



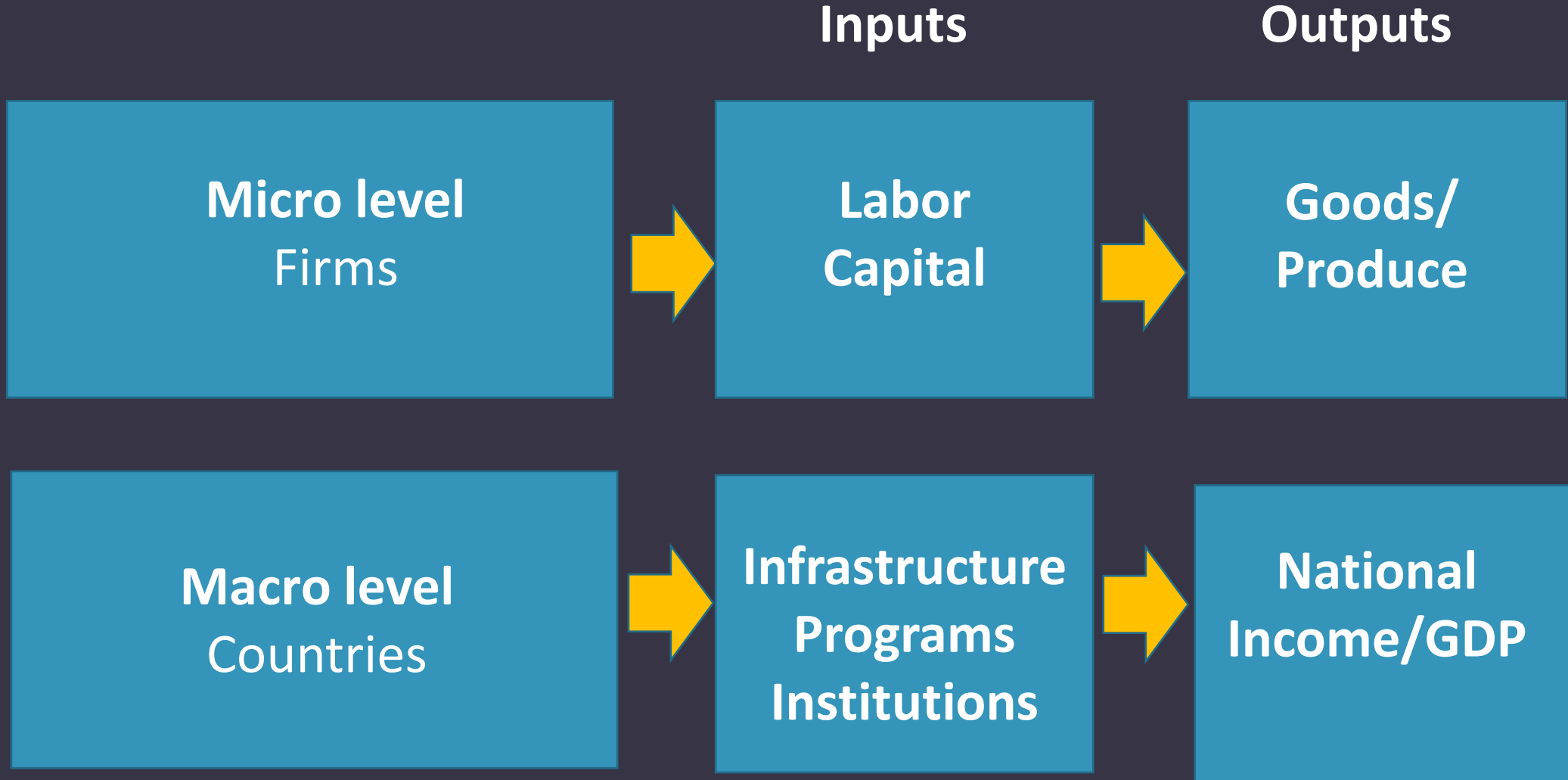
THEORIES OF ECONOMIC GROWTH

FACULTY OF ECONOMICS, THAMMASAT UNIVERSITY

MODULE 4

Economic Growth = Output Growth





ECONOMIC GROWTH

is contingent upon:



- **factor accumulation:** increasing the size of the capital stock and/or increasing the labor force
- **productivity growth:** improving efficiency and introducing technological change

5 important equations and relationships

$$Y = f(K, L)$$

$$\Delta K = I - (dK)$$

$$S = I$$

$$I = sY$$

$$\Delta L = nL$$



Capital (K) can be money, equipment, infrastructure; capital **depreciates** (d) in time; therefore it has to be maintained or replaced. To maintain or increase capital, **investments** (I) are needed.

