EE562 Selected Topics in Development Economics 2

(Topic: A Global Perspective and Empirical Evidence in Thailand)

Faculty of Economics

Thammasat University

Summer Session 2017 (2560)

Time: Wednesdays and Fridays, 9AM – noon

Economic Growth and Development

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Office of the National Economic and Social Development Board (NESDB)

Outline

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Section II

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Section III

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Section IV

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The East Asian Miracle and Endogenous Growth

Section I

Economic Development

Economic Development

- **Development** = Growth *plus* Change
- **Growth**: sustained improvement in the level of per capita income
- **Change**: sustained improvement in institutions and organizations that support growth

Institutions

- Family: respect the authority & share resources
- Culture: propensity to save & invest
- Religion: ability to bring about change
- Law: protect property rights and civil liberties and enforce contracts

Organizations

- **Government:** produce public goods and regulate economic activities
- **Education**: increase productivity and expand the range of economic and social opportunities
- **Health:** enable proactive participation in economic and social activities
- **Business:** provide incentive for profit making, resulting in growth and expansion

Three Core Values of Development

- **Sustenance**: The ability to meet basic human needs including shelter, food, health, education, safety
- **Self-Esteem**: To be a person with a sense of self-respect and self-worth. To live with dignity, respect, and honor
- **Freedom from Servitude**: To be able to choose the path to prosperity and have the opportunity to improve

Objectives of Development

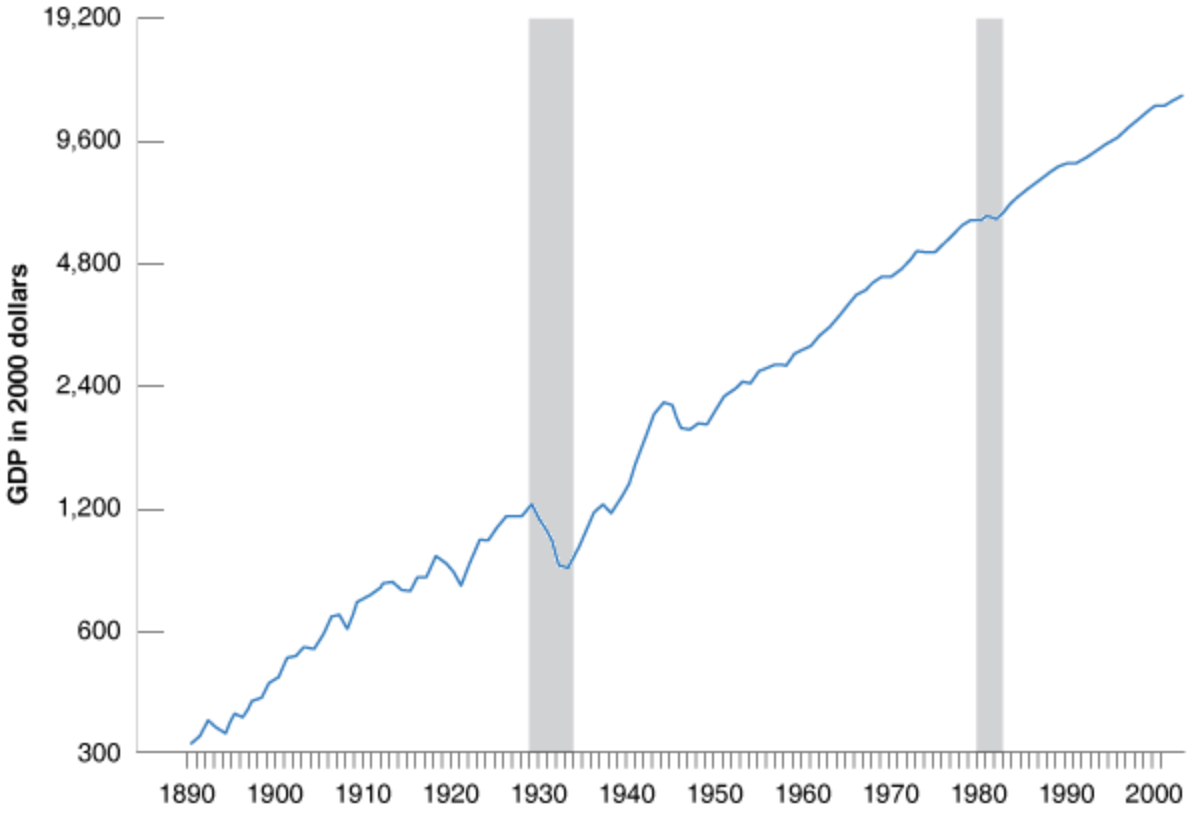
- **To increase the availability and distribution of basic human necessities**
- **To improve the standard of living for the majority of the people**
- **To expand the range of economic and social choices and opportunities**

Section II

The Neo-classical Growth Model

The Facts of Growth

U.S. GDP Since 1890



Growth is the steady increase in aggregate output over time.

The Facts of Growth

- Let's us focus on the determination of output in the *long run* — where growth dominates; while the determination of output in the *short* and *medium run* — where fluctuations dominate.

- The reason we care about growth is that we care about the standard of living.

- The variable we want to focus on and compare either over time or across countries is output per person rather than *output* itself.

The Facts of Growth

The Evolution of Output per Person in Four Rich Countries since 1950				
	Annual Growth Rate Output per Person (%)	Real Output per Person (2000 dollars)		
	1950–2004	1950	2004	2004/1950
France	3.3	5,920	26,168	4.4
Japan	4.6	2,187	24,661	11.2
United Kingdom	2.7	8,091	26,762	3.3
United States	2.6	11,233	36,098	3.2
Average	3.5	6,875	28,422	3.9

- There has been a large increase in output per person.
- There has been convergence of output per person across countries.

The Facts of Growth

The Convergence of Output per Person since 1950

Growth Rate of GDP per Person since 1950 versus GDP per Person in 1950, OECD Countries

Countries with lower levels of output per person in 1950 have typically grown faster.

The **convergence** of levels of output per capita across countries is not specific to the four countries we are looking at, it also extends to the set of OECD countries.

The Neo-classical growth model

The Aggregate Production Function

- The aggregate production function is a specification of the relation between aggregate output and the inputs in production.

$$Y = F(K, N)$$

Y = aggregate output.
K = capital—the sum of all the machines, plants, and office buildings in the economy.
N = labor—the number of workers in the economy.

The function *F*, which tells us how much output is produced for given quantities of capital and labor, is the *aggregate production function*.

The Neo-classical growth model

- The aggregate production function depends on the state of technology. The higher the state of technology, the higher for a given *K* and a given *N*.

$$Y = F(K, N)$$

The *state of technology* is a set of blue prints defining the range of products and the techniques available to produce them.

The Neo-classical growth model

Returns to Scale and Returns to Factors

- Constant returns to scale is a property of the economy in which, if the scale of operation is doubled—that is, if the quantities of capital and labor are doubled—then output will also double.

$$2Y = F(2K, 2N)$$

Or more generally, for any number x,

$$xY = F(xK, xN)$$

The Neo-classical growth model

Output per Worker and Capital per Worker

- Constant returns to scale implies that we can rewrite the aggregate production function as:

$$\frac{Y}{N} = F\left(\frac{K}{N}, \frac{N}{N}\right) = F\left(\frac{K}{N}, 1\right)$$

The amount of *output per worker*, *Y*/*N* depends on the amount of capital per worker, *K*/*N*.

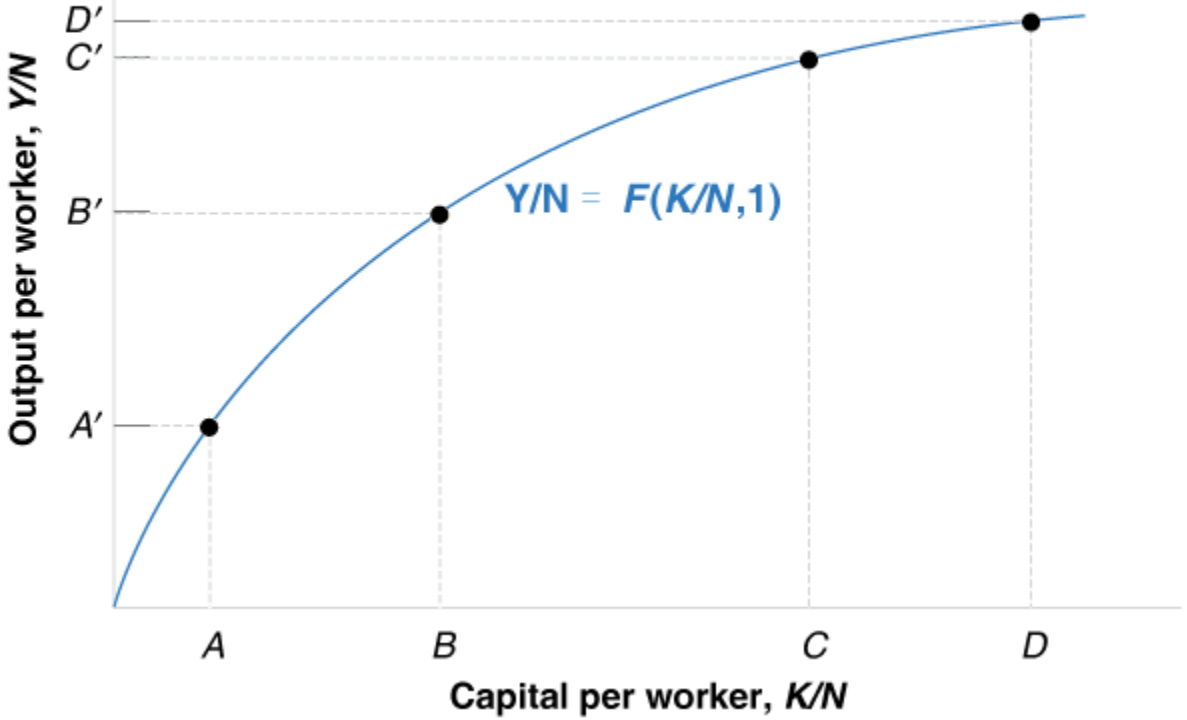
As *capital per worker* increases, so does output per worker.

