

# ECONOMIC GROWTH: CONCEPTS AND PATTERNS

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EE 462 Development Macroeconomics  
Semester 1/2020

# Topics

- Divergent Patterns of Economic Growth since 1960
- Factor Accumulation, Productivity Growth, Econ. Growth
- Saving, Investment, & Capital Accumulation
- Sources of Growth Analysis
- Characteristics of Rapidly Growing Countries

# Divergent Patterns of Economic Growth since 1960

| Group           | <b>Ratios</b> of<br>2009 to 1960<br>GDP/capita | Avg. Annual<br><b>Growth</b><br><b>Rates (%)</b> | Examples of Countries                                |
|-----------------|------------------------------------------------|--------------------------------------------------|------------------------------------------------------|
| Negative growth | 0.89<br>0.98                                   | - 0.23<br>- 0.24                                 | Madagascar<br>Zambia                                 |
| Slow growth     | 1.05 – 2.16                                    | 0.01 – 1.58                                      | Senegal, Kenya, Peru,<br>Chad, S.Africa, Philippines |
| Moderate growth | 3.06 – 4.29                                    | 2.31 – 3.01                                      | Turkey, Brazil, Chile,<br>Lesotho, Mauritius         |
| Rapid growth    | 4.55 – 18.94                                   | 3.14 – 6.18                                      | India, Egypt, Malaysia,<br>Thailand, Botswana, China |
| Industrialized  | 2.6 – 5.13                                     | 1.97 – 3.4                                       | UK, US, Canada, Japan                                |

# Calculating Future Values

- *Question: why small differences in growth rates can make a big difference in income levels over time?*
- Suppose a country's current income/capita is  $X_0$ , and the growth rate is  $r\%$  per year. What will be the income level in year  $t$ ?

$$\rightarrow X_t = X_0 \times (1+r)^t$$

- Example: GDP per capita (2005 PPP) in Thailand was 7,794 in 2009. If the average growth rate is 5% per year, what would be Thailand's GDP per capita GDP in 2019?

$$\rightarrow \text{GDP}_{2019} =$$

$$\rightarrow \text{GDP}_{2019} / \text{GDP}_{2009} =$$

- If  $r = 7\%$ ,  $X_{10} = ?$

# Calculating Growth Rates

- Suppose a country's current income/capita is  $X_0$ , and the income level in year  $X_t$ ?. What's the annual average growth rate? (Recall:  $X_t = X_0 \times (1+r)^t$ )

1. Calculate growth rate using the *endpoint data*.

$$\rightarrow r = (X_t / X_0)^{1/t} - 1$$

Ex.  $X_0=7,794$  and  $X_t=12,695$   $\rightarrow r =$

2. Estimate average growth rate by *least-square regression*.

➤  $\ln X_t = \ln X_0 + \ln(1+r) \times t$

➤ Regression:  $\ln X_t = a + bt$  where  $a = \ln X_0$  and  $b = \ln(1+r)$

$$\rightarrow r = e^b - 1$$

# Calculating Growth Rates (Cont'd)

- “The rule of 70” – based on continuous compounding
- Given the exponential function:

$$X_t = X_0 \times e^{rt}$$

- How many does it take for income to double?

➔ Let  $X_t = 2$  and  $X_0 = 1$ .

Then,

- Example: If a country's GDP grows at 2% per year, how many years would its economy double in size?

# Factor Accumulation, Productivity Growth, Economic Growth

- Economic growth depends on two processes:

1. *Factor Accumulation*

- Increasing in the size of capital stock and labor force.