Investments come from **savings** (S), or **income** (Y) from peoples' wages that are not consumed; if the **savings rate** is s , the savings = sY (which is invested); wages come from **labor** (L); increase in labor is the population rate multiplied by L

Basic Growth Model

- Output is a function of capital and labor
- Increase of capital depends on investments minus depreciation of capital
- Investment comes from savings; savings are derived from income times the saving rate
- Increased income will therefore increase savings, which will increase investments
- Increased investment will increase capital stock
- In the long run this causes growth in output

Y = output = income

K = capital

ΔK = capital increase

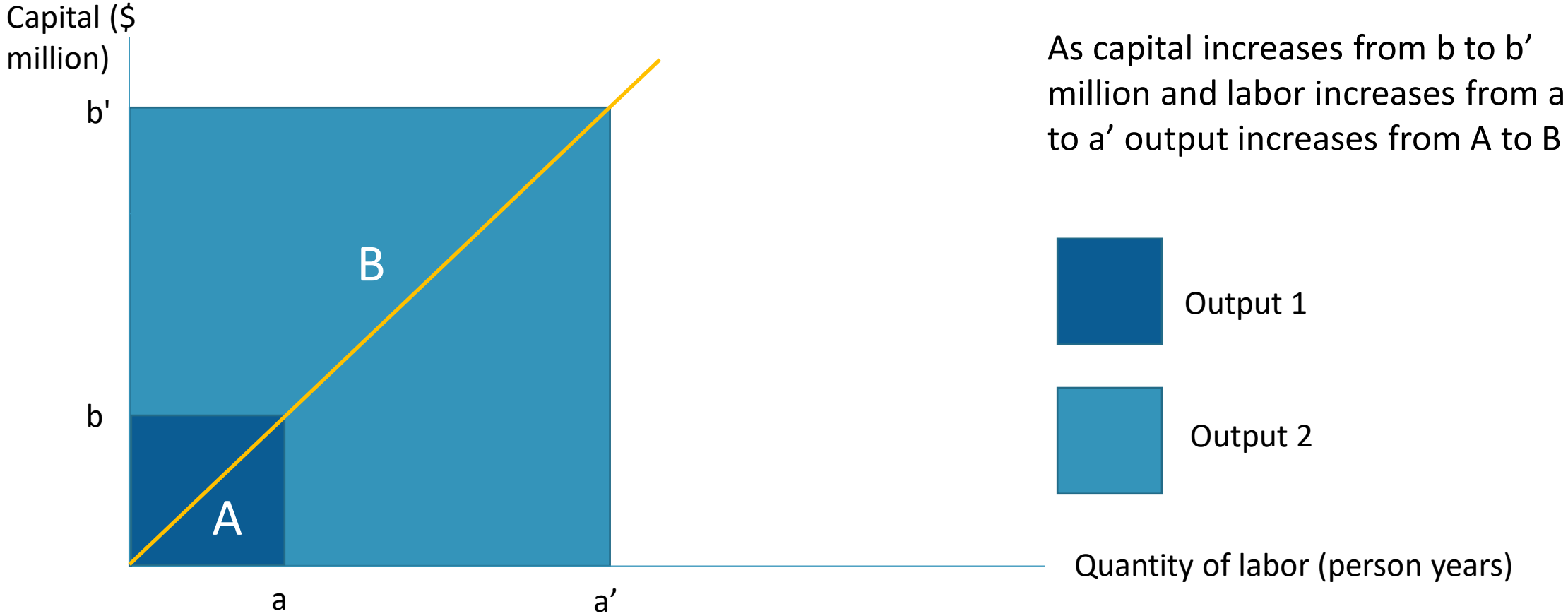
d = capital depreciation

L = labor

S = savings

s = savings rate

Output growth: $Y = f(K, L)$



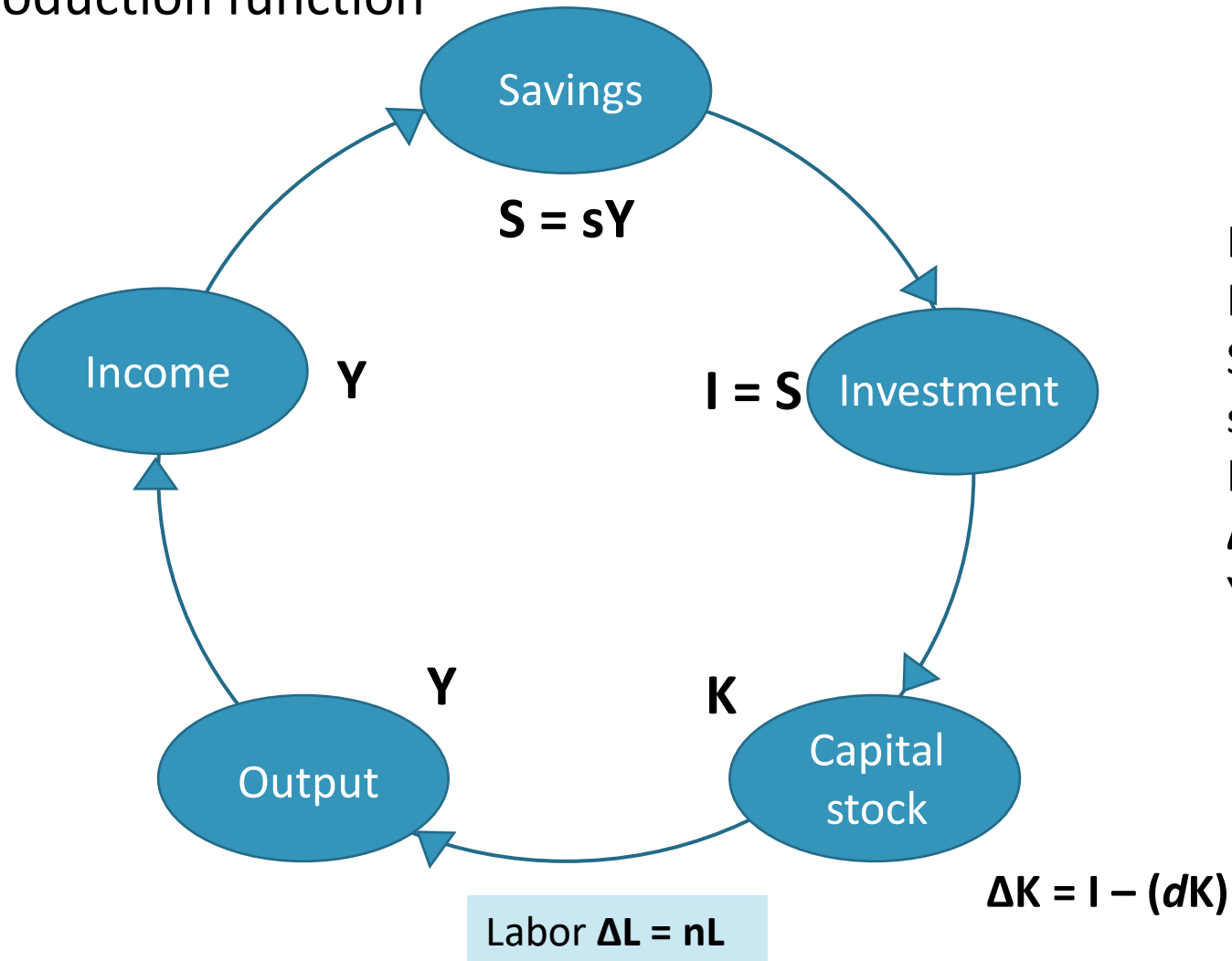
Over time, capital stock will depreciate



There is a need to replace/maintain capital. This comes from investment.
If investment $>$ depreciated capital, then capital stock increases.
If investment $<$ depreciated capital, then capital stock decreases.

Basic Growth Model

The aggregate production function



Notes:

I = investment

S = savings

s = saving rate

K = capital

ΔK = capital increase

Y = output = income

Harrod – Domar Growth Model

- Based on work by Roy Harrod (UK) and Evsey Domar (US); examines the relationship between growth and capital requirements
- Output is assumed to be a linear function of capital; uses a capital-output ratio
- Growth requires a right mix of capital and labor; equals the increment of output divided by the total output
- The lower the ICOR, the better (capital becomes more productive)

Incremental capital-output ratio used to measure the productivity of capital; determines the impact of additional capital

$$v = K/Y$$

$$\Delta Y = \Delta K/v$$

$$g = \Delta Y/Y = \Delta K/Yv$$

whereby:

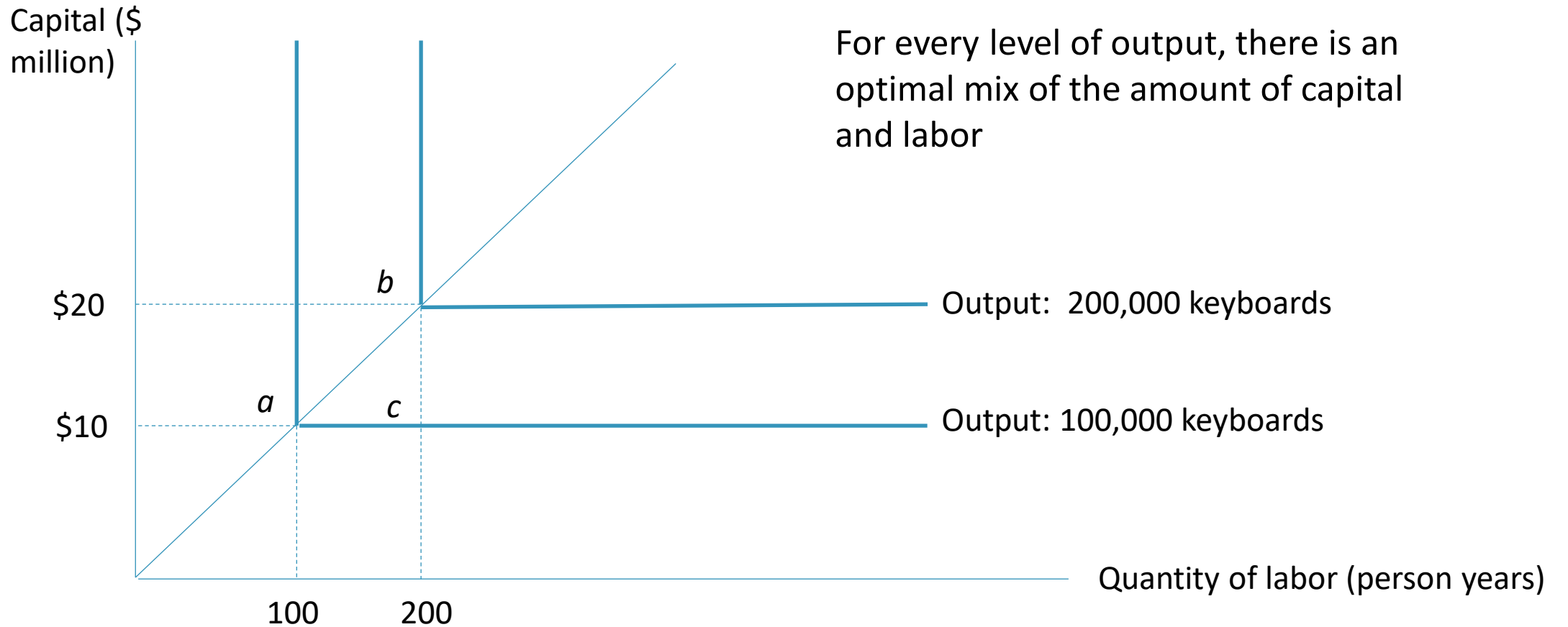
g = growth

v = capital-output ratio

K = capital

Y = output

Harrod – Domar Growth Model



Harrod – Domar Growth Model

- Harrod and Domar: capital created by investment is the main determinant of growth
- Investment = savings; countries that save more will experience higher economic growth
- ICOR: the growth rate can be predicted by adding incremental capital/ investment



Harrod – Domar Growth Model

Strengths

- Simple, data requirements are small and outcome is easy to estimate
- Focuses the importance of savings
- Estimates are fairly accurate in the short term