The Neo-classical growth model

Output per Worker and Capital per Worker

Output and Capital per Worker

Increases in capital per worker lead to smaller and smaller increases in output per worker.



The Neo-classical growth model

The Sources of Growth

- Increases in output per worker (Y/N) can come from increases in capital per worker (K/N).
- Or they can come from improvements in the state of technology that shift the production function, F, and lead to more output per worker given capital per worker.

The Neo-classical growth model

The Sources of Growth

- We can think of growth as coming from capital accumulation and from technological progress—the improvement in the state of technology.

- These two factors play very different roles in the growth process:

  - Capital accumulation *by itself* cannot sustain growth. Saving rate is the proportion of income that is saved.

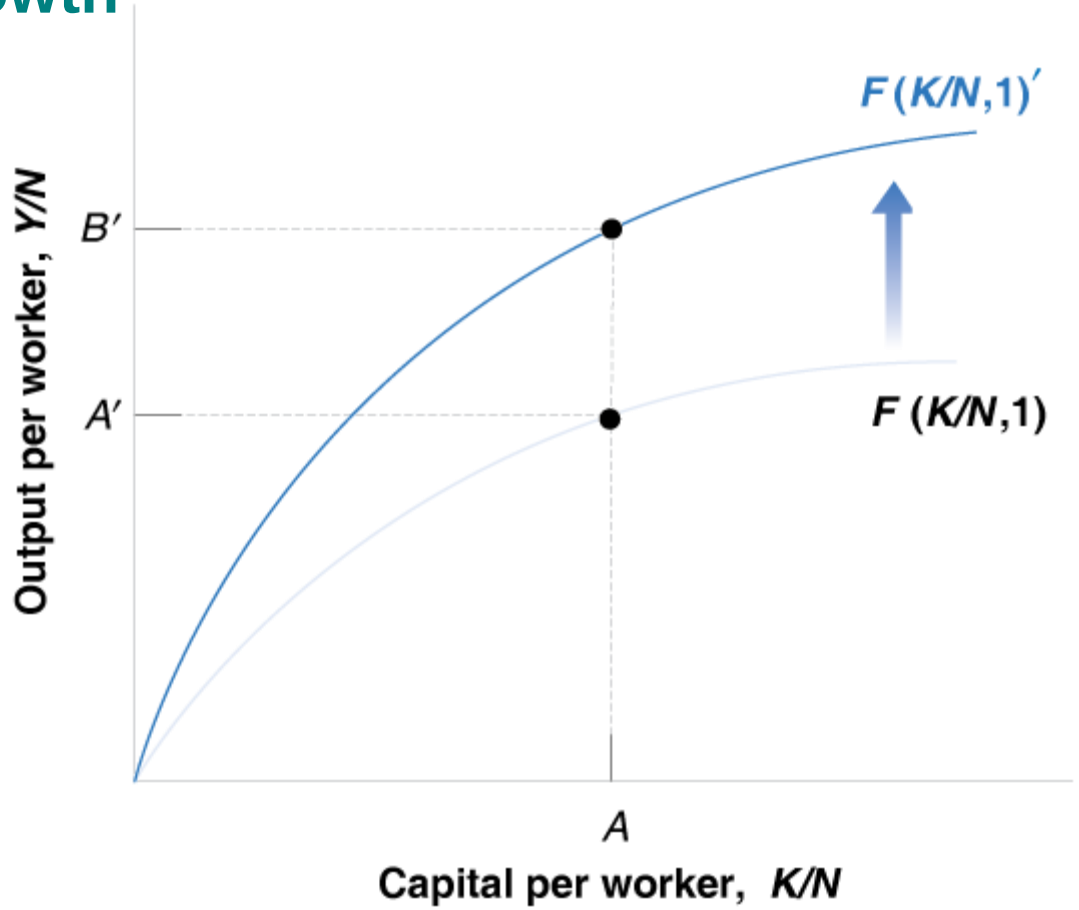
  - Sustained growth requires sustained technological progress. The economy's rate of growth of output per person is eventually determined by the economy's rate of technological progress.

The Neo-classical growth model

The Sources of Growth

The Effects of an Improvement in the State of Technology

An improvement in technology shifts the production function up, leading to an increase in output per worker for a given level of capital per worker.



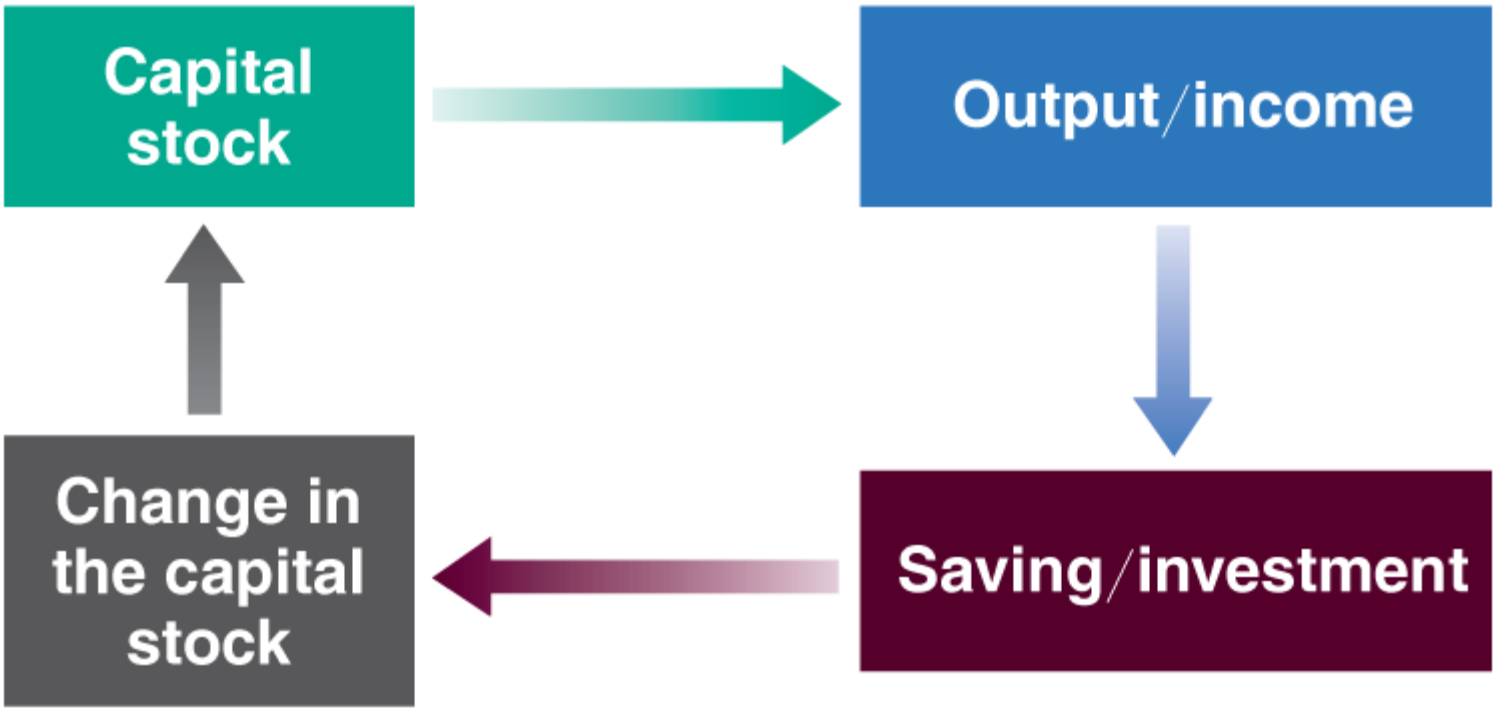
Section III

Capital Accumulation and Growth

The Neo-classical growth model

- At the center of the determination of output in the long run are two relations between output and capital:
  - The amount of capital determines the amount of output being produced.
  - The amount of output determines the amount of saving and, in turn, the amount of capital accumulated, so called, investment, over time.