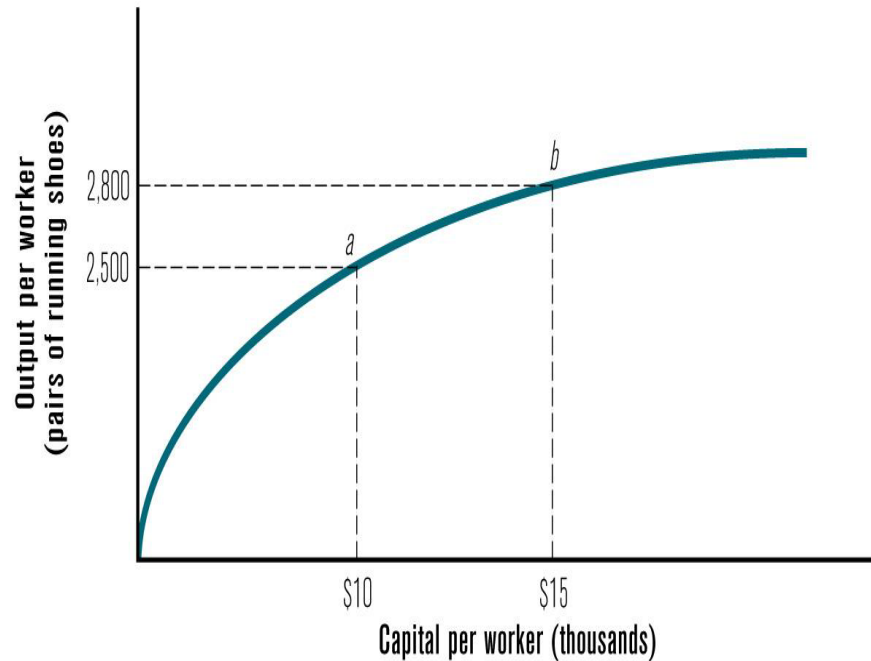
2. *Productivity Growth*

- Increasing the amount of output per unit of machine or worker
- productivity can be increased by greater **efficiency** (e.g. specialization), and **technological change**.

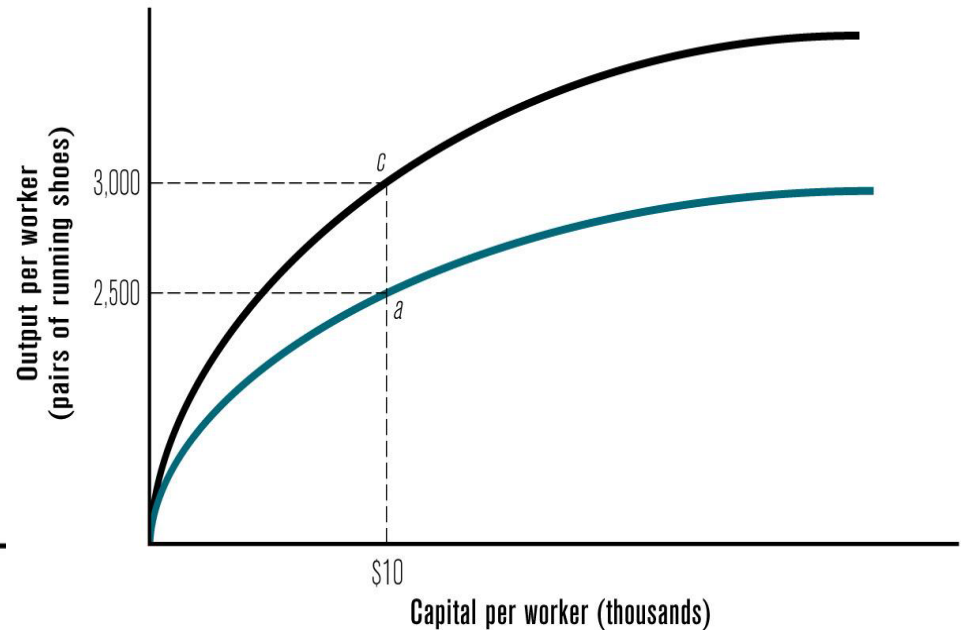
- This can be explained using production function

$$Q = f(\text{Labor, Capital, etc...})$$

# Basic Sources of Economic Growth



Factor Accumulation



Productivity Gains

# Saving, Investment & Capital Accumulation

- Solow growth model:
  - Explores the contribution of each factor to increase to output:  $Q(K, L, \text{Productivity gains})$
- Key elements of economic growth:
  - New investment increases the capital stock
  - Investment (I) is financed through savings (S)
  - Savings comes from current income of GDP:  $S = f(Y)$
- *Sustaining Growth requires both generating new investment and making sure it is productive.*

