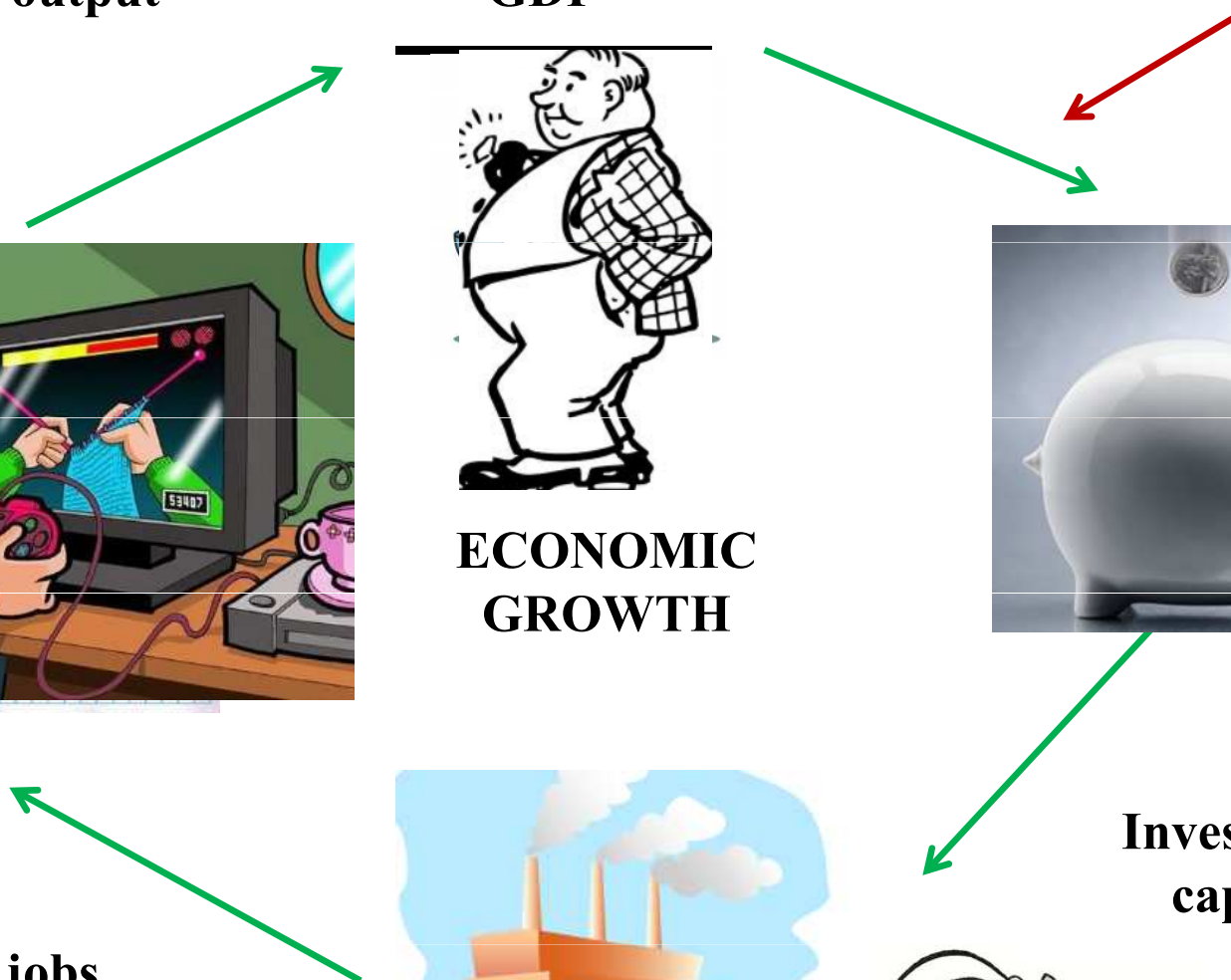