Interactions between Output and Capital



The Neo-classical growth model

- The **focus here is on the role of capital accumulation**, we make the following assumptions:

  - The **size of the population, the participation rate, and the unemployment rate** are all **constant**.

  - There is **no technological progress**.

The Neo-classical growth model

The Effects of Output on Capital Accumulation

- We make three assumptions to derive the relation between output and investment:

  - We assume the economy is closed.

$$I = S + (T - G)$$

  - We assume public saving, $T - G$, is equal to zero.

$$I = S$$

  - We assume that private saving is proportional to income, so

$$S = sY$$

  - Combining these two relations gives:

$$I_t = sY_t$$

The Neo-classical growth model

The Effects of Output on Capital Accumulation

- The evolution of the capital stock is given by:

$$K_{t+1} = (1-\delta)K_t + I_t$$

δ denotes the rate of depreciation

Combining the relation from output to investment, $I_t = sY_t$, and the relation from investment to capital accumulation, we obtain the second important relation we want to express, from output to capital accumulation:

$$\frac{K_{t+1}}{N} = (1-\delta)\frac{K_t}{N} + s\frac{Y_t}{N}$$

The Neo-classical growth model

The Effects of Output on Capital Accumulation

Output and Capital per Worker:

$$\frac{K_{t+1}}{N} = (1-\delta)\frac{K_t}{N} + s\frac{Y_t}{N}$$

- Rearranging terms in the equation above, we can articulate the change in capital per worker over time:

$$\frac{K_{t+1}}{N} - \frac{K_t}{N} = s\frac{Y_t}{N} - \delta\frac{K_t}{N}$$

In words, the change in the capital stock per worker (left side) is equal to saving per worker minus depreciation (right side).

The Neo-classical growth model

Dynamics of Capital and Output

$$\frac{Y_t}{N} = f\left(\frac{K_t}{N}\right) \qquad \frac{K_{t+1}}{N} - \frac{K_t}{N} = s\frac{Y_t}{N} - \delta\frac{K_t}{N}$$

From our main relations above, we express output per worker (Y_t/N) in terms of capital per worker to derive the equation below:

$$\frac{K_{t+1}}{N} - \frac{K_t}{N} = sf\left(\frac{K_t}{N}\right) - \delta\frac{K_t}{N}$$

Change in capital from year t to year $t + 1$ = Investment during year t − Depreciation during year t

The Neo-classical growth model

Dynamics of Capital and Output

$$\frac{K_{t+1}}{N} - \frac{K_t}{N} = sf\left(\frac{K_t}{N}\right) - \delta\frac{K_t}{N}$$

Change in capital from year t to year $t + 1$ = Investment during year t − Depreciation during year t

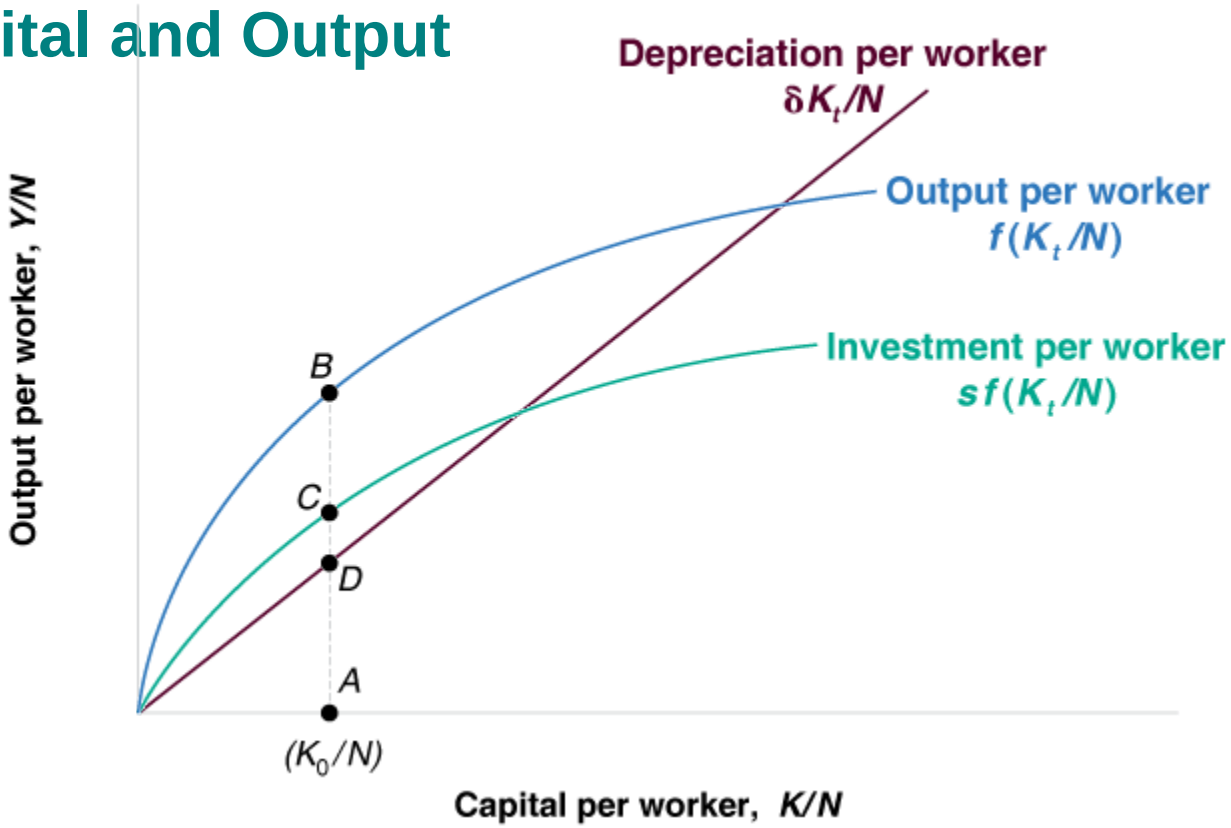
This relation describes what happens to capital per worker. The change in capital per worker from this year to next year depends on the difference between two terms:

- If investment per worker exceeds depreciation per worker, the change in capital per worker is positive: Capital per worker increases.
- If investment per worker is less than depreciation per worker, the change in capital per worker is negative: Capital per worker decreases.

The Neo-classical growth model

Dynamics of Capital and Output

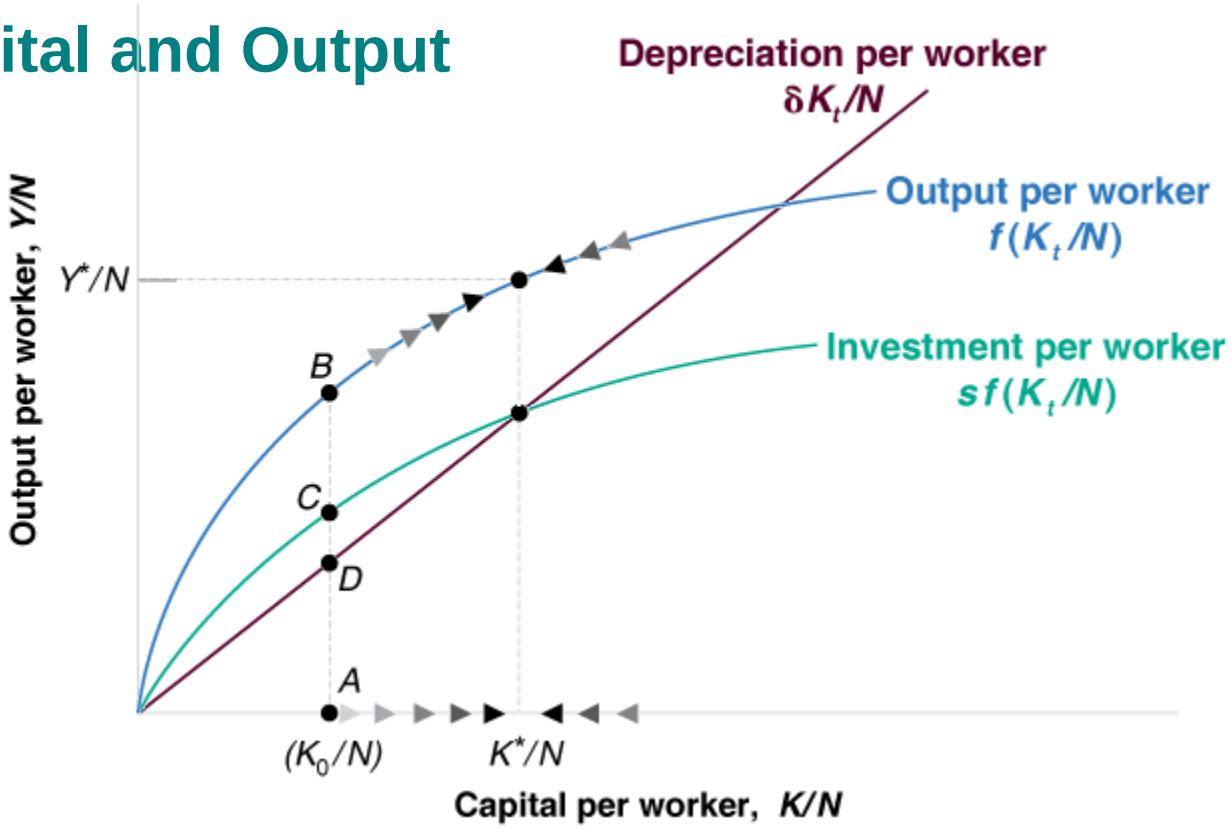
At $K_{0/N}$, capital per worker is low, investment exceeds depreciation, thus, capital per worker and output per worker tend to increase over time.