# Sources of Growth Analysis

- **Growth accounting** (or **source of growth analysis**) measures the relationship between productivity change and economic growth
- **Total factor productivity (TFP)**: contribution to production of efficiency, technology, and other influences on productivity
- The growth equation can be written as:

$$g_Y = (W_K \times g_K) + (W_N \times g_L) + a$$

where

- $g_Y$  = growth of total income (or GDP)
- $g_K, g_L$  = growth of capital and labor
- $W_K, W_N$  = share of capital and labor
- $a$  = rate of productivity of inputs = “**Solow residual**”

# Growth Accounting (Cont'd)

- Example: Assume the following:  $g_Y = 0.05$ ,  $g_K = 0.07$ ,  $g_L = 0.02$ ,  $W_L = 0.6$ , and  $W_K = 0.4$ .  $a = ?$ 
  - Recall  $g_Y = (W_K \times g_K) + (W_L \times g_L) + a$
  -
- Problems with Solow residual:
  - could represent influences other than productivity gains.
  - “a” captures the measurement errors and omitted variables because it is the residual in the equation.

# Sources of Growth: Empirical Evidence

General findings:

- Economic growth in industrialized countries are attributed vastly by TFP, and less by capital accumulation.
- Data problems and price distortions are major concerns in developing countries.
- Sources of econ growth in LDCs attribute a larger role to capital accumulation than in industrialized countries. Why?
- Among developing countries, TFP growth in East Asia was faster than that in other regions.
- TFP growth tends to become more important as income rises.

