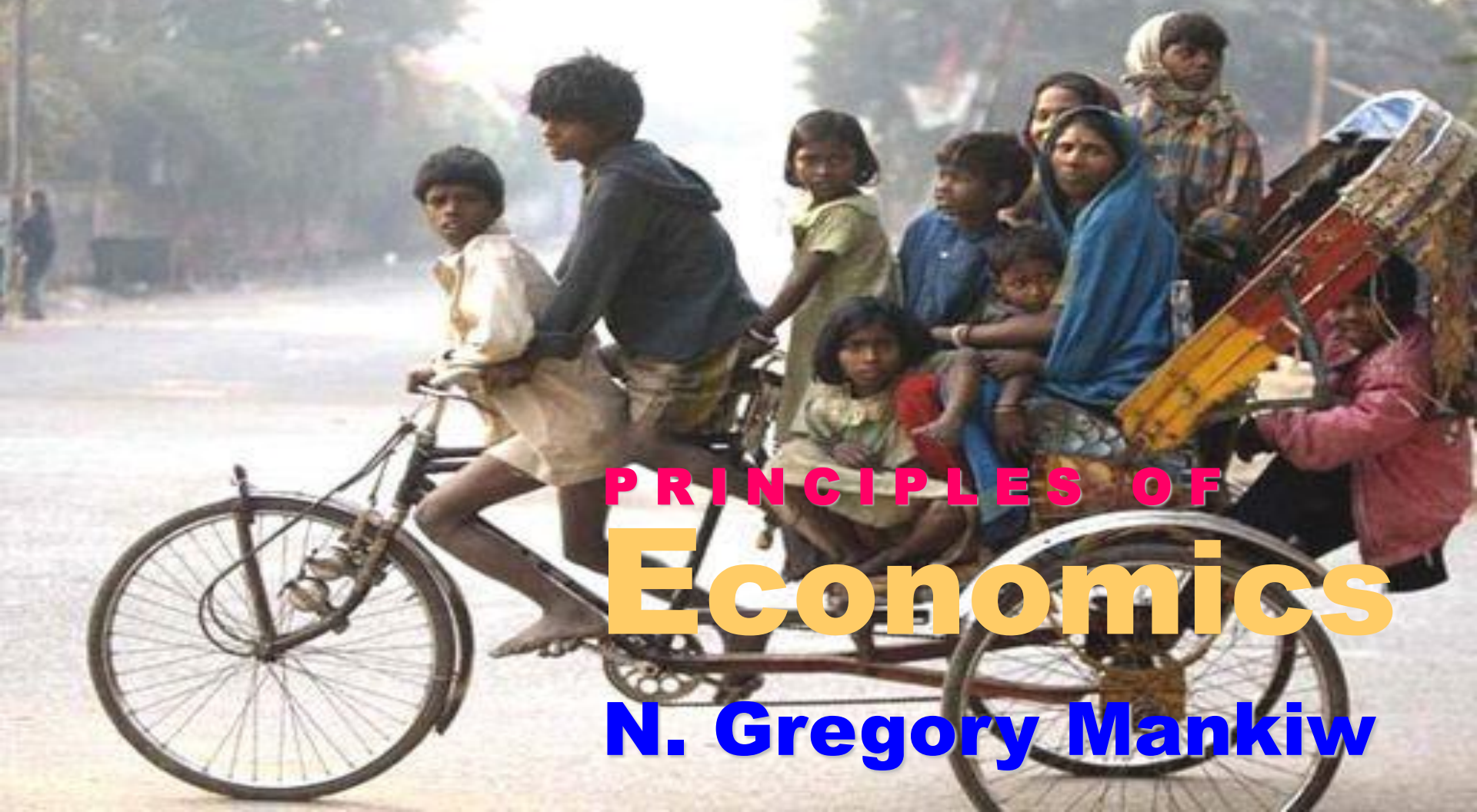




Ch - 25

Production and Growth



PRINCIPLES OF

Economics

N. Gregory Mankiw



**In this chapter,
look for the answers to these questions:**

- What are the facts about living standards and growth rates around the world?
- Why does productivity matter for living standards?
- What determines productivity and its growth rate?
- How can public policy affect growth and living standards?

Production and Growth

- ❖ A country's standard of living depends on its ability to produce goods and services.
- ❖ Standard of living may be measured in different ways:
 - ❖ By comparing personal incomes.
 - ❖ By comparing the total market value of a nation's production per person (per capita GDP).
- ❖ Standard of living varies across different countries and different geographical regions of a country.
- ❖ Within a country there are also large changes in the standard of living over time.

Economic Growth around the World

- Living standards, as measured by real GDP per person, vary significantly among nations.
- The poorest countries have average levels of income that have not been seen in the high-income countries like United States for many decades.
- Annual growth rates that seem small become large when compounded for many years.
- Compounding refers to the accumulation of a growth rate over a period of time.

the U.K., an advanced economy

A photograph of a residential street in the UK, illustrating a point about the economy. In the foreground, a man in a purple jacket, a young man in a school uniform, and a woman in a plaid shirt are seated at a table set for tea. The background shows a row of brick houses with various items, including a large blue sailboat, a washing machine, and a microwave, placed on the street and in front of the houses.

Life expectancy: 81.25 years (2018)

4

A typical family with all their possessions in Mexico, an upper middle income country



GDP per capita (Constant 2010) : \$10,386 (2018)
Life expectancy: 74.99 years (2018)
Adult literacy: 95.38% (2018)

A typical family with all their possessions in India, a lower middle income country



GDP per capita (Constant 2010) :

\$ 2,086 (2018)

Life expectancy:

69.42 years (2018)

Adult literacy:

74.99% (2018)

A typical family with all their possessions in Mali, a poor country



GDP per capita (Constant 2010) :

\$ 779 (2018)

Life expectancy:

58.89 years (2018)

Adult literacy:

35.47% (2018)

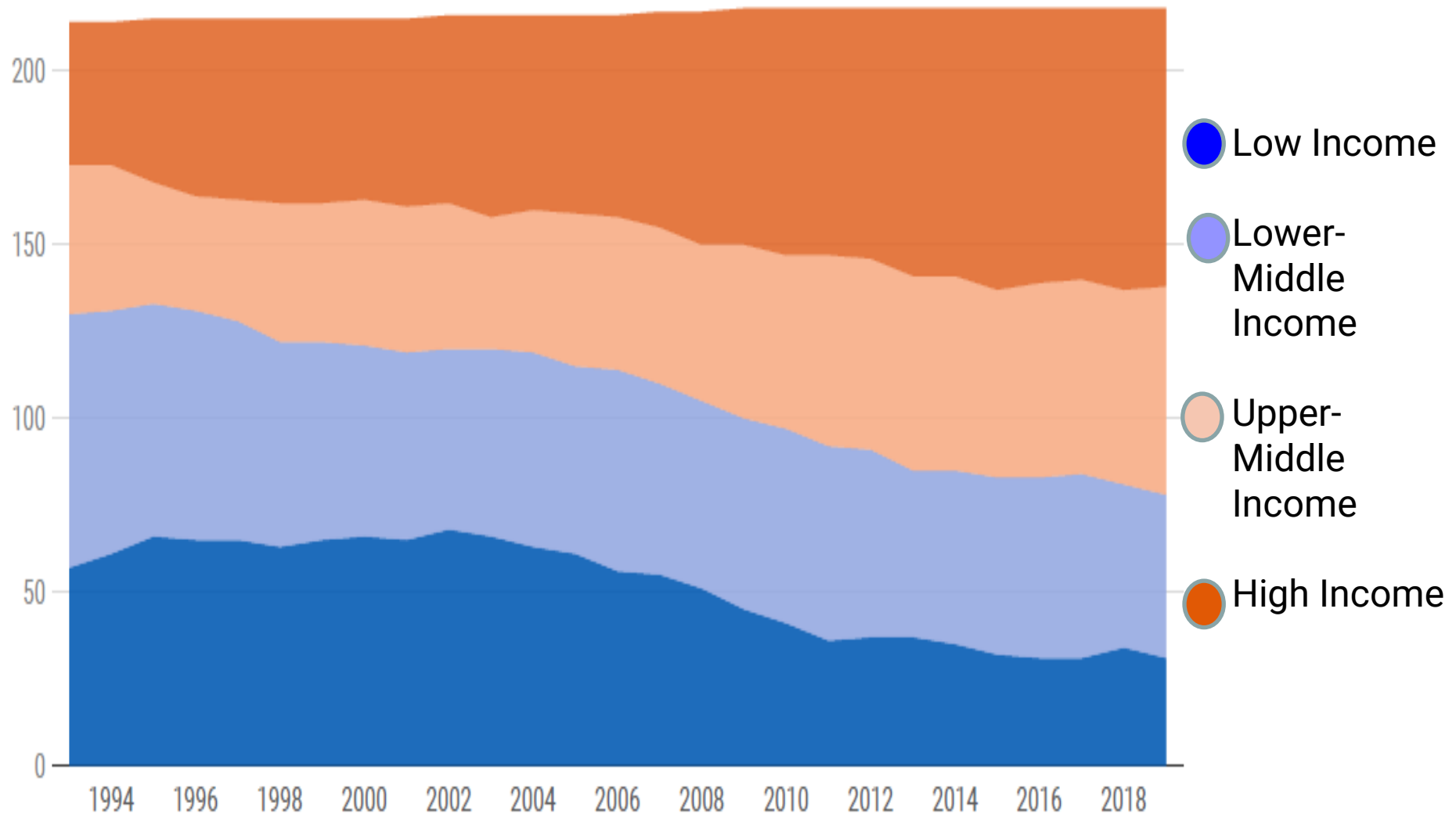
Per capita Incomes and Growth Around the World