The Neo-classical growth model

Dynamics of Capital and Output

At K*/N, output per worker and capital per worker remain constant at their long-run equilibrium levels.



- When capital and output are low, investment exceeds depreciation, and capital increases. When capital and output are high, investment is less than depreciation, and capital decreases

The Neo-classical growth model

Steady-State Capital and Output

$$\frac{K_{t+1}}{N} - \frac{K_t}{N} = sf\left(\frac{K_t}{N}\right) - \delta\frac{K_t}{N}$$

- The state in which output per worker and capital per worker are no longer changing is called the steady state of the economy. In steady state, the left side of the equation above equals zero, then:

$$sf\left(\frac{K^*}{N}\right) = \delta\frac{K^*}{N}$$

Given the steady state of capital per worker (K^*/N), the steady-state value of output per worker (Y^*/N), is given by the production function:

$$\frac{Y^*}{N} = f\left(\frac{K^*}{N}\right)$$

The Neo-classical growth model

The Saving Rate and Output

- Three observations about the effects of the saving rate on the growth rate of output per worker are:

1. *The saving rate has no effect on the long run growth rate of output per worker, which is equal to zero.*

2. Nonetheless, *the saving rate determines the level of output per worker in the long run.* Other things equal, countries with a higher saving rate will achieve higher output per worker in the long run.

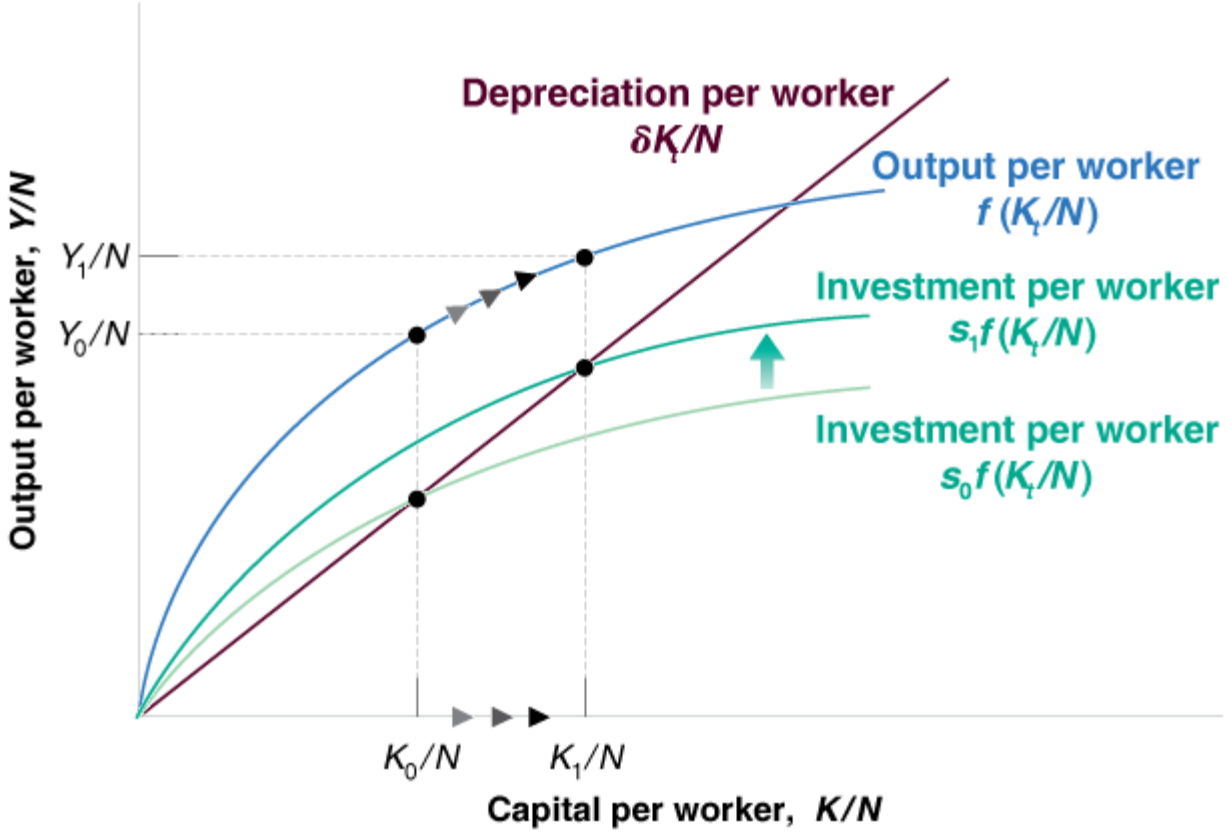
3. An increase in the saving rate will lead to higher growth of output per worker for some time, but not forever.

The Neo-classical growth model

The Saving Rate and Output

The Effects of Different Saving Rates

A country with a higher saving rate achieves a higher steady- state level of output per worker.



Section IV

Technological Progress and Growth

Technological Progress and Growth

Technological Progress and the Production Function

- Technological progress has many dimensions. It may mean:
  - Larger quantities of output
  - Better products
  - New products
  - A larger variety of products
- Technological progress leads to increases in output for given amounts of capital and labor.

Technological Progress and Growth

Technological Progress and the Production Function

- Let's denote the state of technology by *A* and rewrite the production function as:

$$Y = F(K, N, A)$$
$$(+\ +\ +)$$

A more restrictive but more convenient form is

$$Y = F(K, AN)$$

Output depends on both capital and labor (*K* and *N*), and on the state of technology (*A*).

Technological Progress and Growth

Technological Progress and the Production Function

- Technological progress *reduces* the number of workers needed to achieve a given amount of output.

- Technological progress *increases AN*, which we can think of as the amount of effective labor, or labor in "efficiency units" in the economy.

With constant returns to scale,

$$2Y = F(2K,\ 2AN)$$

More generally,

$$xY = F(xK,\ xAN)$$

Technological Progress and Growth

Technological Progress and the Production Function

- The relation between output per effective worker and capital per effective worker is:

$$\frac{Y}{AN} = F\left(\frac{K}{AN}, 1\right)$$

which we can redefine as

$$\frac{Y}{AN} = f\left(\frac{K}{AN}\right)$$

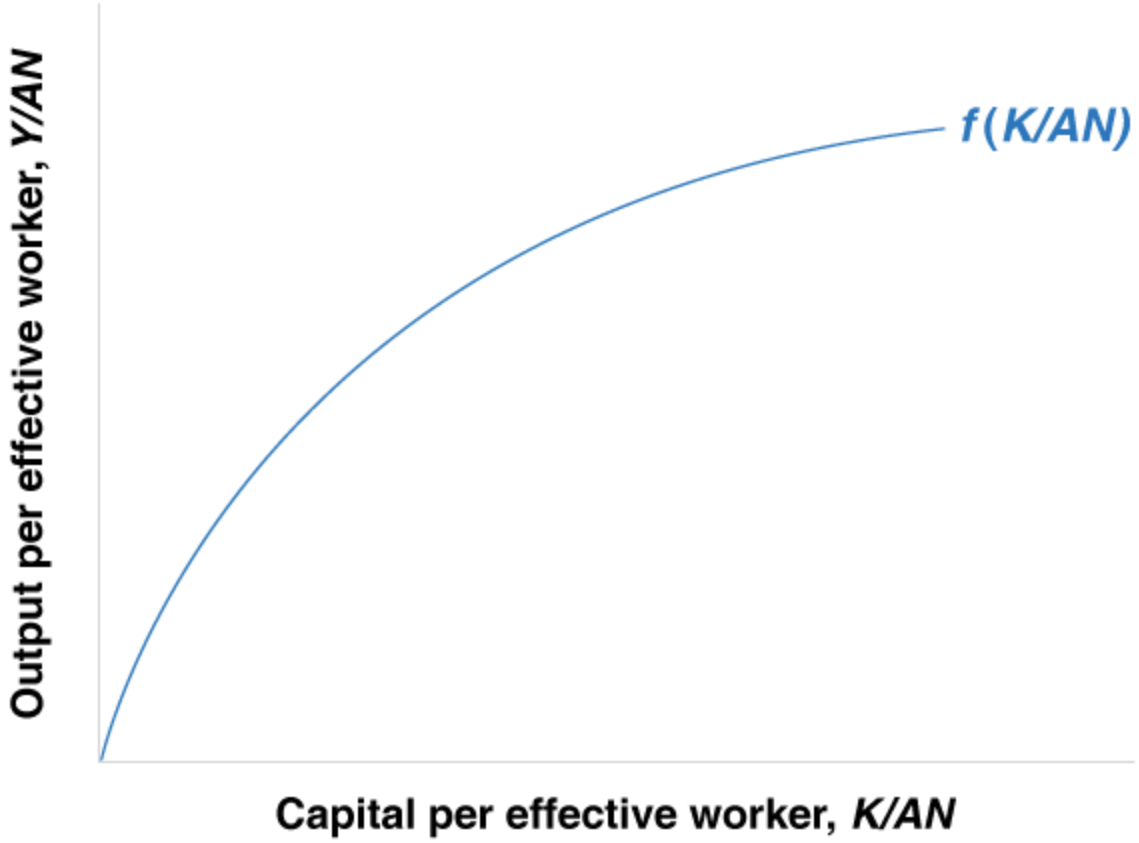
In words: *Output per effective worker* is a function of *capital per effective worker.*

