

ECONOMIC GROWTH: CONCEPTS AND PATTERNS

EE 462 Development Macroeconomics

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 | Ratios of 2009 to 1960 GDP/capita | Avg. Annual Growth Rates (%) | Examples of Countries |
|--------------------|---|------------------------------------|--|
| Negative growth | 0.89 0.98 | - 0.23 - 0.24 | Madagascar Zambia |
| Slow growth | 1.05 – 2.16 | 0.01 – 1.58 | Senegal, Kenya, Peru, Chad, S.Africa, Philippines |
| Moderate growth | 3.06 – 4.29 | 2.31 – 3.01 | Turkey, Brazil, Chile, Lesotho, Mauritius |
| Rapid growth | 4.55 – 18.94 | 3.14 – 6.18 | India, Egypt, Malaysia, 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 2012. If the average growth rate is 5% per year, what would be Thailand's GDP per capita GDP in 2022?

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

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

- If $r = 7\%$, $X_{10} = ?$ **Ans. $\text{GDP}_{2022} = (\text{GDP}_{2022}/\text{GDP}_{2012} = \underline{\quad})$**

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*.

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

$$\triangleright \text{Regression: } \ln X_t = a + bt \text{ where } a = \ln X_0 \text{ and } b = \ln(1+r)$$

$$\rightarrow r =$$

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 **years** does it take for income to double?

→ Let $X_t = 2$ and $X_0 = 1$.

Then, $2 = 1 \times e^{rt}$ and $\ln 2 = \ln 1 + rt$

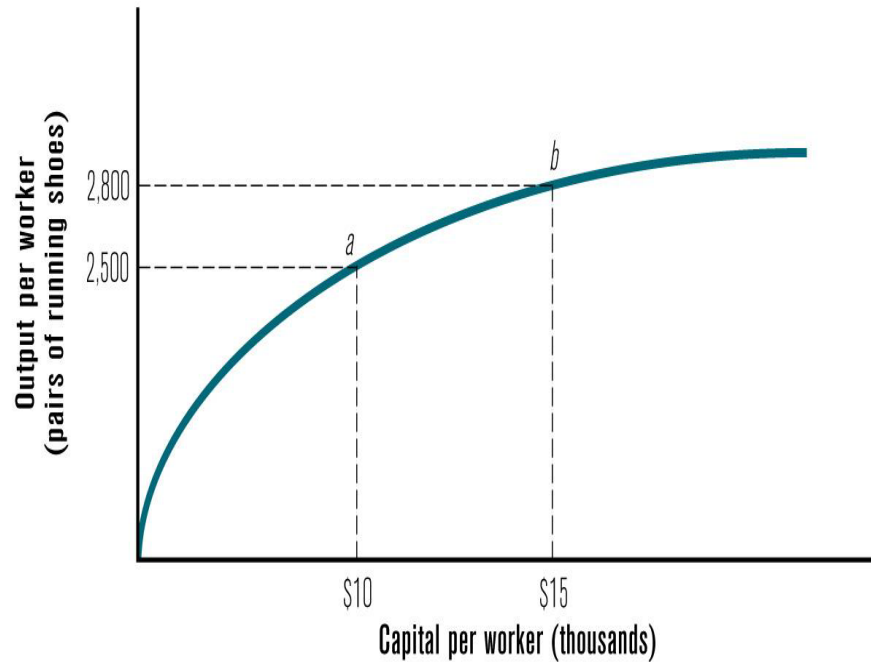
So, **doubling time (t) = $\frac{0.7}{r}$** .

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

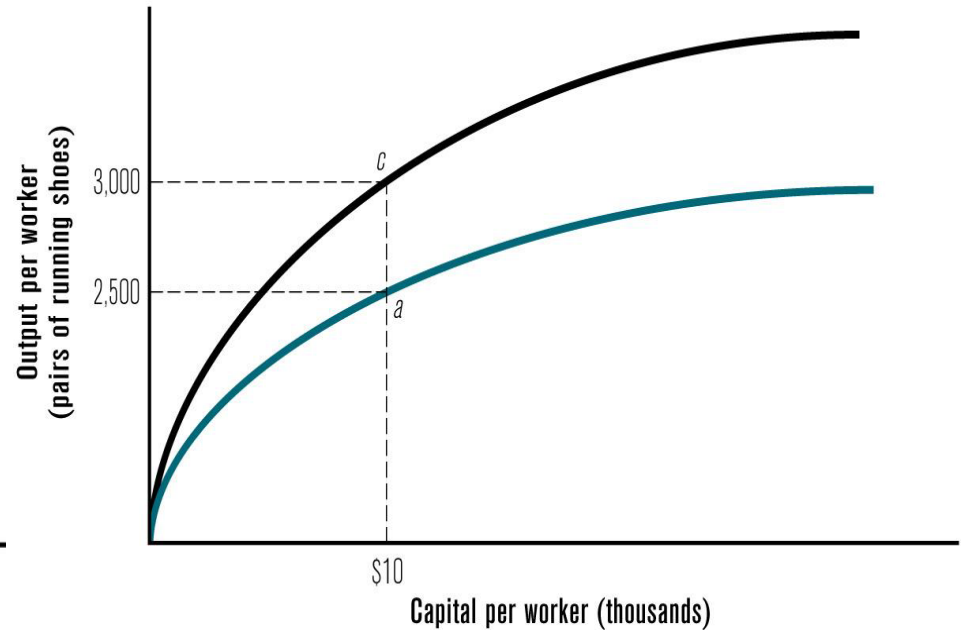
Factor Accumulation, Productivity Growth, Economic Growth