Vast differences in living standards around the world.

Great variation in growth rates across countries.

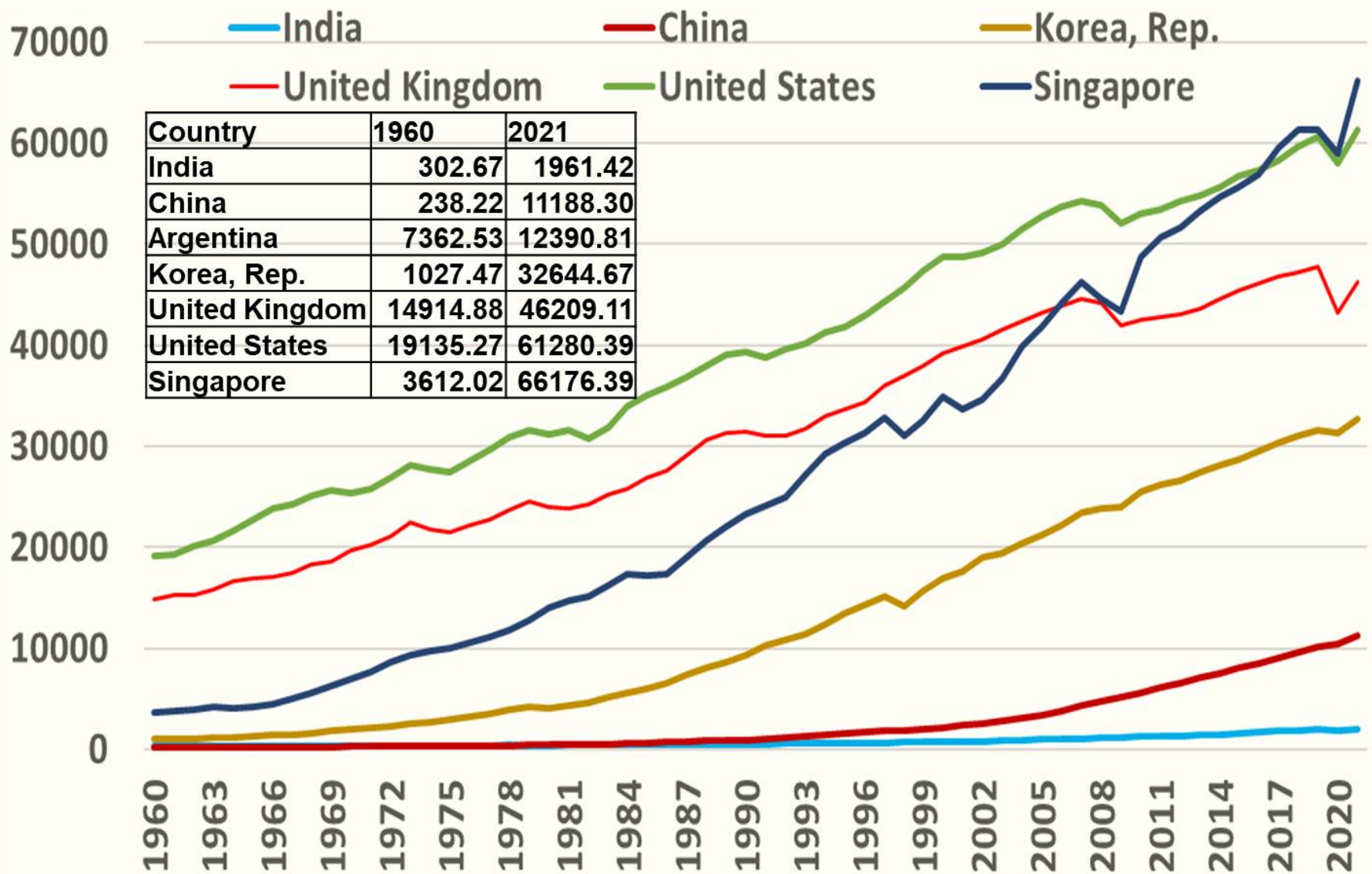
Country	GDP per capita, 1960 (2010 price, \$)	GDP per capita, 2005 (2010 price, \$)	GDP per capita, 2019 (2010 price, \$)	Average Annual growth rate, 1960-2005	Average Annual growth rate, 1960-2019
China (UMI)	192	2,732	8,242	6.37%	6.81%
Singapore (HI)	3,503	40,499	58,830	5.67%	4.98%
Japan (HI)	8,608	43,394	49,188	3.77%	3.06%
Spain (HI)	7,376	31,029	33,393	3.28%	2.63%
India (LMI)	330	1,040	2,152	2.63%	3.27%
Israel (HI)	8,789	27,548	35,279	2.64%	2.44%
United States (HI)	17,563	48,500	55,753	2.30%	2.00%
Canada (HI)	16,406	44,471	51,589	2.27%	1.99%
Colombia (UMI)	2,339	5,404	7,838	1.90%	2.09%
New Zealand (HI)	NA	33,338	38,993	1.49%	1.39%
Philippines (LMI)	1,100	1,894	3,338	1.26%	1.94%
Argentina (UMI)	5,643	8,578	9,742	1.08%	1.07%
Saudi Arabia (HI)	NA	19,382	20,542	1.62%	1.30%
Rwanda (LI)	351	465	845	1.30%	2.15%
Haiti (LI)	1,512	1,127	1,245	0.57%	0.25%

Number of countries by income group, 1993-2019



The number of High-income countries increased, and the number of Low-income economies decreased since 1993.