Technological Progress and Growth

Technological Progress and the Production Function

Output per Effective Worker versus Capital per Effective Worker

Because of decreasing returns to capital, increases in capital per effective worker lead to smaller and smaller increases in output per effective worker.



Technological Progress and Growth

Interactions between Output and Capital

- The dynamics of output and capital per worker involve:
  - The relation between output per worker and capital per worker.

$$I = S = sY$$

Dividing both sides by *AN*, we get

$$\frac{I}{AN} = s\left(\frac{Y}{AN}\right)$$

Technological Progress and Growth

Interactions between Output and Capital

The dynamics of output and capital per worker involve:

- The relation between investment per worker and capital per worker.

Given that $\frac{Y}{AN} = f\left(\frac{K}{AN}\right)$ then, $\frac{I}{AN} = sf\left(\frac{K}{AN}\right)$

Technological Progress and Growth

Interactions between Output and Capital

The dynamics of output and capital per worker involve:

- The relation between depreciation per worker—equivalently, the investment per worker needed to maintain a constant level of capital per worker—and capital per worker.

$$\delta K + (g_A = g_N)K$$

$$(\delta + g_A + g_N)K$$

The amount of investment per effective worker needed to maintain a constant level of capital per effective worker is

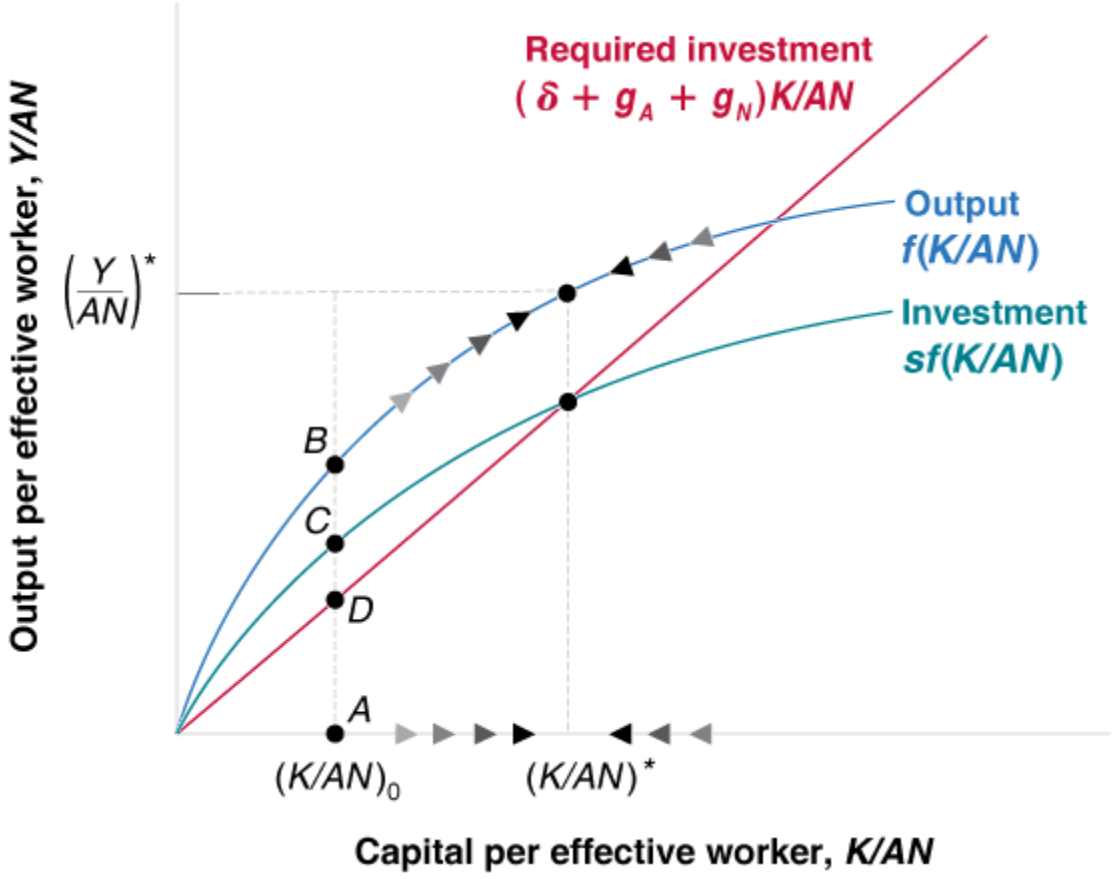
$$(\delta + g_A + g_N)\frac{K}{AN}$$

Technological Progress and Growth

Interactions between Output and Capital

The Dynamics of Capital per Effective Worker and Output per Effective Worker

Capital per effective worker and output per effective worker converge to constant values in the long run.



Technological Progress and Growth

Dynamics of Capital and Output

- We can now give a graphical description of the dynamics of capital per effective worker and output per effective worker:

Because actual investment exceeds the investment level required to maintain the existing level of capital per effective worker, K/AN increases.

Starting from $(K/AN)_0$, the economy moves to the right, with the level of capital per effective worker increasing over time.

In the long run, capital per effective worker reaches a constant level, and so does output per effective worker.

This implies that output (Y) is growing at the same rate as effective labor (AN).

Technological Progress and Growth

Dynamics of Capital and Output

- In steady state, output (Y) grows at the same rate as effective labor (AN); effective labor grows at a rate (g_A+g_N); therefore, output growth in steady state equals (g_A+g_N). Capital per effective worker also grows at a rate equal to (g_A+g_N).

- The growth rate of output is independent of the saving rate.

- Because output, capital, and effective labor all grow at the same rate, (g_A+g_N), the steady state of the economy is also called a state of balanced growth.

Technological Progress and Growth

Dynamics of Capital and Output

The Characteristics of Balanced Growth		
		Rate of growth of:
1	Capital per effective worker	0
2	Output per effective worker	0
3	Capital per worker	g_A
4	Output per worker	g_A
5	Labor	g_N
6	Capital	$g_A + g_N$
7	Output	$g_A{}^W + g_N$

Technological Progress and Growth

Dynamics of Capital and Output

On the balanced growth path (equivalently: in steady state, or in the long run):