Weaknesses

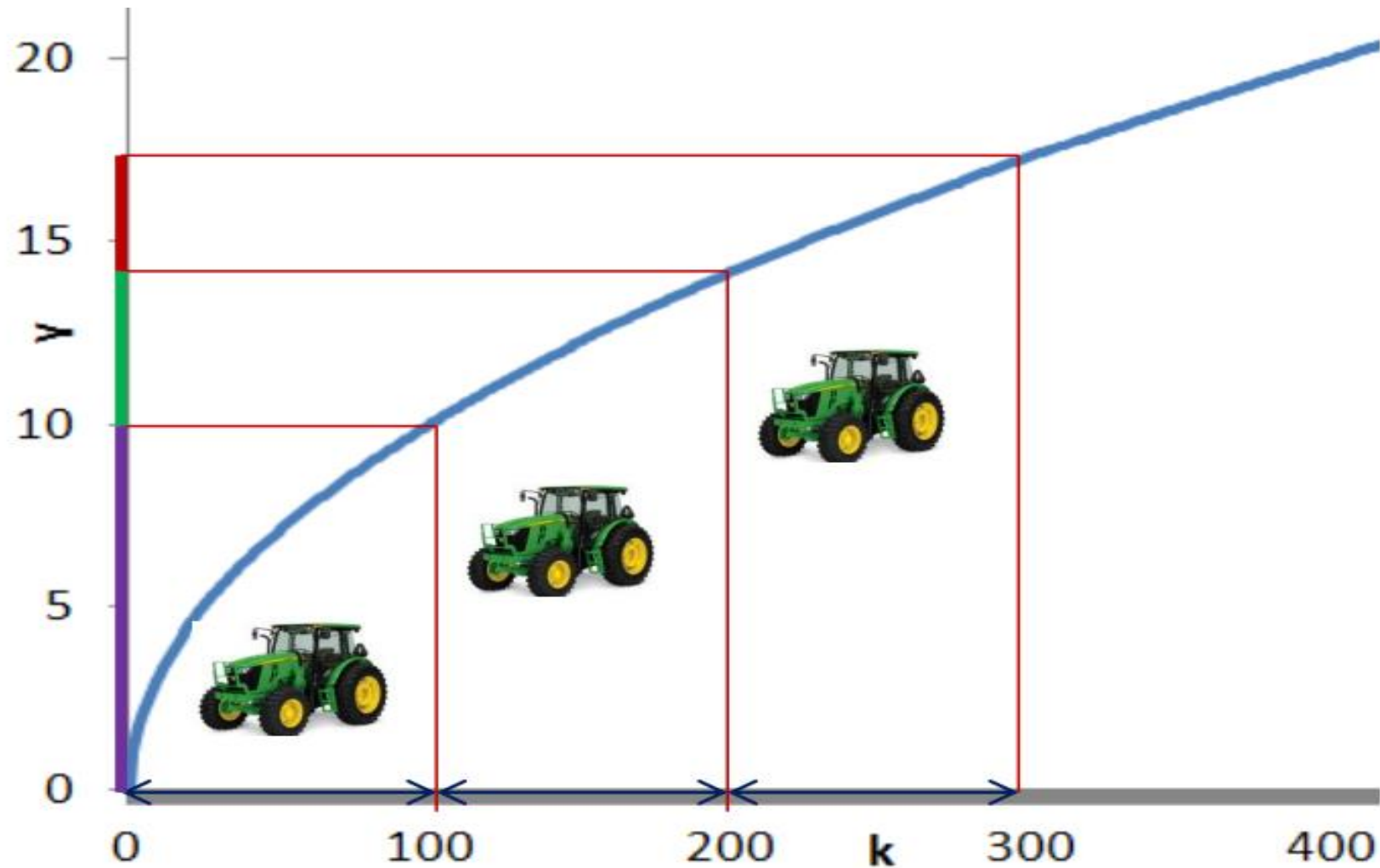
- Not all investments are productive
- Does not take into account external economic shocks
- Not reliable for long term estimates
- Assumes that relationships between labor, capital, and output are fixed
- Does not take into account productivity growth

Neoclassical Growth Model (Robert Solow)

- Output is a function of capital per worker
- The relation between capital, labor and output is not fixed
- More investments per worker will increase worker output; however it will give diminishing returns