GDP Per Capita (Constant 2015 US\$)



GDP Per-capita and Its Growth in India

Year	GDP per capita (constant 2010 US\$)	GDP per capita growth (annual %)	Year	GDP per capita (constant 2010 US\$)	GDP per capita growth (annual %)	Year	GDP per capita (constant 2010 US\$)	GDP per capita growth (annual %)
1961	336	1.67	1981	438	3.57	2001	852	3.03
1962	339	0.86	1982	443	1.09	2002	869	2.06
1963	352	3.84	1983	464	4.83	2003	922	6.09
1964	370	5.25	1984	471	1.46	2004	979	6.19
1965	353	-4.64	1985	485	2.90	2005	1,040	6.23
1966	345	-2.12	1986	497	2.48	2006	1,107	6.40
1967	365	5.59	1987	505	1.72	2007	1,174	6.05
1968	369	1.23	1988	542	7.30	2008	1,193	1.59
1969	385	4.27	1989	562	3.73	2009	1,268	6.35
1970	396	2.86	1990	581	3.37	2010	1,358	7.04
1971	394	-0.63	1991	576	-0.98	2011	1,410	3.89
1972	382	-2.82	1992	595	3.39	2012	1,469	4.17
1973	386	0.92	1993	611	2.71	2013	1,545	5.13
1974	382	-1.15	1994	639	4.61	2014	1,640	6.19
1975	407	6.64	1995	675	5.53	2015	1,752	6.80
1976	404	-0.65	1996	712	5.53	2016	1,876	7.08
1977	424	4.83	1997	727	2.12	2017	1,987	5.91
1978	438	3.32	1998	758	4.25	2018	2,086	5.02
1979	405	-7.39	1999	810	6.90	2019	2,152	3.13
1980	423	4.30	2000	827	2.02			

Incomes and Growth Around the World

Since growth rates vary, the country rankings can change over time:

- Poor countries are not necessarily doomed to poverty forever – e.g., **Singapore**, incomes were low in 1960 and are quite high now.
- Rich countries can't take their status granted forever: They may be overtaken by **poorer but faster-growing countries**.

Incomes and Growth Around the World

Questions ???

- Why are some countries richer than others?
- Why do some countries grow quickly while others seem stuck in a poverty trap?
- What policies may help to raise the growth rates and long-run living standards?

Economic Growth Vs. Economic Development

Economic Growth : Increase in per capita real GDP (RGDP) measured by its rate of change per year.

Economic Development looks at a wider range of statistics than just GDP per capita.

Development is concerned with how people are actually affected. It looks at peoples actual living standard and the freedom they have to enjoy a good standard of living.

- ❖ Real income per head – GDP per capita
- ❖ Levels of literacy and education standards
- ❖ Levels of health care
- ❖ Quality and availability of housing
- ❖ Levels of environmental standards
- ❖ Life expectancy.

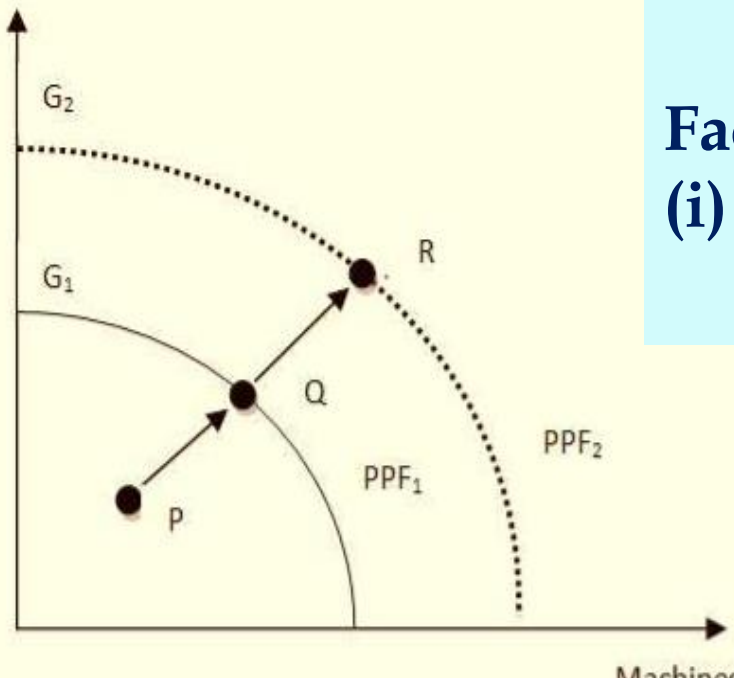
The Nature of Growth (Short run & Long run)

- **Short-run changes in capacity utilization:**
 - The production possibilities curve (PPC) shows our short-run limit of production capacity.
 - The economy often produces a mix of output that lies inside the PPC.
 - The short-run goal is to achieve full employment – that is, to move the economy out to the PPC.
 - We do this by putting to use all of our available resources and our best expertise.

The Nature of Growth

- Long-run change in capacity to produce:
 - To achieve large and lasting increases in output, we must push the PPC outward – that is, to increase our productive capacity.
 - Economic growth: an increase in output (real GDP); an expansion of production possibilities.

The Nature of Growth...



P to Q => Short-run Growth
=> No shifting in PPC

Factors of Growth –
(i) Utilisation of unutilized resources

Q to R => Long-run Growth => PPC shifts outside
Factors of Growth –

- (i) Augmentation of more resources**
- (ii) Technological advancement -(Increase in productivity)**
- (iii) Free trade – Movement of resources and technology from advanced countries to poor countries)**

Measures of Growth

(Rule - 70)

- **GDP Growth rate**: percentage change in real GDP from one year to the next.
 - Economic growth is an exponential process.
 - Small changes compound from year to year.
- A shortcut method of indicating growth rate is to use
 - **Rule of 70** : To find how many years (approx.) it takes to double GDP, divide 70 by the growth rate.
 $\Rightarrow N = 70 / \text{growth rate} = 70 / i$
(At 3.5% growth rate, GDP will double in about 20 years)

Rule – 70 (Ref: Ch-27, p.p. -580)

.....FYI.....



The Magic of Compounding and the Rule of 70



Suppose you observe that one country has an average growth rate of 1 percent per year, while another has an average growth rate of 3 percent per year. At first, this might not seem like a big deal. What difference can 2 percent make?

The answer is: a big difference. Growth rates that seem small when written in percentage terms are large after they are compounded for many years.

Consider an example. Suppose that two college graduates—Finn and Quinn—both take their first jobs at the age of 22 earning \$30,000 a year. Finn lives in an economy where all incomes grow at 1 percent per year, while Quinn lives in one where incomes grow at 3 percent per year. Straightforward calculations show what happens. Forty years later, when both are 62 years old, Finn earns \$45,000 a year, while Quinn earns \$98,000. Because of that difference of 2 percentage points in the growth rate, Quinn's salary is more than twice Finn's.

An old rule of thumb, called the *rule of 70*, is helpful in understanding growth rates and the effects of compounding. According to the rule of 70, if some variable grows at a rate of x percent per year, then

that variable doubles in approximately $70/x$ years. In Finn's economy, incomes grow at 1 percent per year, so it takes about 70 years for incomes to double. In Quinn's economy, incomes grow at 3 percent per year, so it takes about $70/3$, or 23, years for incomes to double.

The rule of 70 applies not only to a growing economy but also to a growing savings account. Here is an example: In 1791, Ben Franklin died and left \$5,000 to be invested for a period of 200 years to benefit medical students and scientific research. If this money had earned 7 percent per year (which would, in fact, have been possible to do), the investment would have doubled in value every 10 years. Over 200 years, it would have doubled 20 times. At the end of 200 years of compounding, the investment would have been worth $2^{20} \times \$5,000$, which is about \$5 billion. (In fact, Franklin's \$5,000 grew to only \$2 million over 200 years because some of the money was spent along the way.)

As these examples show, growth rates and interest rates compounded over many years can lead to some spectacular results. That is probably why Albert Einstein once called compounding "the greatest mathematical discovery of all time."

Measures of Growth...

- **GDP per capita**: total real GDP divided by total population.
 - This is a measure of living standards.
 - It increases only when **GDP growth exceeds population growth**.
 - In countries where population growth exceeds GDP growth, **living standards fall**.

Measures of Growth...