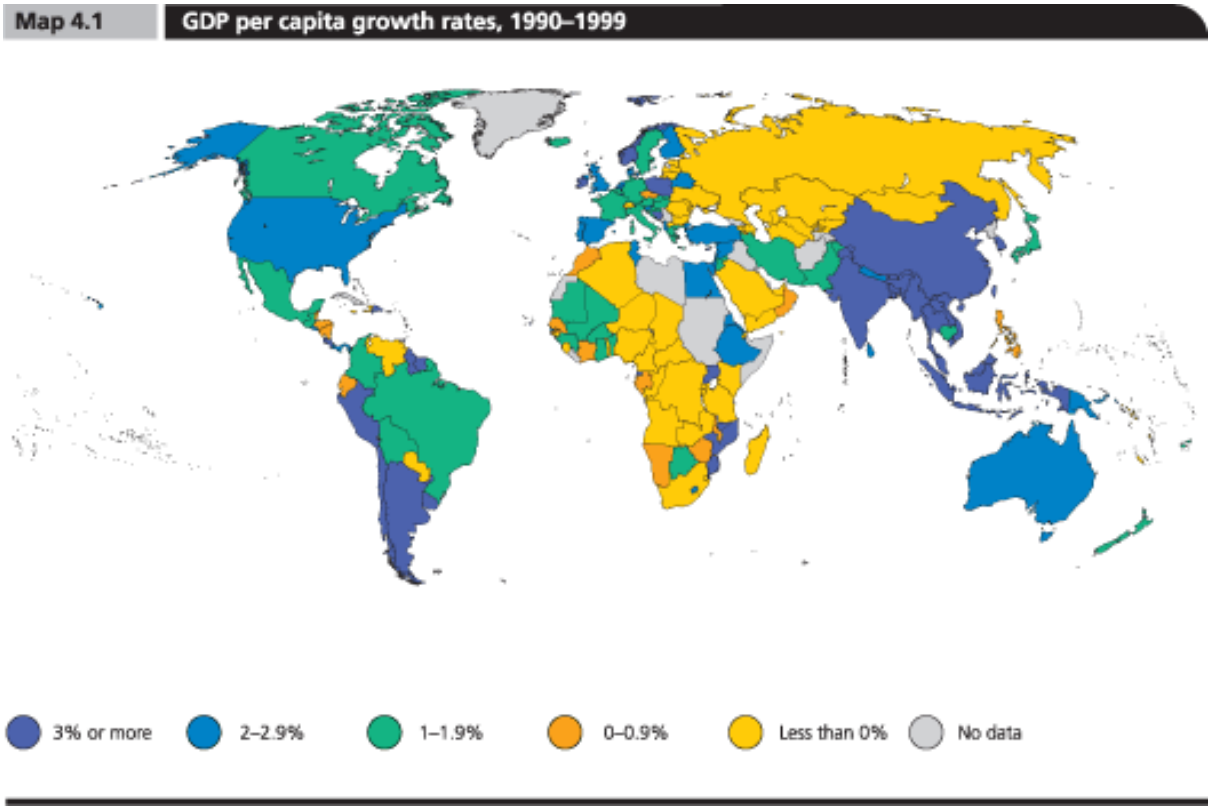
- *Capital per effective worker* and *output per effective worker* are constant.
- Equivalently, *capital per worker* and *output per worker* are growing at the rate of technological progress, g_A.
- Or, in terms of labor, capital, and output: *Labor* is growing at the rate of population growth, g_N; *capital* and *output* are growing at a rate equal to the sum of population growth and the rate of technological progress, $(g_A + g_N)$.

Section V

The East Asian Miracle and Endogenous Growth

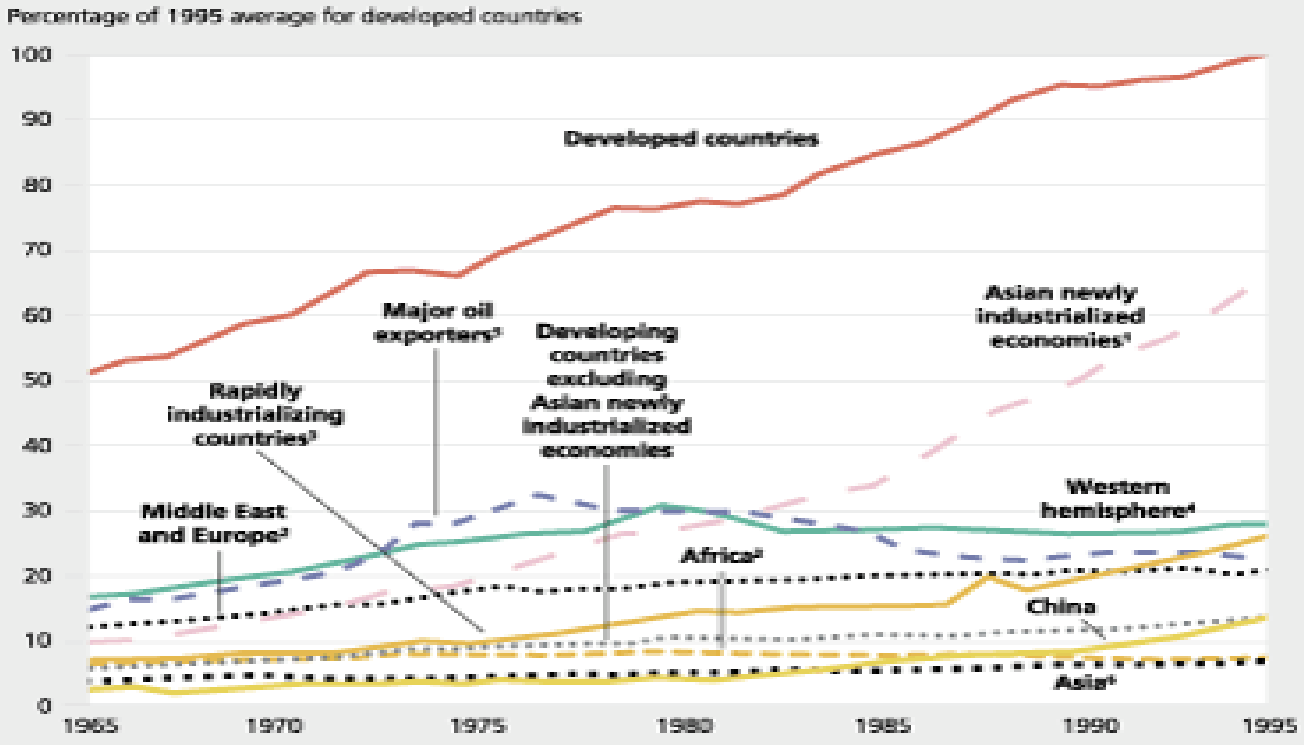
The East Asian Miracle

- East Asian countries have recorded unique experiences of Economic Growth
  - > Fast
  - > Sustained over a fairly Long-run



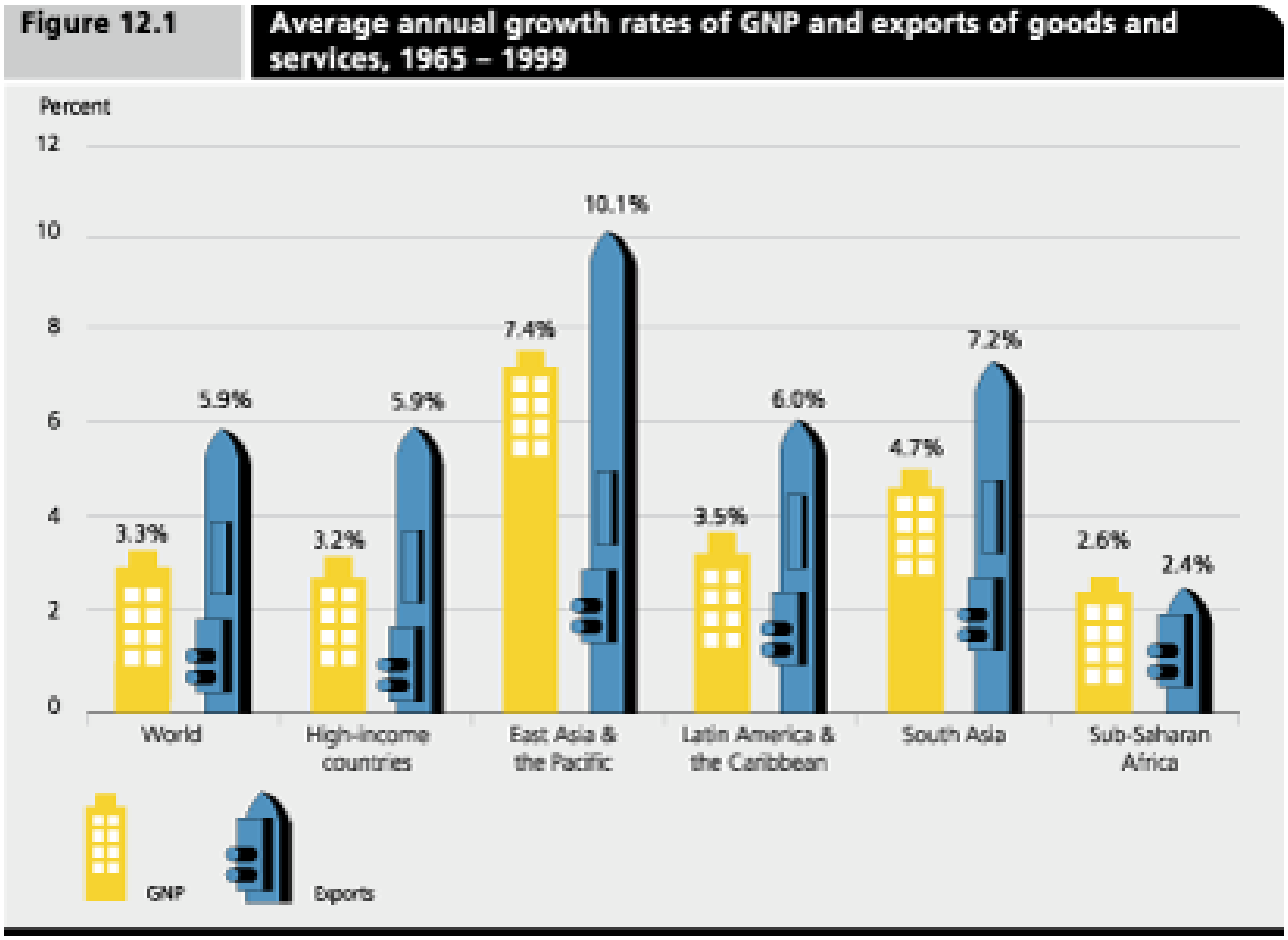
The East Asian Miracle

Figure 4.4 **Real GDP per capita in developed and developing countries, 1965 – 1995**



1. Asian newly industrialized economies: Hong Kong (China), Republic of Korea, Singapore, and Taiwan (China).
2. Excluding major oil exporters.
3. Consists of Chile, Indonesia, Malaysia, and Thailand.
4. Excluding major oil exporters and Chile.
5. Excluding Iraq.
6. Excluding China, Hong Kong (China), Indonesia, Republic of Korea, Malaysia, Singapore, Taiwan (China), and Thailand.