Diminishing returns to capital



Neoclassical Growth Model

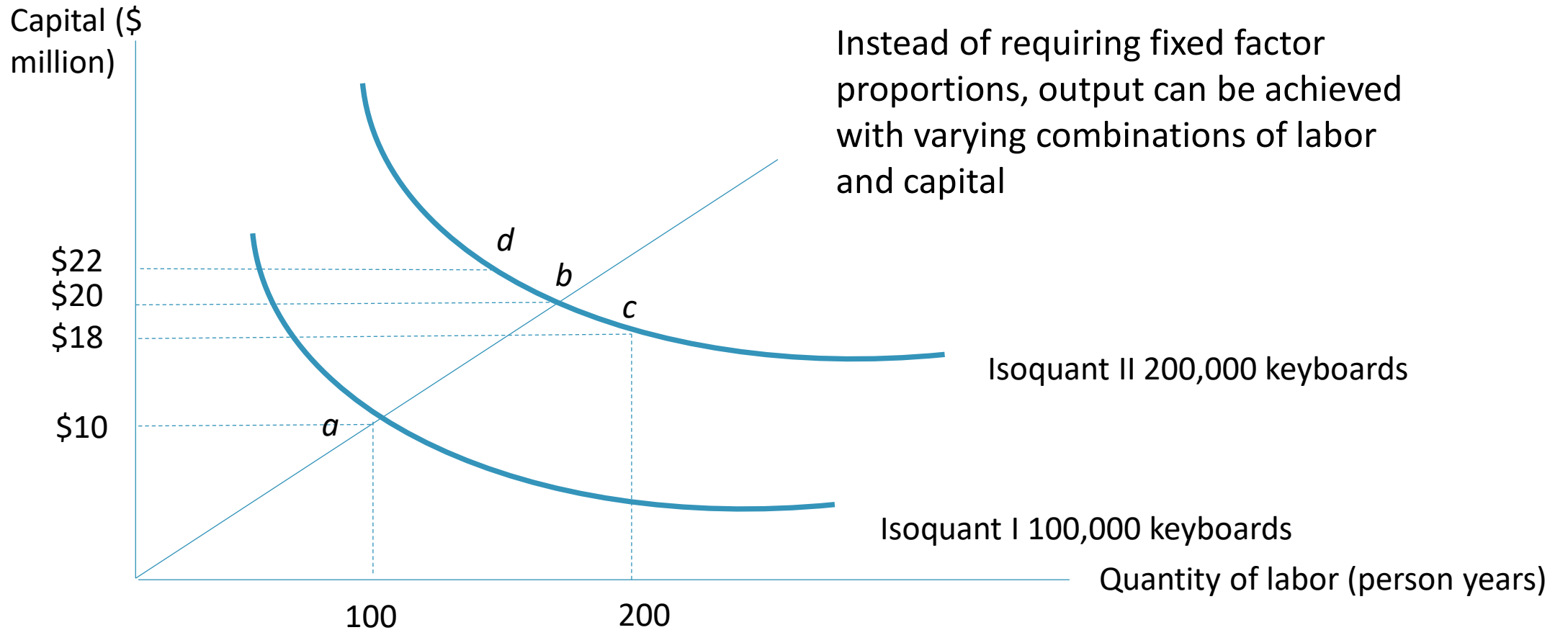
Assumptions

- Population grows at a constant rate, n
- All workers in the economy save a constant proportion, s
- All firms in the economy produce output using the same production technology that takes in capital and labor as inputs
- Capital stock (K), change in capital stock (Δk), the rate of capital depreciation (d) and investment (I) are linked together

$$\Delta k = sy - (n + d)k$$

Change in in capital stock is equal to savings minus capital depreciation

Neoclassical Growth Model



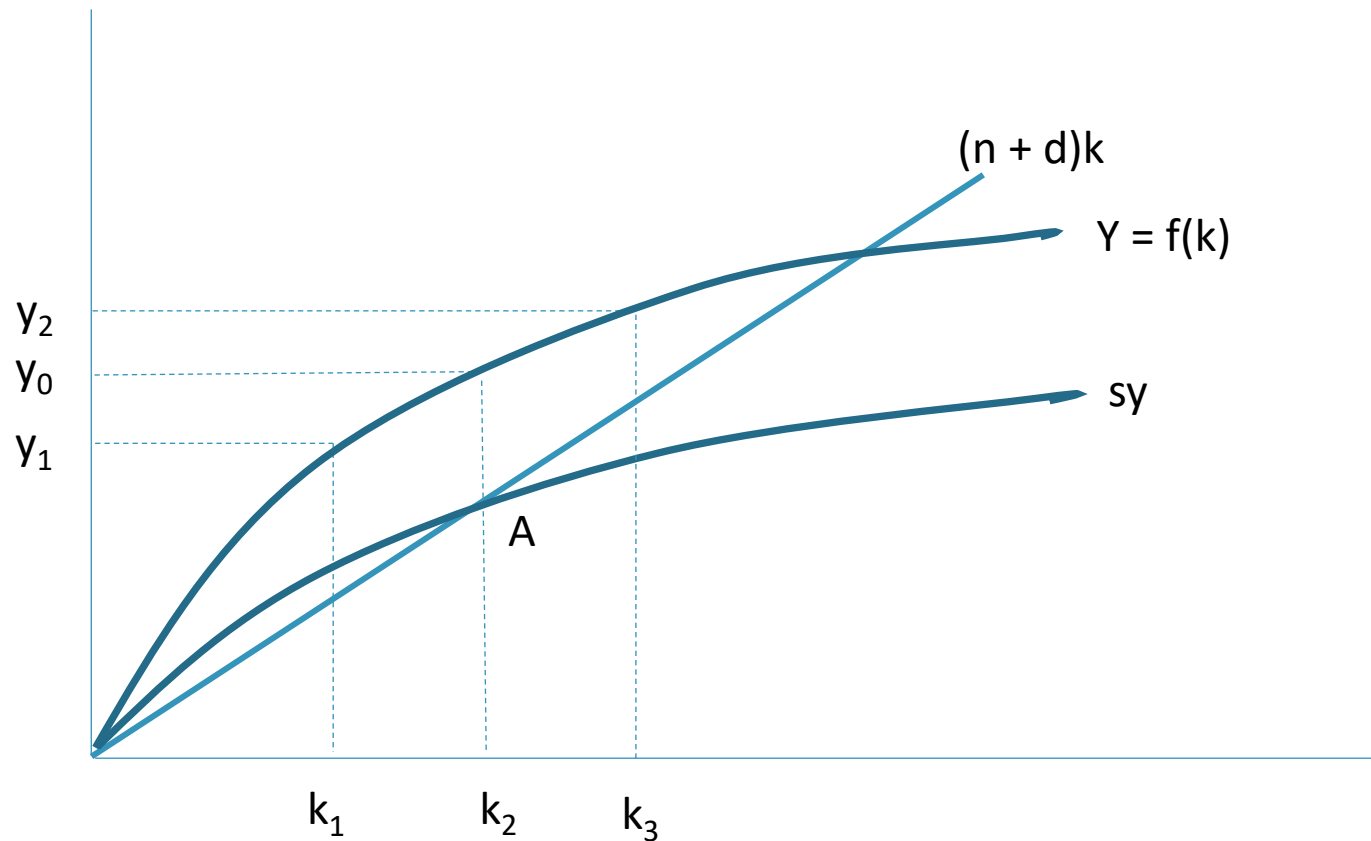
Neoclassical Growth Model (Solow)