- **GDP per worker**: real GDP divided by the labor force.
 - A measure of productivity.
 - If the labor force grows faster than the population, GDP per capita grows and living standards rise.
- **Productivity is better measured by output per labor-hour.**
 - Increases in GDP per capita over recent decades are due to the rising productivity of the average American worker.

Productivity

- Recall one of the Ten Principles from Chap.01:
A country's standard of living depends on its ability to produce goods & services.
- This ability depends on **productivity**, the average quantity of **goods & services (g&s)** produced per unit of labor input.
- Y = Real GDP = quantity of output produced
 L = Quantity of Labor
So productivity = **Y/L** (GDP per worker)

Productivity - Questions

1. In 2009, Modern Electronics, Inc. produced 60,000 calculators, employing 80 workers, each of whom worked 8 hours per day. In 2010, the same firm produced 76,500 calculators, employing 85 workers, each of whom worked 10 hours per day. What happens to productivity at Modern Electronics. (decreased by 4%)
2. Country A has a population of 1,000, of whom 800 work 8 hours a day to make final goods worth Rs.128,000. Country B has a population of 2,000, of whom 1,800 work 6 hours a day to make final goods worth Rs. 270,000. Compare two countries in terms of productivity and real GDP per person. (Country A has lower productivity and lower real GDP per person than country B)

Why Productivity Is So Important

- When a nation's workers are very productive, real GDP is large and incomes are high.
- When productivity grows rapidly, so do living standards.
- What, then, determines productivity and its growth rate?

The Production Function

- The production function is a graph or equation showing the relation between output and inputs:

$$Y = A f(L, K, H, N)$$

$f(\dots)$ – a function that shows how inputs are combined to produce output

“ A ” – the level of technology

- “ A ” multiplies the function $F(\dots)$, so improvements in technology, i.e., increases in “ A ” allow more output (Y) to be produced from any given combination of inputs.

The Production Function

$$Y = A f(L, K, H, N)$$

- If we multiply each input by $1/L$, then output is multiplied by $1/L$:

$$Y/L = A f(1, K/L, H/L, N/L)$$

- This equation shows that:

Productivity (output per worker) depends on:

- The level of technology (A)
- Physical capital per worker (K/L)
- Human capital per worker (H/L)
- Natural resources per worker (N/L)

Productivity

- Recall one of the Ten Principles from Chap.01:
A country's standard of living depends on its ability to produce goods & services.
- This ability depends on **productivity**, the average quantity of **goods & services (g&s)** produced per unit of labor input.
- Y = Real GDP = quantity of output produced
 L = Quantity of Labor
so productivity = Y/L (GDP per worker)

Determinants of Production (Y)

- ✓ The level of technology (A)
- ✓ Labor size (L)
- ✓ Physical capital (K)
- ✓ Human capital (H)
- ✓ Natural resources (N)

Determinants of Productivity (Y/L)

- ✓ The level of technology (A)
- ✓ Physical capital per labor (K/L)
- ✓ Human capital per labor (H/L)
- ✓ Natural resources per labor (N/L)

Physical Capital Per Worker

- Recall: The **stock of equipment and structures** used to produce goods & services is called **[physical] capital**, denoted by **K**.
- K/L = [Physical] capital per worker.
- Productivity is higher when the average worker has more capital (machines, equipment, etc.).
- *i.e.*, an increase in K/L causes an increase in Y/L .

Human Capital Per Worker

- **Human capital (H):**
the **accumulated skill and knowledge** of human beings which they acquire through education, training, and experience
- It is a source of both increased productivity and technological advance.
- **H/L** = the average worker's human capital
- Productivity is higher when the average worker has more human capital (education, skills, etc.).
- an increase in **H/L** causes an increase in **Y/L**.

Natural Resources Per Worker

- **Natural resources (N)**: the inputs into production that nature provides, *e.g.*, land, mineral deposits
- Other things equal, more **N** allows a country to produce more **Y**.
In per-worker terms, an increase in **N/L** causes an increase in **Y/L**.
- Some countries are rich because they have abundant natural resources (*e.g.*, Saudi Arabia has lots of oil).
- But countries need not have much **N** to be rich (*e.g.*, Japan imports the **N** it needs).

Technological Knowledge

- **Technological knowledge**: society's understanding of the best ways to produce goods & services.
- Technological progress does not only mean a faster computer, a higher-definition TV, or a smaller cell phone.
- It means **any advance in knowledge** that boosts productivity (allows society to get more output from its resources).
 - *E.g.*, Henry Ford and the assembly line.

Tech. Knowledge vs. Human Capital

- Technological knowledge refers to society's understanding of how to produce goods & services.
- Human capital results from the effort people expend to acquire this knowledge.
- Both are important for productivity.
- Human capital growth and technological change are intimately related.
- Technology advances because knowledge advances and knowledge is part of human capital. .

Tech. Knowledge vs. Human Capital

.....technological knowledge can easily be shared among infinitely many producers. Human capital is generally tied to the individuals that expend the effort to acquire it.

For example, if someone **discovers** a more cost-effective way to manufacture cars, this knowledge can be shared with all auto manufacturers, causing a general increase in productivity in the auto sector.

If someone **acquires** some skills or experience that enable him or her to do his or her job better, then his productivity rises, but not that of all persons in his occupation.

ECONOMIC GROWTH AND PUBLIC POLICY

**Next, we look at the ways
public policy can affect
long-run growth in productivity
and living standards.**

01. Saving and Investment

- We can boost productivity by increasing **K**, which requires investment.
- Since resources scarce, producing more capital requires producing fewer consumption goods.
- Reducing consumption **=>** increasing saving.
This extra saving funds the production of investment goods. (*More details in chapter-26*)

“The growth that arises from capital accumulation is not a free lunch”

Implication:-

- 1. Trade off between current and future consumption**
- 2. Trade off between current consumption and saving**

SAVING & INVESTMENT IN NATIONAL INCOME ACCOUNTS

(Ref: Ch:26, p.p. – 561)

Savings

Savings is the portion of current income, not spent on consumption and tax payment.

Investments

Investment is the expenditure made by firm towards purchase of assets with the goal of increasing future income.

Risk, Return, and Liquidity

- **Risk**

- The chance that the value of an investment / saving will decrease.

- **Return**

- The profit or yield from an investment / saving.

- **Liquidity**

- The ability of an investment / saving to be converted into cash quickly without loss of value.

Risk, Return & Liquidity

■ Savings

- Low risk
- Low return
- High liquidity

■ Investments

- High risk
- High return
- Low liquidity

REASONS TO SAVE

- ▶ Provision for unexpected emergencies.
- ▶ Purchase expensive items in the future.
- ▶ Plan for retirement.
- ▶ Buy shares of a mutual fund
- ▶ Buy corporate bonds or equities
- ▶ Purchase a certificate of deposit at the bank

PLACES TO SAVE

- ✓ Savings Accounts
- ✓ Money Market Accounts
- ✓ Guaranteed Investment Certificates
- ✓ Registered Savings Accounts
- ✓ Savings Bonds
- ✓ Insurance

The Meaning of Saving and Investment...

- **Investment** is the purchase of new capital.
- Examples of investment:
 - General Motors spends \$250 million to build a new factory in Flint, Michigan.
 - You buy \$5000 worth of computer equipment for your business.
 - Your parents spend \$300,000 to have a new house built.

Remember: In economics, investment is not the purchase of stocks and bonds!