Is Asia's Miracle a Myth?



"Export-led growth"

Is Asia's Miracle a Myth?

- Some argue that there is no big contribution by technology to the economic growth in the East Asian countries (Paul Krugman; Alwyn Young).

- In fact there is not much of indigenous technical innovations of the East Asian.

Factors of East Asian Miracles

Word Bank attributed the Asian Miracles to

1) Accumulation of **Physical Capital** (Savings)

2) Hard work (Labor Supply)

3) Fostering **Human Capital** (Education)

4) **Social Capital** (Harmony-not confrontation, Law and Order, Lack of Corruption)

5) **Sound Government Policies** (Industrial Policy, Export Promotion, etc.)

Human Capital in East Asia

- Human Capital = Creativity
  - Knowledge;
  - Soundness of Mind and Body

- Human Capital is fostered through education of all levels

Human Capital

Human Capital is conventionally measured by

Schooling (Years) and/or

National Expenses on Education

(They are incomplete measures!)

Education in East Asian context

Figure 7.6

Mean Mathematical Literacy			Mean Scientific Literacy		
Range of rank order positions for each country based on sample (with 95% confidence)			Range of rank order positions for each country based on sample (with 95% confidence)		
Country	Rank		Country	Rank	
	Highest possible	Lowest possible		Highest possible	Lowest possible
Japan	1	3	Korea	1	2
Korea	2	3	Japan	1	2
New Zealand	4	8	Finland	3	4
Finland	4	7	United Kingdom	3	7
Australia	4	9	Canada	4	8
Canada	5	8	New Zealand	4	8
Switzerland	4	10	Australia	4	8
United Kingdom	6	10	Austria	8	10
Belgium	9	15	Ireland	9	12
France	10	15	Sweden	9	13
Austria	10	16	Czech Republic	10	13
Denmark	10	16	France	13	18
Iceland	11	16	Norway	13	18
Liechtenstein	9	18	United States	11	21
Sweden	13	17	Hungary	13	21
Ireland	16	19	Iceland	14	20
Norway	17	20	Belgium	13	21
Czech Republic	17	20	Switzerland	13	21
United States	16	23	Spain	16	22
Germany	20	22	Germany	19	23
Hungary	20	23	Poland	19	25
Russian Fed.	21	25	Denmark	21	25
Spain	23	25	Italy	22	25
Poland	23	26	Liechtenstein	20	26
Latvia	25	28	Greece	25	29
Italy	26	28	Russian Fed.	25	29
Portugal	26	29	Latvia	25	29
Greece	27	30	Portugal	26	29
Luxembourg	29	30	Luxembourg	30	30
Mexico	31	31	Mexico	31	31
Brazil	32	32	Brazil	32	32

- Why is education so much valued in EA?

  In East Asia, Education has been the most important means of Social Mobility or the Upward Movement in Social Class.

Incentive for Education

- Education is Investment
- Investment responds to Returns
- Upward Mobility through Income and Recognition Scales of the Society = **Social Mobility**

Government Policies

- Industrial Policies

Facilitating most efficient resource Allocation

- Export Promotion Policies

Promotion of Strategic Industries

Export-Orientation is conducive for Economic Growth:

- **Specialization** based on Ricardo's comparative advantage theory of trade
- Trade provides Expanded Market, which enables **(Large) Scale of Production**
- Openness provides changes for Technology Transfer

From Neo-classical Growth Theory to Endogenous Growth Theory

- Criticism of neoclassical growth theory since:
  - It does not explain determinants of technological progress
  - In many developed countries, invention and advances in technology are the key determinants of growth, but much less important for poor countries
  - More important to invest in human and physical capital and borrow technological advances from others
- Endogenous growth theory (Romer, Lucas) emphasizes different growth opportunities in physical capital and knowledge
- Diminishing marginal returns to physical capital, but perhaps not knowledge

Endogenous Growth Theory

- Endogenous growth theory — explaining the sources of productivity growth

$$Y = AK$$

  - Need to modify the production function to allow for self-sustaining, endogenous growth
  - Production function with a constant MPK
  - K is the only factor
  - Output is proportional to K

Endogenous Growth Theory

- Constant *MPK*
  - Human capital
    - Knowledge, skills, and training of individuals
    - Human capital tends to increase in the same proportion as physical capital
  - Research and development programs
  - Increases in capital and output generate increased technical knowledge, which offsets decline in *MPK* from having more capital

Government Policies to Raise Long-Run Living Standards

- Policies to raise the rate of productivity growth
  - Improving infrastructure
    - Infrastructure: highways, bridges, utilities, dams, airports
    - Empirical studies suggest a link between infrastructure and productivity
    - U.S. infrastructure spending has declined in the last two decades

Government Policies to Raise Long-Run Living Standards

- Policies to raise the rate of productivity growth
  - Improving infrastructure
    - Would increased infrastructure spending increase productivity?
      - There might be reverse causation: Richer countries with higher productivity spend more on infrastructure, rather than vice versa
      - Infrastructure investments by government may be inefficient, since politics, not economic efficiency, is often the main determinant

Government Policies to Raise Long-Run Living Standards

- Policies to raise the rate of productivity growth
  - Building human capital
    - There's a strong connection between productivity and human capital
    - Government can encourage human capital formation through educational policies, worker training and relocation programs, and health programs
    - Another form of human capital is entrepreneurial skill
    - Government could help by removing barriers like red tape

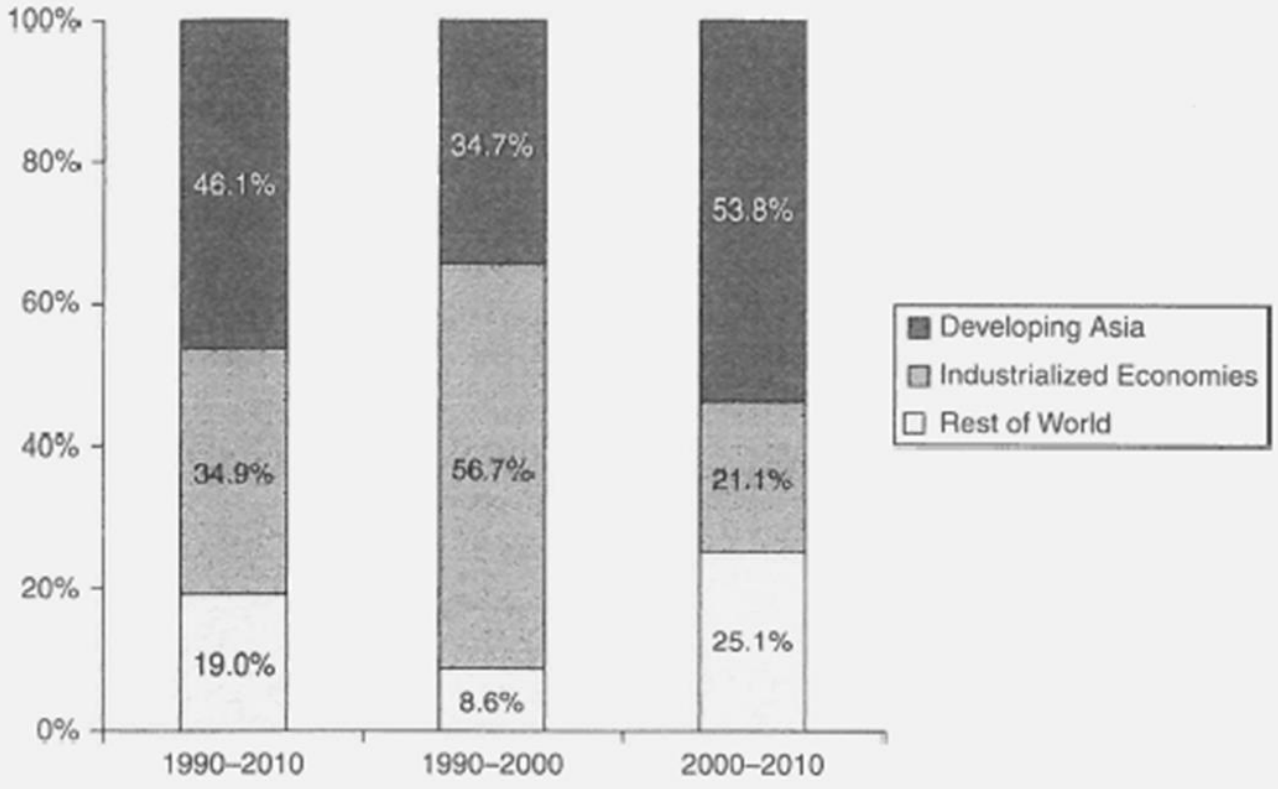
Government Policies to Raise Long-Run Living Standards

- Policies to raise the rate of productivity growth
  - Encouraging research and development
    - Support scientific research
    - Fund government research facilities
    - Provide grants to researchers
    - Contract for particular projects
    - Give tax incentives
    - Provide support for science education

THE RISE OF DEVELOPING ASIA: Surprise, Scale, and Speed!