# Sources of Growth Across Countries 1960-2000 (1980s)

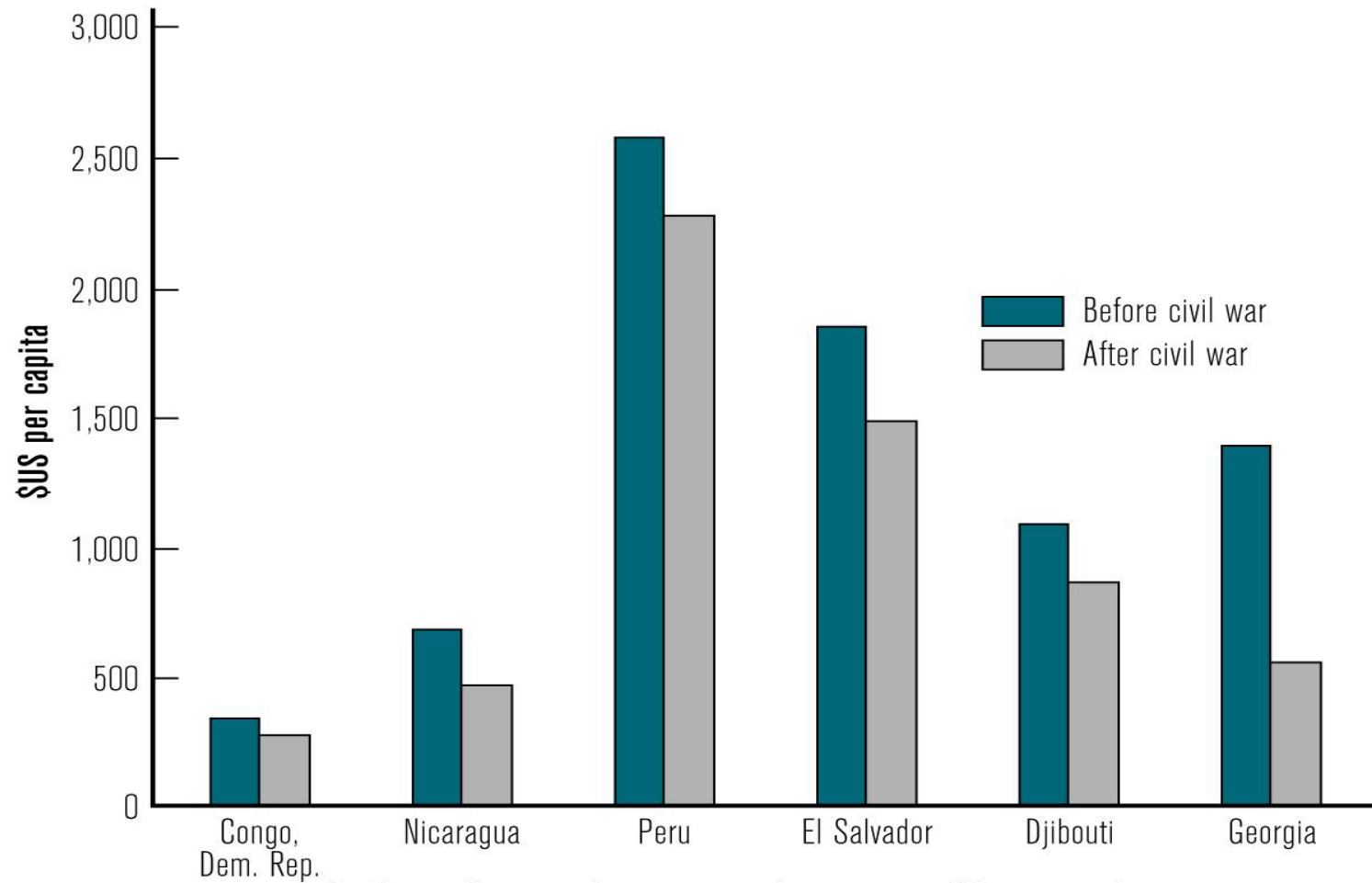
| Country/<br>Region | Growth of<br>Output per<br>worker | Capital per<br>worker | Education<br>per worker | TFP   |
|--------------------|-----------------------------------|-----------------------|-------------------------|-------|
| Brazil             | -1.63                             | 0.16                  | 0.68                    | -2.47 |
| Ethiopia           | -1.74                             | 1.11                  | 0.27                    | -3.12 |
| Ghana              | -1.14                             | -1.23                 | 0.15                    | 0.07  |
| Africa             | -1.06                             | -0.07                 | 0.42                    | -1.41 |
| East Asia          | 4.36                              | 2.45                  | 0.66                    | 1.25  |
| Latin America      | -1.77                             | 0.04                  | 0.47                    | -2.28 |
| Middle East        | 1.15                              | 0.55                  | 0.53                    | 0.07  |
| South Asia         | 0.68                              | 1.02                  | 0.42                    | 2.25  |
| Industrialized     | 1.82                              | 0.69                  | 0.24                    | 0.9   |

Source: Collins & Bosworth (2003). "The Empirics of Growth: An Update."