Different Kinds of Saving

Private saving (S_{Pvt})

= The portion of households' income that is not used for consumption or paying taxes

$$= Y - T - C$$

Disposable Income = $Y - T$ (Take-home pay)

Private Saving

= Disposable Income – Consumption Expenditure

$$= (Y - T) - C = \underline{Y - T - C} = Y - (T + C)$$

Public saving (S_{Pub})

= Tax revenue less government spending

$$= T - G$$

Budget Deficits and Surpluses

Budget surplus

An excess of tax revenue over govt spending

$$\Rightarrow \mathbf{T - G > 0 \Rightarrow T > G}$$

\Rightarrow PUBLIC SAVING IS POSITIVE

Budget deficit

A shortfall of tax revenue from govt spending

$$\Rightarrow \mathbf{T - G < 0 \Rightarrow T < G}$$

\Rightarrow PUBLIC SAVING IS NEGATIVE

National Saving

National saving (S_{Nat})

= private saving + public saving

$$= (\mathbf{Y} - \mathbf{T} - \mathbf{C}) + (\mathbf{T} - \mathbf{G})$$

$$= Y - \cancel{T} - C + \cancel{T} - G$$

$$= \mathbf{Y} - \mathbf{C} - \mathbf{G}$$

= the portion of national income (Y) that is not used for consumption (C) or government purchases (G)

Saving and Investment

Recall the national income accounting identity:

$$Y = C + I + G + NX$$

For the rest of this chapter, focus on the closed economy case:

$$\underline{Y = C + I + G}$$

Solve for **I**:

$$I = Y - C - G = \overbrace{(Y - T - C) + (T - G)}^{\text{national saving}}$$

Saving = investment in a closed economy

Diminishing Returns and the Catch-Up Effect

- The govt. can implement policies that raise saving and investment. (*More details in chapter-26*) Then **K** will rise, causing productivity and living standards to rise.
- But this **faster growth is temporary**, due to **diminishing returns to capital**: As **K (capital)** rises, the extra output from an additional unit of **K** falls....

Diminishing Returns and the Catch-Up Effect

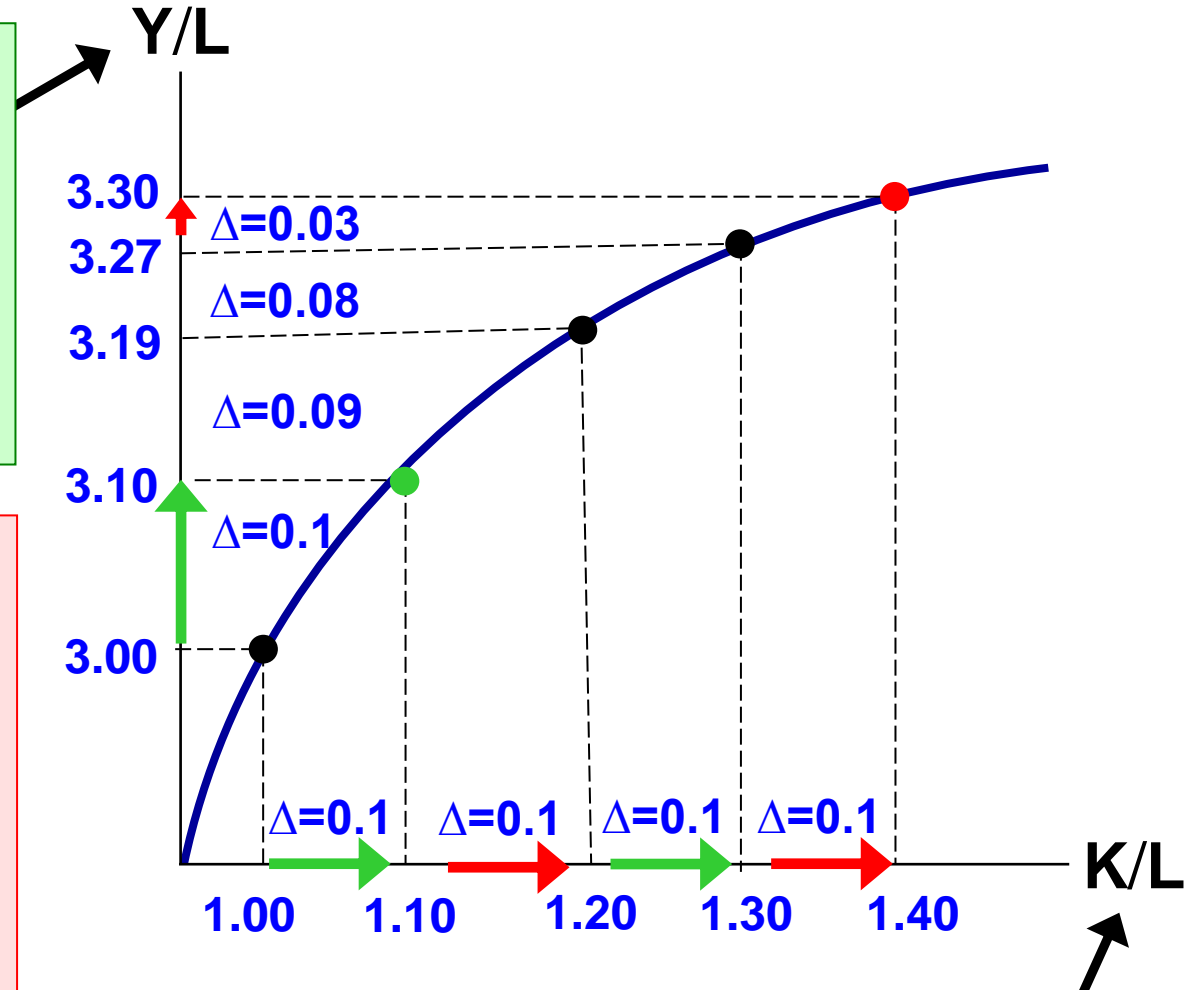
- Economic Growth from an Increase in Capital
 - More Output
 - Diminishing Returns to Added Capital,
 - Higher Labor Productivity

Time Period	Quantity of Labour (L)	Quantity of Capital (K)	Total Output (Y)	Capital per Labour (K/L)	Output per Labour (Y/L)	Change in Capital Labour Ratio $\Delta(K/L)$	Change in Output Labour Ratio $\Delta(Y/L)$
1	100	100	300	1.00	3.00	-	-
2	100	110	310	1.10	3.10	0.10	0.10
3	100	120	319	1.20	3.19	0.10	0.09
4	100	130	327	1.30	3.27	0.10	0.08
5	100	140	330	1.40	3.30	0.10	0.03

The Production Function & Diminishing Returns

If workers have little K ,
giving them more
increases their
productivity a lot.

If workers already
have a lot of K ,
giving them more
increases
productivity
fairly little.



Capital per worker

The Production Function & Diminishing Returns...

This Figure illustrates the relationship between productivity (**output per worker**) and one of its determinants: physical capital per worker (K/L). The curve is drawn for given values of the other determinants of productivity (human capital per worker, natural resources per worker, technology). A change in any of these other determinants would shift the curve.