- The Solow model: useful for analyzing the relationships between savings, investment, population growth, output and economic growth
- Once an economy reaches its long run potential level of income and economic growth matches population growth, sustained increase in income is unlikely (known as the *steady state*)
- Introduction of technological change will increase productivity, therefore raising the production function

What the Solow diagram tells us

Higher income countries have relatively lower growth rates; lower income countries tend to have the potential to achieve higher growth rates
Growth rate tends to slow down as incomes increase
Therefore incomes of low income countries can catch up with high income countries (convergence model)

Neoclassical Growth Model (Solow)



A is the only point wherein the amount of new savings sy is exactly the same as the amount of capital depreciation; A is therefore the steady state of capital per worker and output per worker

Role of technology

- **Technological improvements:**
 - improvements in business processes or products
 - the major driver of economic growth

- **Technological progress:**
 - drives increases in productivity
 - allows for better quality and more efficient production of goods and services



Why do high income countries have lower rates of growth compared to lower income countries?

High income countries

have accumulated capital which requires more maintenance/replacement. Therefore depreciation rate is also high.

Examples: - US, European countries
- Japan (1990-current)

Lower income countries

have less accumulated capital which requires less maintenance and replacement. Therefore depreciation rate is lower.

Examples: - Japan (1950-1970)
- Cambodia, Laos, Vietnam (1990-2019)