- **Surprise:** Industrialized Economies Predominated in World Economic Growth from 1990-2000 and Developing Asia Led from 2000-2010.
- **Scale:** China and India Predominated in the Growth of Developing Asia from 1990-2000 and China Alone Led from 2000-2010.
- **Speed:** China's Growth Accelerated from 7.1 Percent in 1990-2000 to 10.9 Percent in 2000-2010 and India's Growth from 5.4 Percent to 7.4 Percent

THE RISE OF DEVELOPING ASIA: Surprise, Scale, and Speed!



Source: Author's calculations; data from WDI, ADB, TED.

Figure 3.1 Contribution to the world's GDP growth: Developing Asia versus other parts of the world

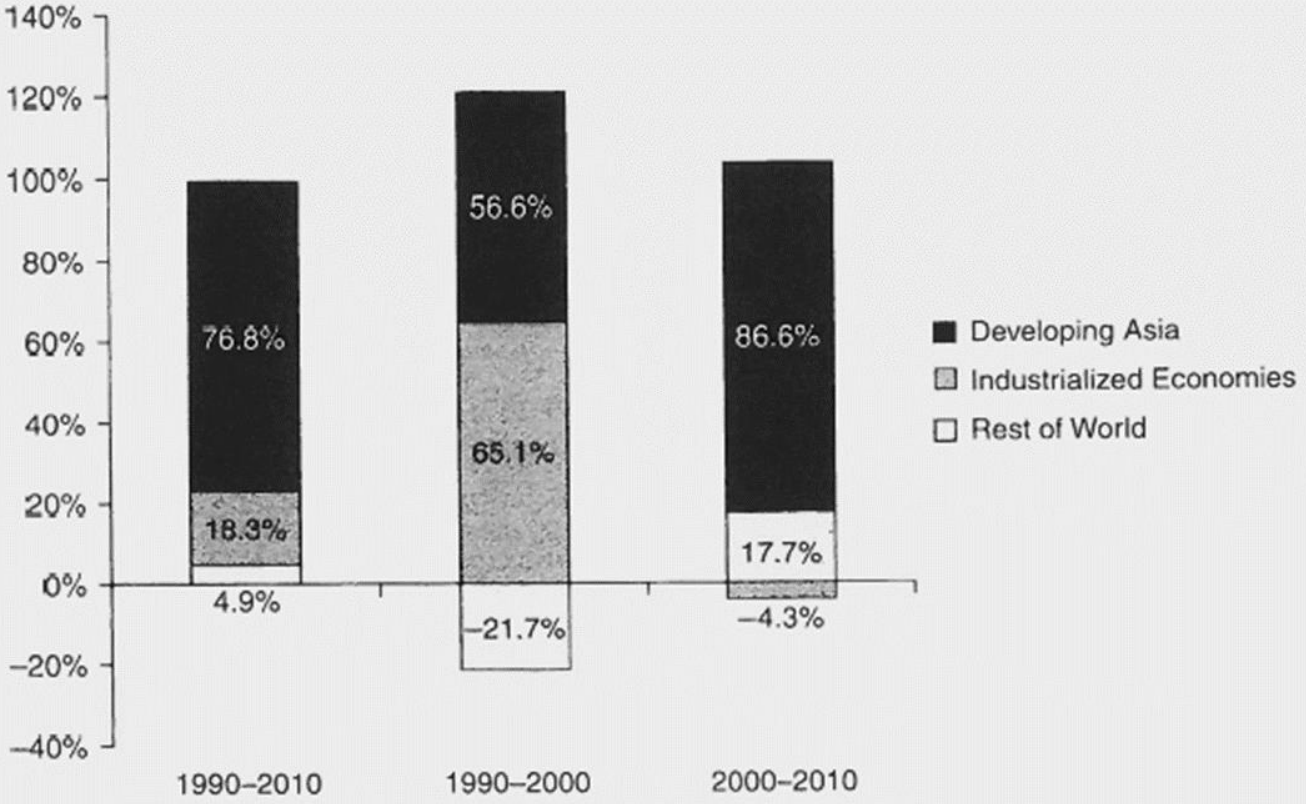
CAPITAL ACCUMULATION: THE RISE OF THE SHARE OF INVESTMENT

- Fixed Investment Grew Faster than GDP for Developing Asia from 1990-2000 and 2000-2010. Developing Asia Predominated in World Growth of Fixed Investment in Both Sub-Periods.

- China Predominated in the Growth of Fixed Investment in Developing Asia from 1990-2000 and in the World Economy from 2000-1010.

- India's Share of Growth of Fixed Investment in the World Economy More than Doubled between 1990-2000 and 2000-2010.

CAPITAL ACCUMULATION: THE RISE OF THE SHARE OF INVESTMENT



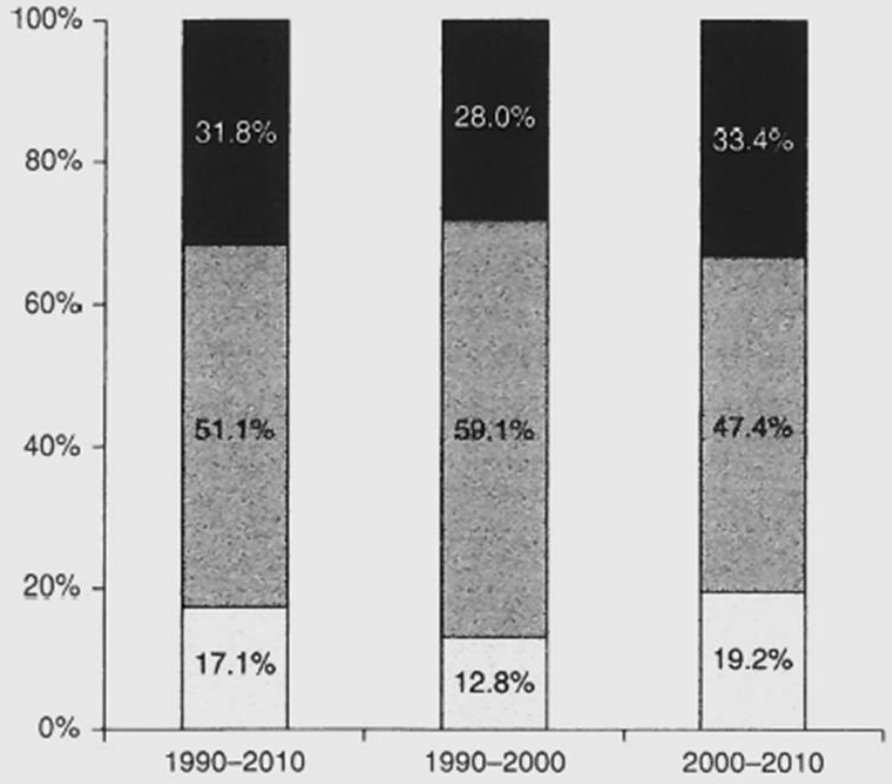
Source: Author's calculations; data from WDI, ADB, ICP.

Figure 3.10 *Contribution to the world's fixed investment growth: Developing Asia versus other parts of the world*

GLOBALIZATION: RISE IN THE SHARE OF EXPORTS

- Exports Grew Faster than GDP for the World Economy, Developing Asia, Industrialized Economies and the Rest of the World from 1990-2000 and 2000-2010.
- Industrialized Economies Continued to Predominate in the Growth of Exports in the World Economy in Both Sub-Periods.
- Shares of Each the Four Tigers – Hong Kong, Singapore, South Korea, and Taiwan – in World Exports Exceeded that of China in 1990 and that of India in 1990, 2000, and 2010 (Except for Taiwan in 2010).

GLOBALIZATION: RISE IN THE SHARE OF EXPORTS



Source: Author's calculations; data from WDI, ADB.

Figure 3.13 Contribution to the world's exports of goods and services growth: Developing Asia versus other parts of the world

THE RECENT ASIAN GROWTH

- The Asian Growth During 2000-2010 Surprised by Capturing The Lead in Growth in the World Economy.
- The Scale of the China and India Played a Crucial Role in The Rapid Growth of Developing Asia.
- Economic Growth in Developing Asia Reached Unprecedented Speeds During 2000-2010.

End of Lecture