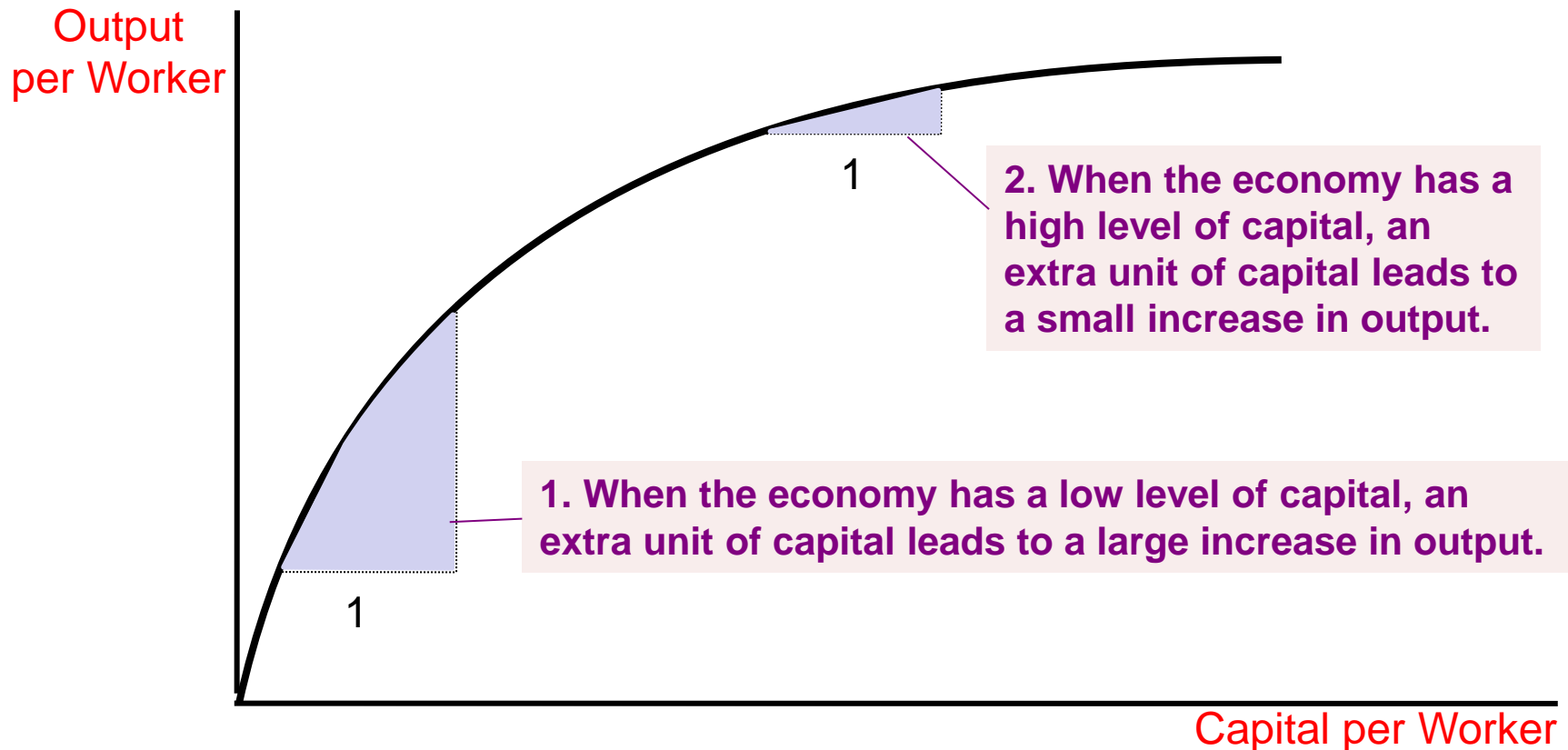
The graph is positively sloped: productivity is higher when the average worker has more capital.

The graph is curved, reflecting **diminishing returns to capital**: **as the average worker gets more and more capital, productivity rises at a decreasing rate.**

If workers don't have very much capital, giving them more will increase their productivity a lot. If workers already have a lot of capital, giving them more won't increase their productivity very much.

The Production Function & Diminishing Returns

Illustrating the production function:

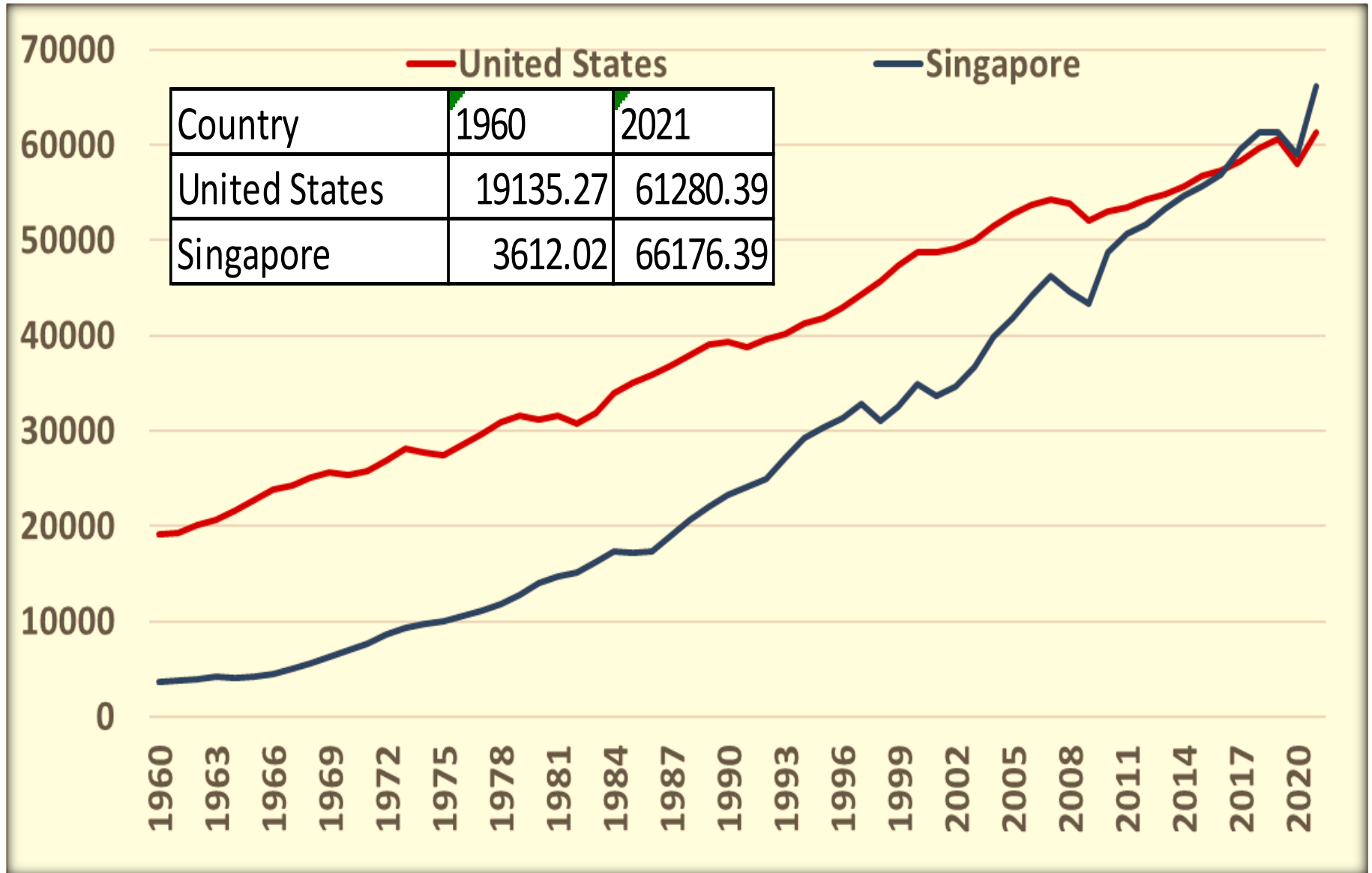


This figure shows how the amount of capital per worker influences the amount of output per worker. Other determinants of output, including human capital, natural resources, and technology, are held constant. The curve becomes flatter as the amount of capital increases because of diminishing returns to capital