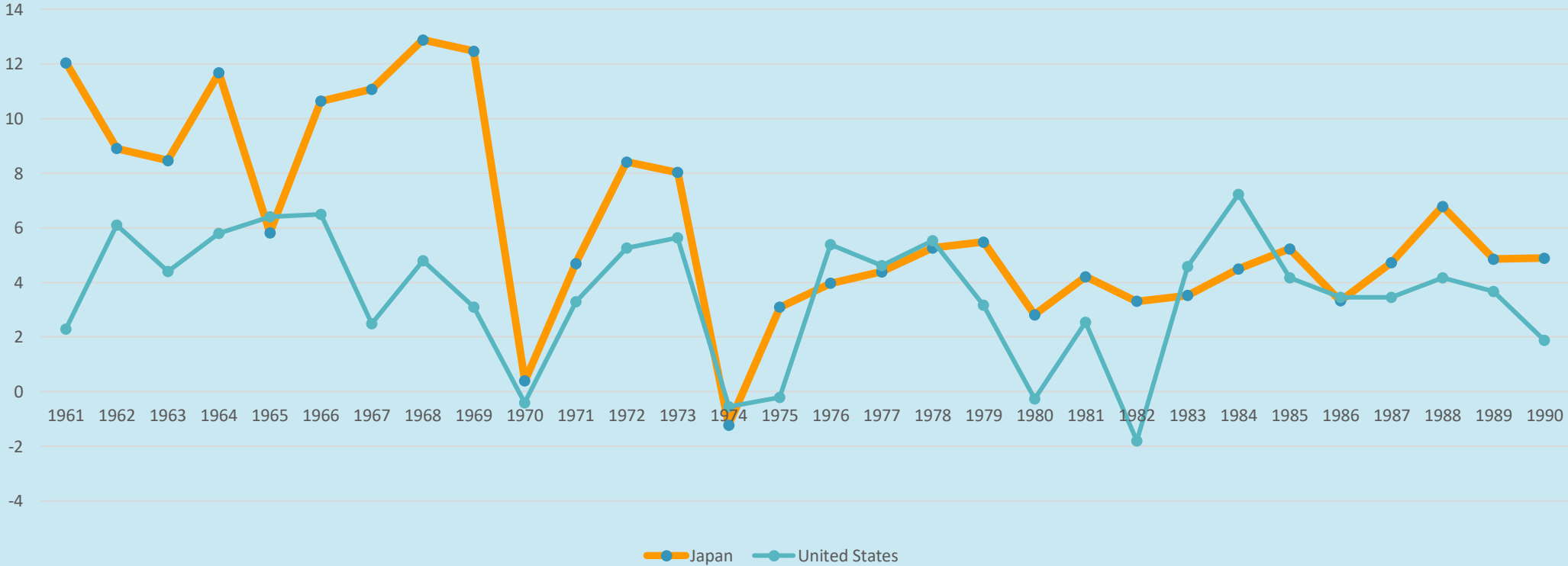
Case Study: Japan

- Between 1960-1990, Japan had high rate of growth
- In 1960, its GDP per capita was 1/3 of the US, and grew at 9% per year.
- In 1990, its GDP per capita was 85% of the US but growth rate fell to 4% and growth did not resume



Convergence Debate

- Higher income countries have relatively lower growth rates; lower income countries have the potential to achieve higher growth rates



Built-up infrastructure requires maintenance



New infrastructure adds to capital stock

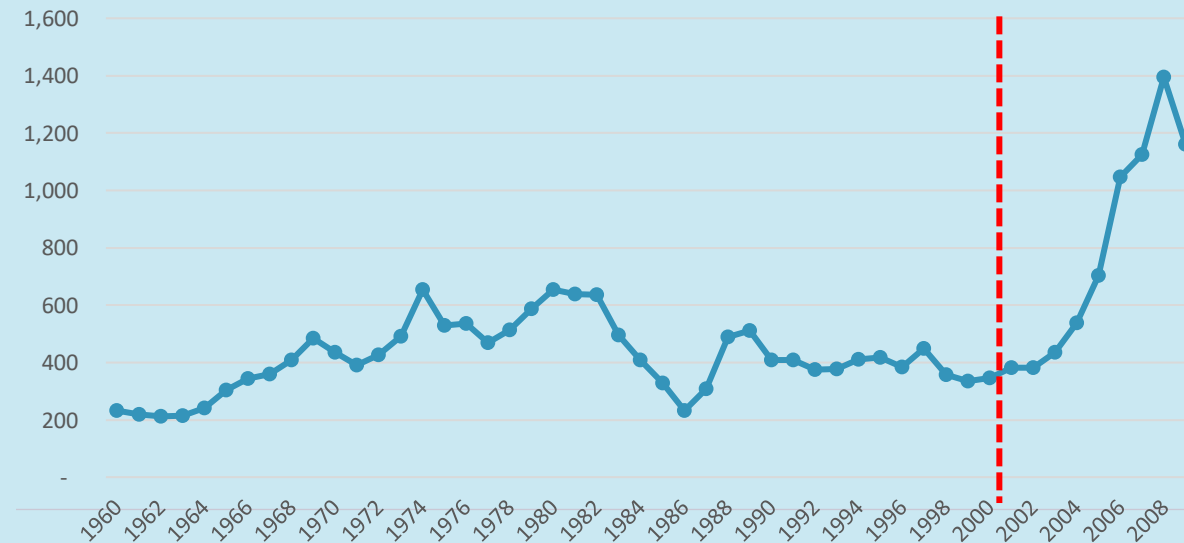


Crumbling infrastructure; rapid depreciation



Convergence does not apply to all countries

- This is the case for most countries, however not for all cases
- The case of Zambia demonstrates how GDP growth is stagnant over time (up to 2000)
- Since 2000, policies to reform the economy led to improved economic growth



Case study: Zambia

In 1960 Zambia's GDP per capita was \$1,803 and in 2009 was \$1,765.

The economy did not grow because of the lack of foreign investments, government policy, lack of technological change and occurrence of natural disasters

Conclusion

Economic models look at

- relationships between output, capital, savings
- investment relationships
- capital depreciation and population growth



Conclusion

- Harrod-Domar: relationship between labor, capital and output is fixed
- Robert Solow: relationship between capital labor and output is flexible; diminishing returns to capital; technology is central to sustaining economic growth



Conclusion

- Less developed countries likely to experience higher growth rates compared to developed countries because of convergence
- Models are based on assumptions and can only partially explain occurrences and are not necessarily accurate



T **HANK** **Y** **OU!**