# Characteristics of Rapidly Growing Countries

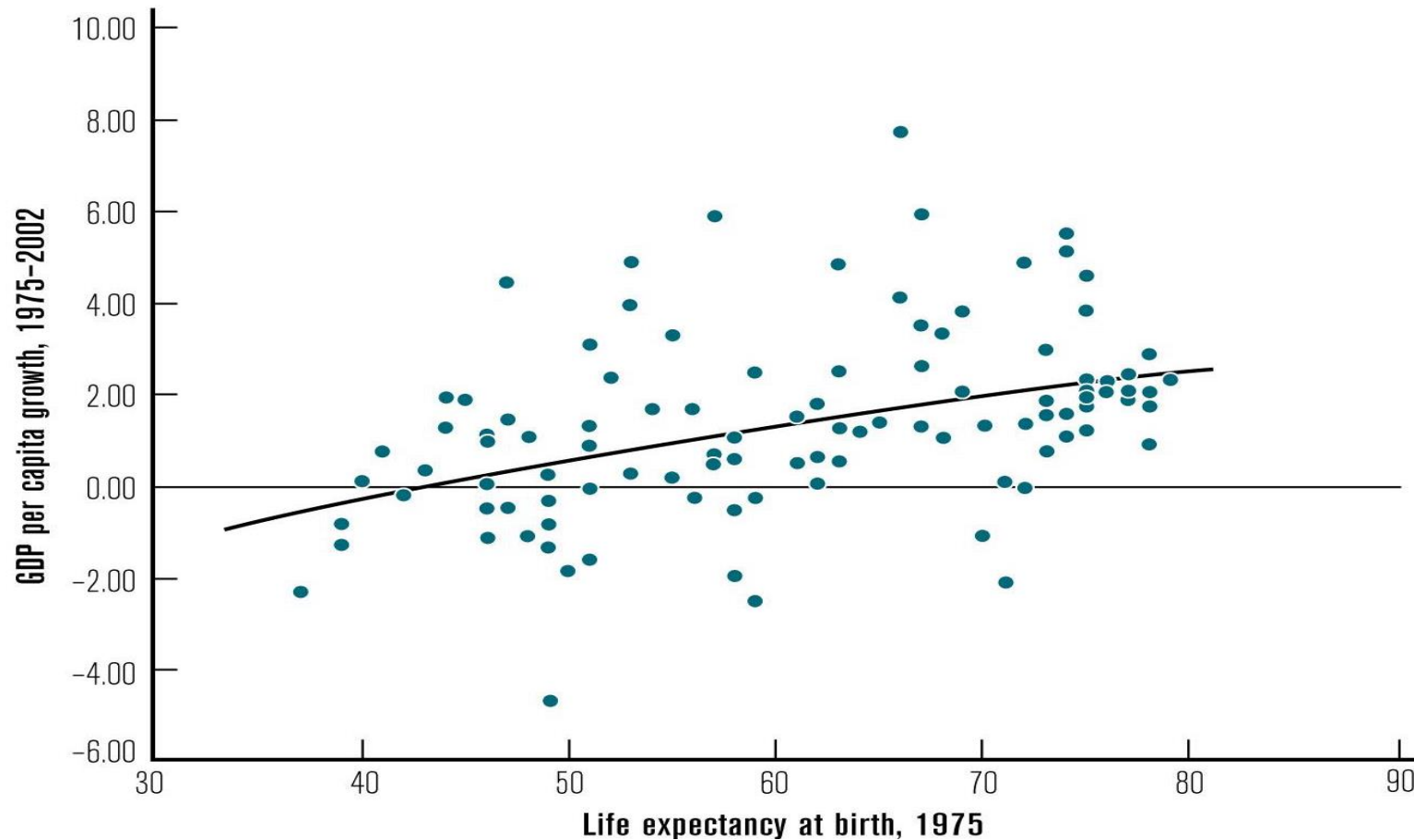
- Why some economies growth faster than others?
  - Need to look at empirical evidence; there's no consensus
  - Important to ask “which causes which?”
- Six broad characteristics that fast-growing countries share:
  1. Macroeconomic stability
  2. Investment in health and education\*
  3. Effective governance and institutions
  4. Favorable environment to private enterprise
  5. Trade, openness, and growth\*
  6. Favorable geography or location?

# GDP per capita before and after a Civil War



➔ Average income was 28% lower after the civil war than before.