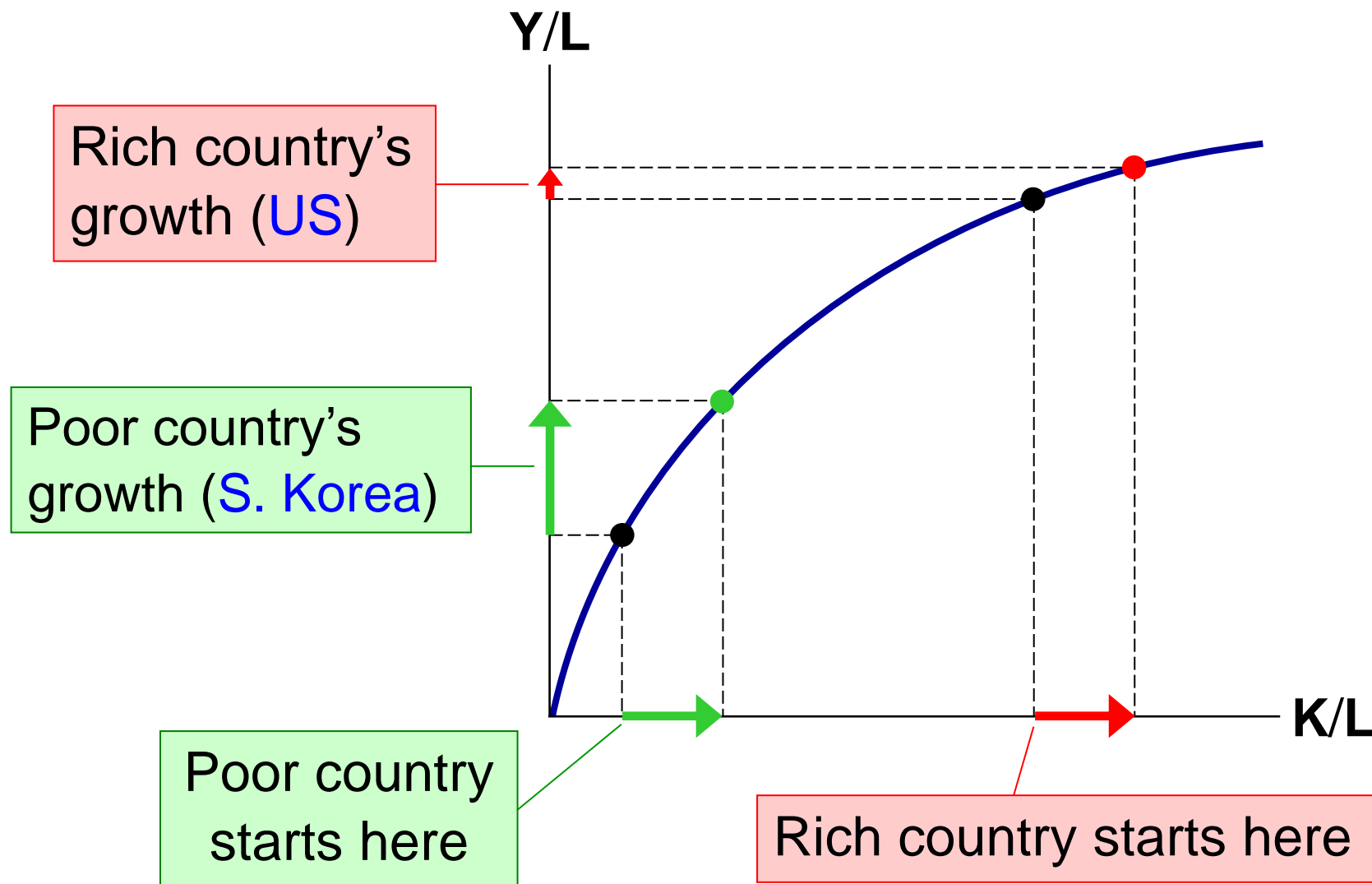
The catch-up effect:

- ❖ The property whereby poor countries tend to grow more rapidly than rich ones.
- ❖ The theory stating that the growth rates of less developed countries will exceed the growth rates of developed countries, allowing the less developed countries to catch up.
- ❖ A theory postulating that countries with relatively low levels of economic development find it easier to achieve higher growth rates than countries with more advanced economies due to diminishing capital returns.

The catch-up effect:



The catch-up effect: the property whereby poor countries tend to grow more rapidly than the rich one.



The catch-up effect

- ❖ Notice that K/L increases by the same amount in both countries.
- ❖ But due to operation of diminishing returns, the increase in K/L has a bigger effect on Q/L in the poor country than in the rich country.
- ❖ As a result, the poor country enjoys a higher growth rate than the rich country.
- ❖ And the gap between them shrinks over time.

This is called the “Catch-up Effect”

Example of the Catch-Up Effect

- Over 1960-1990, the U.S. and S. Korea devoted a similar share of GDP to investment, so you might expect they would have similar growth performance.
- But growth was more than 6% in S. Korea and only 2% in the U.S.
- **Explanation: the catch-up effect.**
In 1960, K/L was far smaller in Korea than in the U.S., hence Korea grew faster.

Explaining Catch-Up Effect

Poorer countries today have **all the modern Western technology available**, and can thus go from pre-industrial technology to late 20th or early 21st century technology almost immediately, enabling a far faster technological advance than was available in 19th century Western countries, something which in turn implies a much faster increase in productivity.

The other key reason is **trade**. When Western countries were at a similar stage of development, they didn't have large export markets in wealthier countries, and thus couldn't specialize in producing goods for those markets where they had a comparative advantage, as those markets didn't exist. By contrast, China for example, can specialize in producing for large export markets labor intensive goods where they due to their low wage levels have a comparative advantage.

02. Investment from Abroad

- To raise K/L and hence productivity, wages, and living standards, the govt can also encourage
 - **Foreign Direct Investment (FDI):**
a capital investment (e.g., factory) that is owned & operated by a foreign entity
 - **Foreign Portfolio Investment (FPI):**
a capital investment financed with foreign money but operated by domestic residents
- Some of the returns from these investments flow back to the foreign countries that supplied the funds.

02- Investment from Abroad...

Most beneficial for poor countries because -

- Poor countries are able to have investment projects which cannot be generated within the country since they have not enough saving to fund investment projects themselves.
- Poor countries are able to enhance their productivity since they learn state-of-the-art technologies developed in other countries.

03. Free Trade

- **Inward-oriented policies**
(e.g., tariffs, limits on investment from abroad) aim to raise living standards by avoiding interaction with other countries.
- **Outward-oriented policies**
(e.g., the elimination of restrictions on trade or foreign investment) promote integration with the world economy.

03 - Free Trade...

- Recall: **Trade can make everyone better off.**
- **Trade has similar effects as discovering new technologies** – it improves productivity and living standards.
- Countries with inward-oriented policies have generally failed to create growth.
 - E.g., **Argentina during the 20th century.**
- Countries with outward-oriented policies have often succeeded.
 - E.g., **S. Korea, Singapore, Taiwan after 1960.**

04. Education

- Govt can increase productivity by promoting education—investment in human capital (**H**).
 - **Public schools, subsidized loans for college**
- Education has significant effects: In the U.S., each year of schooling raises a worker's wage by 10%.
- But investing in **H** also involves a tradeoff between present & future:
Spending a year in school requires sacrificing a year's wages now to have higher wages later.

Brazil has implemented a policy which gives families cash payments if their children attend school faithfully.

Brain drain (Problem of poorer countries): The emigration of highly educated workers to rich countries, where they can enjoy a higher standard of living.

05. Health and Nutrition

- **Health care expenditure** is a type of investment in human capital – healthier workers are more productive.
- In countries with significant malnourishment, raising workers' caloric intake raises productivity:
 - Over 1962-95, caloric consumption rose 44% in S. Korea, and economic growth was spectacular.
 - Nobel winner Robert Fogel:
30% of Great Britain's growth from 1790-1980 was due to improved nutrition.

06. Property Rights and Political Stability

- Recall:

“Markets are usually a good way to organize economic activity”.

The price system allocates resources to their most efficient uses.

- This requires respect for **property rights**, the ability of people to exercise authority over the resources they own.

Property Rights and Political Stability...

- In many poor countries, the justice system doesn't work very well:
 - Contracts aren't always enforced
 - Fraud, corruption often go unpunished
 - In some, firms must bribe govt officials for permits
- Political instability (e.g., frequent coups) creates uncertainty over whether property rights will be protected in the future.

Property Rights and Political Stability...

- When people fear their capital may be stolen by criminals or confiscated by a corrupt govt, there is less investment, including from abroad, and the economy functions less efficiently. Result: lower living standards.
- Economic stability, efficiency, and healthy growth require law enforcement, effective courts, a stable constitution, and honest govt officials.