- 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 $g_Y = (W_K \times g_K) + (W_L \times g_L) + a$
 - Substitute: $0.05 = (0.4 \times 0.07) + (0.6 \times 0.02) + a$
 - TFP growth: $a =$
(i.e. ____% of GDP growth)
 - Growth in K accounts for _____ % of g_Y
 - Growth in L accounts for _____ % of g_Y
- 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 Across Countries 1960-2000 (1980s)

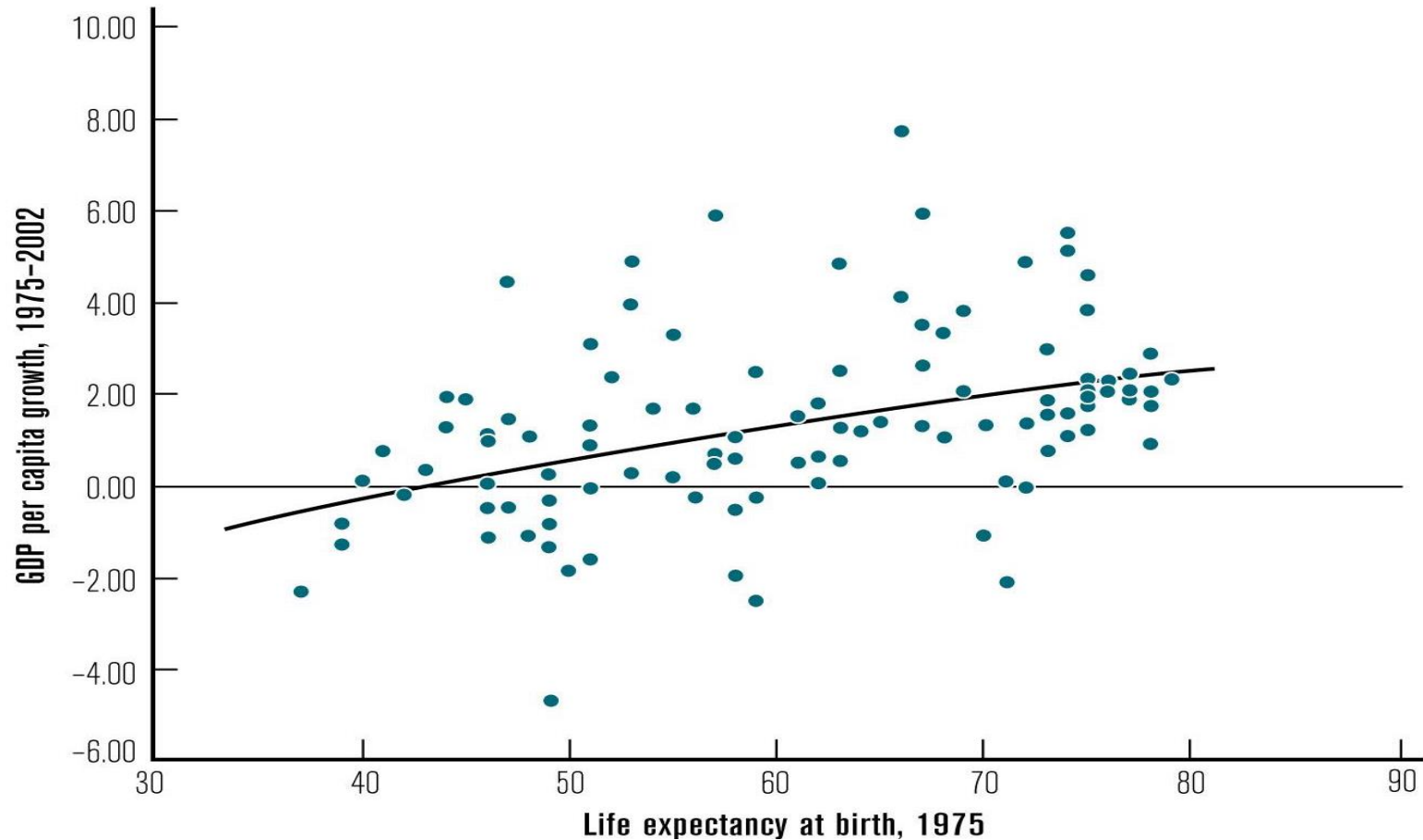
| Country/ Region | Growth of Output per worker | Capital per worker | Education per worker | TFP |
|--------------------|-----------------------------------|-----------------------|-------------------------|-------|
| Brazil | -1.63 | 0.16 | 0.68 | -2.47 |
| Ethiopia | -1.74 | 1.11 | 0.27 | -3.12 |
| 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?