# Growth and Life Expectancy

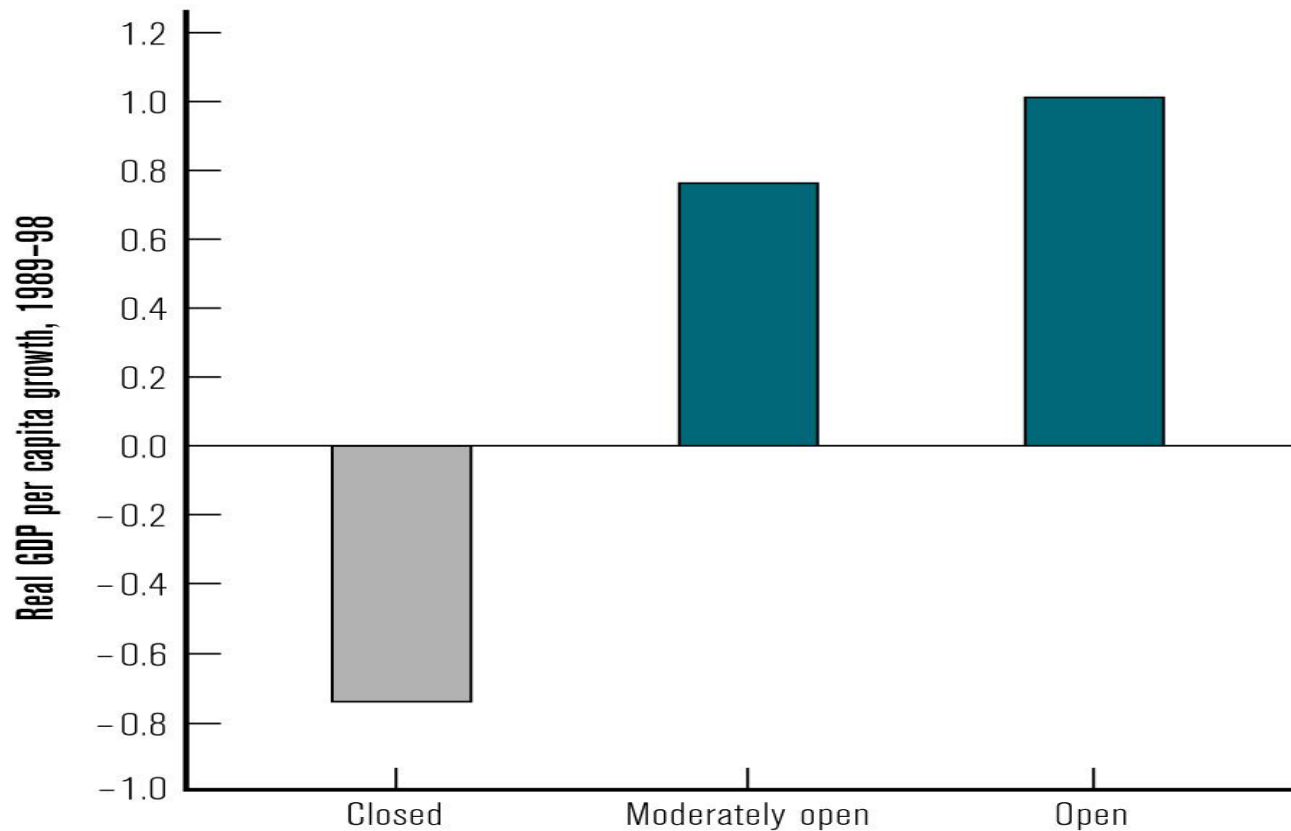


Better health → faster growth OR faster growth (higher income) → improve LE?

# Institutions, Governance & Growth [Box 3.2]

- 5 institutions are necessary according to Rodrik and Subramanian (2003):
  1. *Market-creating institutions*: protect property rights
  2. *Market-regulating institutions*: deal with market failures
  3. *Market-stabilizing institutions*: control macroeconomic volatility
  4. *Market-legitimizing institutions*: provide social protection and insurance
  5. *Political institutions*: how a country is governed & extent of political participation