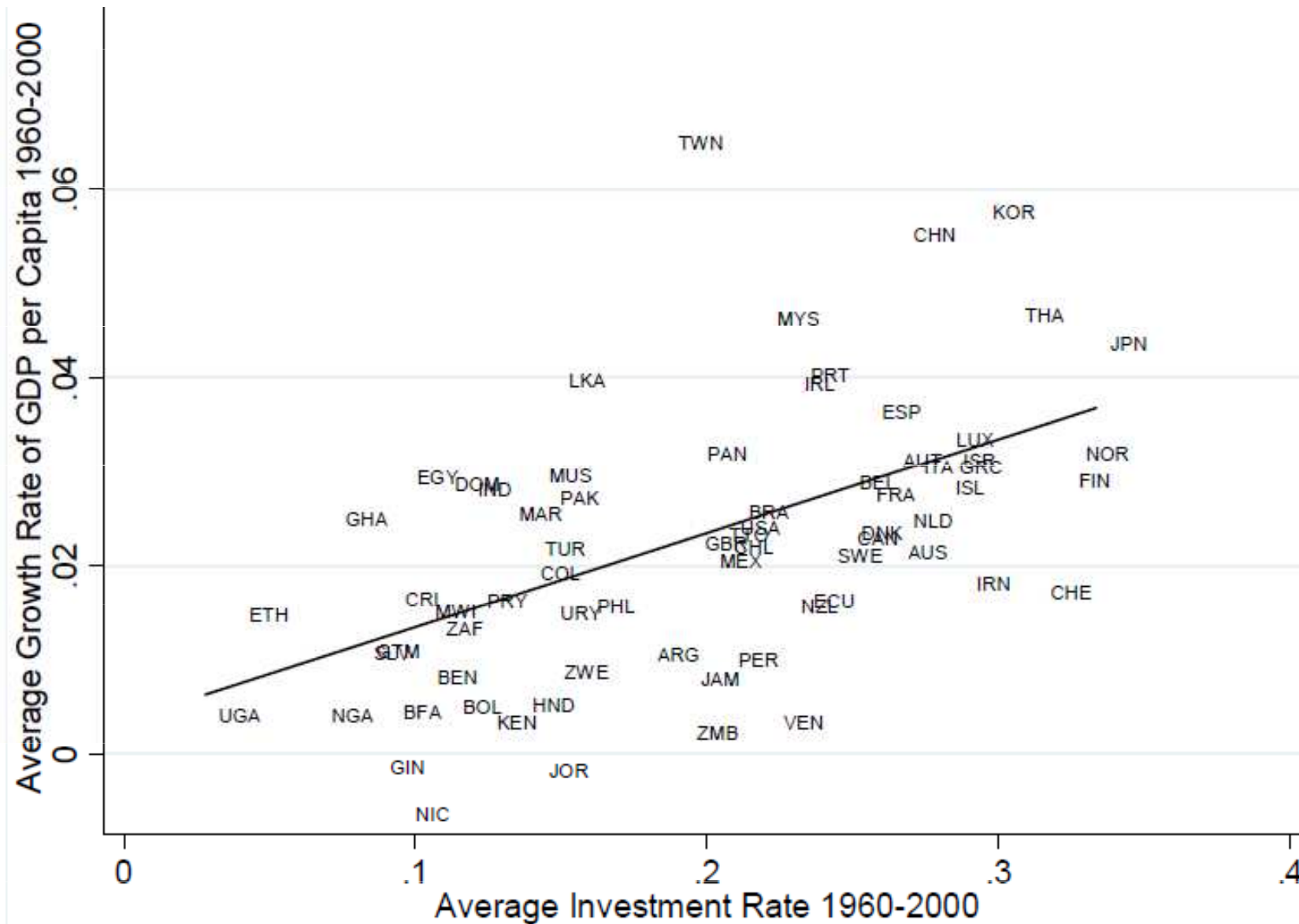
Correlates of Economic Growth