Growth and Life Expectancy

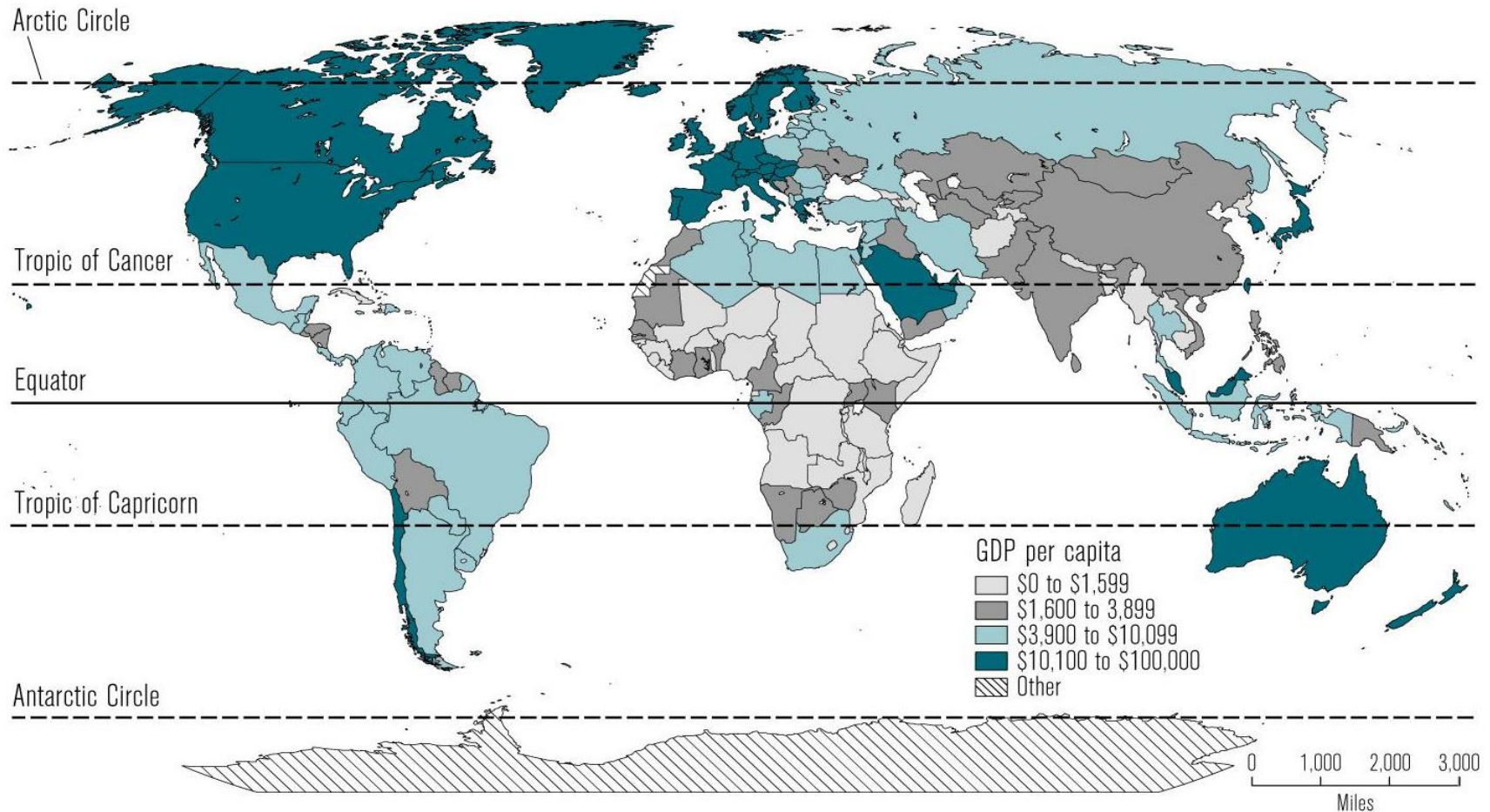


Better health → faster growth OR faster growth (higher income) → improve LE?

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

Does geography matter?



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