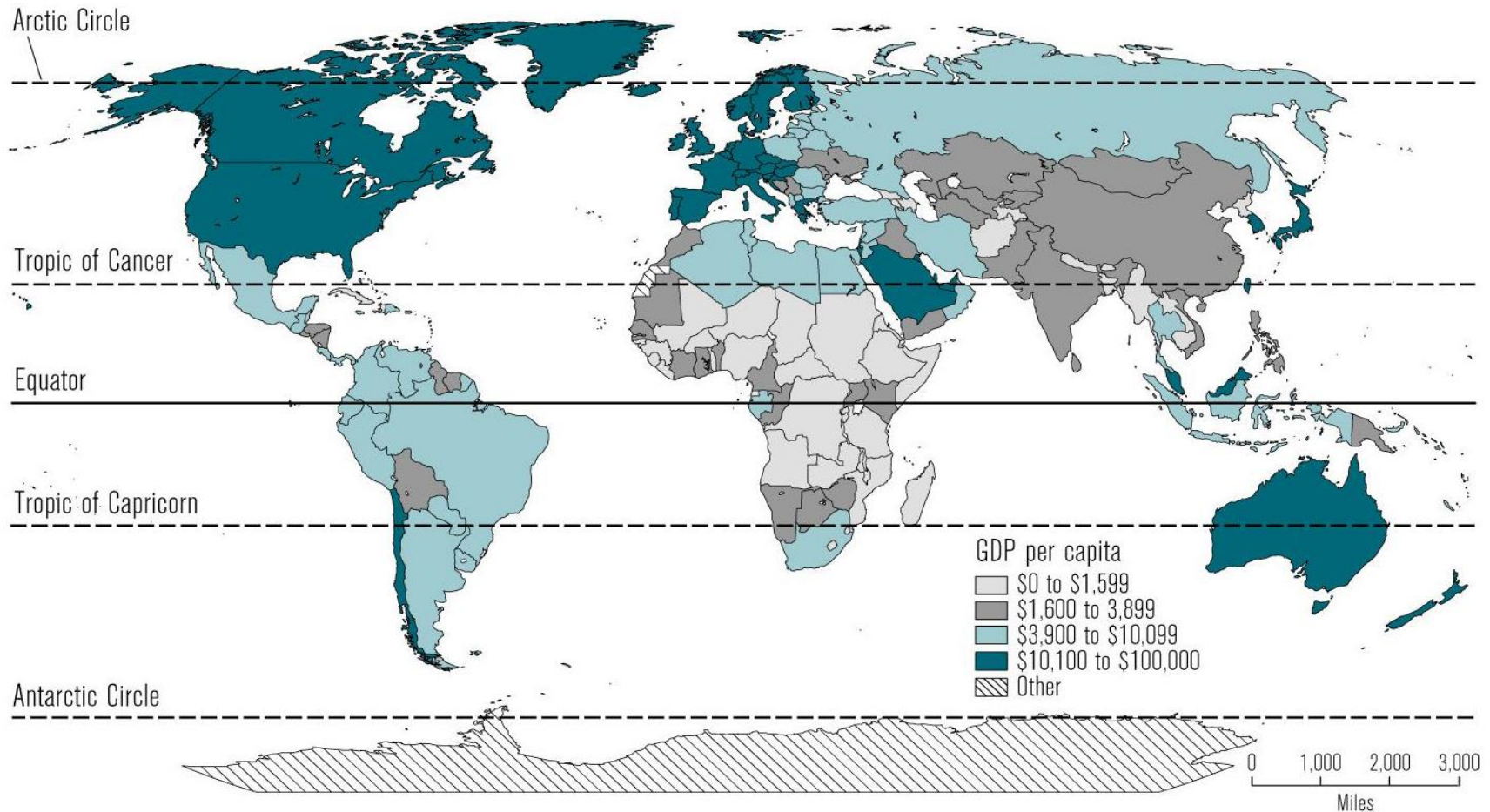
# Openness and Growth



Inconclusive evidences:

1. How to construct measure of trade policy orientation
2. Pro-trade policies → growth?

# Does geography matter?



More recent data: <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?view=map>