• Investment in **physical capital**

Source: Acemoglu, D. (2009)

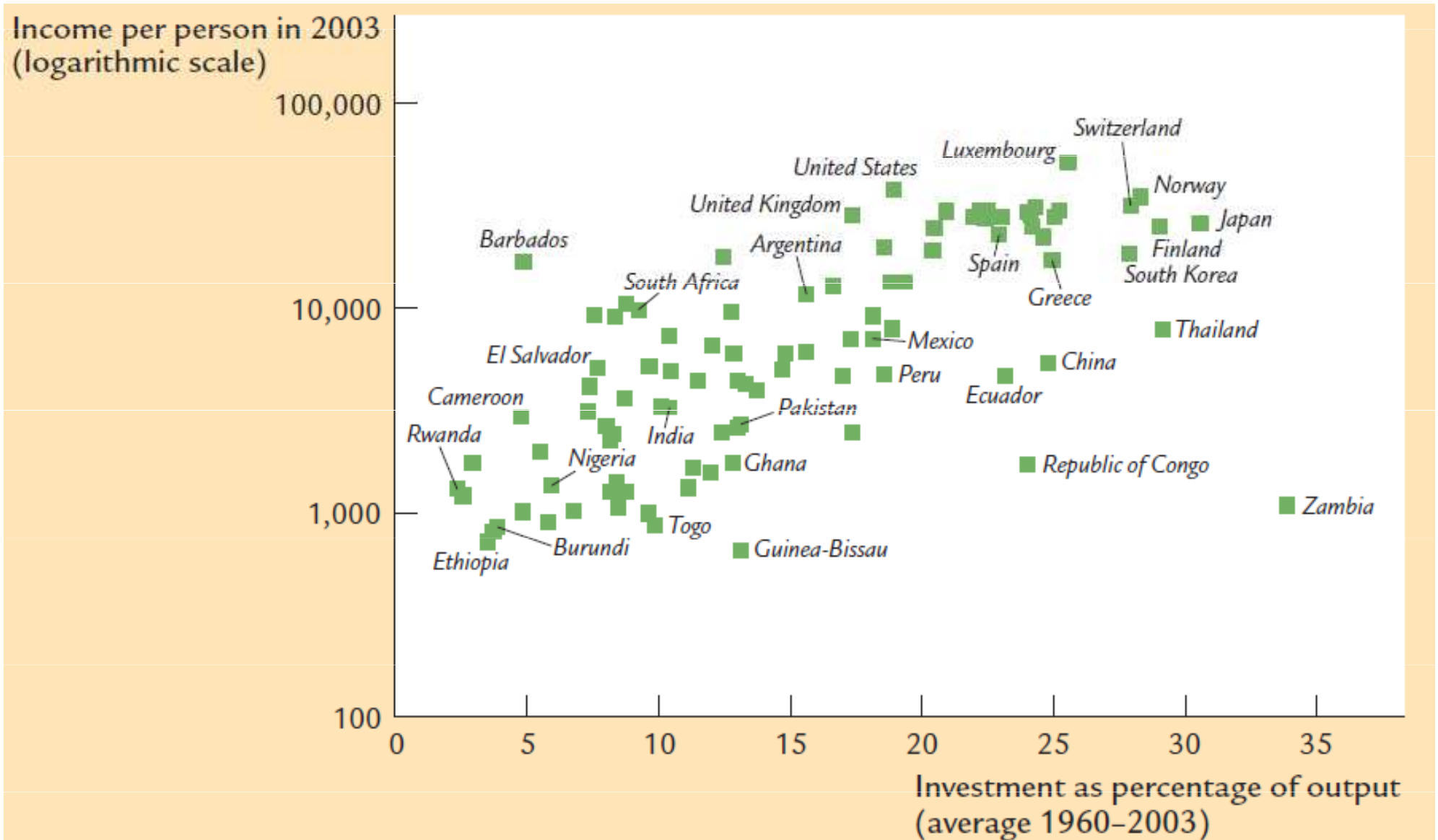# Correlates of Economic Growth (Cont.)

- Investment in **human capital**

Source: Acemoglu, D. (2009)

Economic and Population Growth

Savings and Economic Growth

Income per person in 2003 (logarithmic scale) vs. Investment as percentage of output (average 1960–2003). Data points labeled: Switzerland, Luxembourg, Norway, United States, Japan, United Kingdom, Finland, Argentina, Spain, South Korea, Barbados, Greece, South Africa, Thailand, Mexico, China, El Salvador, Peru, Cameroon, Ecuador, Rwanda, India, Pakistan, Nigeria, Ghana, Republic of Congo, Zambia, Togo, Burundi, Guinea-Bissau, Ethiopia.

Next class: Solow-Swan Growth Model

N!B! Reading Assignment: Handout "Theories that don't work"