07. Research and Development

- Technological progress is the main reason why living standards rise over the long run.
- One reason is that knowledge is a **public good**: Ideas can be shared freely, increasing the productivity of many.
- Policies to be undertaken by Government to promote technological progress.

07. Research and Development (R & D)

- Policies to promote tech. progress:
 - Farming methods
 - Aerospace research
 - Air Force; NASA
 - Patent laws
 - Tax incentives or direct support for private sector R&D
 - Research grants at universities / autonomous institutes
 - National Science Foundation
 - National Institutes of Health
 - NISER / IIT / NIT in India



Sriharikota: India's first private rocket Vikram-S developed by Skyroot Aerospace ahead of its lift-off, at the Satish Dhawan Space Centre in Sriharikota. (PTI Photo)(PTI11_17_2022_000201B) (PTI)
Dt: 18/NOV/2022

Source: <https://www.livemint.com/science/news/isro-to-launch-india-s-first-privately-built-rocket-today-all-you-need-to-know-11668731696402.html>

08. Population Growth

...may affect living standards in 3 different ways:

1. Stretching natural resources

- 200 years ago, Malthus argued that population growth would **strain society's ability to provide for itself**.
- Since then, the world population has increased six fold. If Malthus was right, living standards would have fallen. Instead, they've risen.
- Malthus failed to account for technological progress and productivity growth.

Population Growth...

2. Diluting the capital stock

- Bigger population \Rightarrow higher $L \Rightarrow$ lower K/L
 \Rightarrow lower productivity & living standards.
- This applies to H as well as K :
fast population growth
 \Rightarrow more children
 \Rightarrow greater strain on educational system.
- Countries with fast population growth tend to have lower educational attainment.

Population Growth...

Diluting the capital stock.....

To combat this, many developing countries use policy to control population growth.

- Contraception education & availability
- Promote female literacy to raise opportunity cost of having babies

Population Growth...

3. Promoting tech. progress

- More people
 - => more scientists, inventors, engineers
 - => more frequent discoveries
 - => faster tech. progress & economic growth
- Evidence from Michael Kremer:
Over the course of human history,
 - growth rates increased as the world's population increased
 - more populated regions grew faster than less populated ones

Are Natural Resources a Limit to Growth?

- Some argue that population growth is depleting the Earth's non-renewable resources, and thus will limit growth in living standards.
- But **technological progress** often yields ways to avoid these limits:
 - Hybrid cars use less gas.
 - Better insulation in homes reduces the energy required to heat or cool them.
- As a resource becomes scarcer, its market price rises, which increases the incentive to conserve it and develop alternatives.

ACTIVE LEARNING 1

Discussion Question

Which of the following policies do you think would be most effective at boosting growth and living standards in a poor country over the long run?

- a. Offer tax incentives for investment by local firms
- b. Offer tax incentives for investment by foreign firms
- c. Give cash payments for good school attendance
- d. Crack down on govt corruption
- e. Restrict imports to protect domestic industries
- f. Allow free trade

ACTIVE LEARNING 2

Review productivity concepts

- List the determinants of productivity.
- List the policies that attempt to raise living standards by increasing one of the determinants of productivity.

ACTIVE LEARNING 2

Answers

Determinants of productivity:

K/L, physical capital per worker

H/L, human capital per worker

N/L, natural resources per worker

A, technological knowledge

Policies to boost productivity:

- Encourage saving and investment, to raise **K/L**
- Encourage investment from abroad, to raise **K/L**
- Provide public education, to raise **H/L**
- Provide better health facilities, to raise **H/L**
- Patent laws or grants, to increase **A**
- Control population growth, to increase **K/L**

ACTIVE LEARNING 2

Answers

Determinants of productivity:

K/L, physical capital per worker

H/L, human capital per worker

N/L, natural resources per worker

A, technological knowledge

Policies to boost productivity:

- Patent laws or grants, to increase **A**
- Control population growth, to increase **K/L**

Productivity-Policies - Questions

A country with a relatively low level of real GDP per person is considering adopting two policies to promote economic growth. The first is to increase barriers to trade. The second is to restrict foreign portfolio investment. Which of these policies would most economists think would promote growth? (Neither)

Productivity-Policies - Questions

In the past there have been violent protests against the World Bank and the World Trade Organization (WTO). The protesters argued that these institutions promote free trade and also encourage corporations in rich countries to invest in poor countries. The protesters contended that these practices make rich countries richer and poor countries poorer. Do you agree on the contentions of the protesters? Give your answer with reason. (disagree with the protesters because these practices will help make both rich and poor countries richer)

Productivity-Policies - Questions

The president of a poor country has announced that he will implement the following measures which he claims are designed to increase growth:


1. Reduce corruption in the legal system;
2. Reduce reliance on market forces because they allocate goods and services in an unfair manner;
3. Restrict investment in domestic industries by foreigners because they take some of the profits out of the country;
4. Encourage trade with neighboring countries; and
5. Increase the fraction of GDP devoted to consumption.

Analyse these measures in terms of their effect on growth?

CONCLUSION

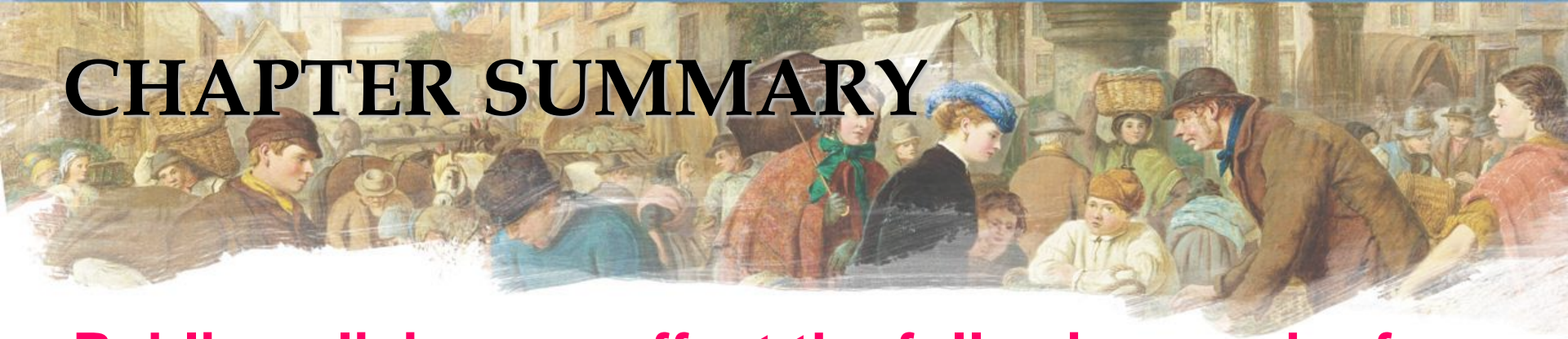
- In the long run, living standards are determined by productivity.
- Policies that affect the determinants of productivity will therefore affect the next generation's living standards.
- One of these determinants is saving and investment.
- In the next chapter, we will learn how saving and investment are determined, and how policies can affect them.

CHAPTER SUMMARY

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- There are great differences across countries in living standards and growth rates.
 - Productivity (output per unit of labor) is the main determinant of living standards in the long run.
 - Productivity depends on physical and human capital per worker, natural resources per worker, and technological knowledge.
 - Growth in these factors – especially technological progress – causes growth in living standards over the long run.

Because of diminishing returns to capital, growth from investment eventually slows down, and poor countries may “catch up” to rich ones.

CHAPTER SUMMARY



Public policies can affect the following, each of which has important effects on growth:

- Saving and investment
- Foreign Investment
- International trade
- Education
- Health & nutrition
- Property rights and political stability
- Research and development
- Population growth

Practice Question (From Text Book – Ch: 25)

Production and Growth

Question for Review		Problems & Application	
1		1	a
2		6	a, b
3		7	a, b
6		8	
7		9	
8		10	a