Econ 1A. Chapter 9. **Economic Growth**

1. **Economic growth** is a sustained expansion of production possibilities measured as the increase in **RGDP (Y)** over a given time period.

2. Rapid economic growth maintained over a number of years can transform **a poor country** into **a rich one**. Slow economic growth or absence of growth can condemn a country to **devastating poverty**.

3. Economic growth is different from the rise in income that occurs during recovery from a recession. Economic growth is a substained trend, not a temporary cyclical expansion.

4. **Economic growth rate** is the rate of change of RGDP expressed as a % per year. It tells us how rapidly the economy is expanding. **But it does not tell us about the change in the standard of living**.

   Let Y = RGDP.
   G_Y = Growth rate of RGDP=[(Y in current year–Y in previous year)/Y in previous year]x100

5. **The standard of living depends on RGDP per person**. So the contribution of RGDP growth to the change in standard of living depends on the growth rate of RGDP per person.

   $G_{Y/Pop}$ = *Growth rate of RGDP per person*
   = *Growth rate of RGDP – Growth rate of population.*
   = $G_Y - G_{Pop}$.

   G_{Pop} = Growth rate of population
   = [(Pop. in current year – Pop. in previous year)/Pop. in previous year] x 100.

   $G_{Y/Pop}$ = Growth rate of RGDP per person
   = [(RGDP per person in current year–RGDP per person in previous year)/
   RGDP per person in previous year] x 100

**********.

Example:

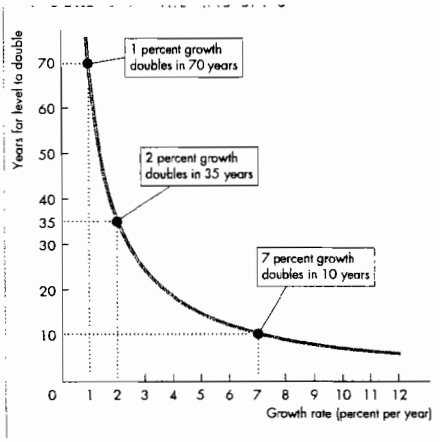
	Y(RGDP)	Population	RGDP per person (Y/Pop)
2000	$8.0 trillion	200 million	$40,000
2001	$8.4 trillion	202 million	$41,584

(1) G_Y = [(8.4-8.0)/8.0]x100 = 5%
(2) G_{Pop} = [(202-200)/200]x100 = 1%
(3) $G_{Y/Pop}$ = [(41,580-40,000)/40,000]x100 = 4%.
(4) $G_{Y/Pop} = G_Y - G_{Pop}$ = 5% - 1% = 4%.

**********.

6. If the growth rate of RGDP per person ($G_{Y/Pop}$) > (<) 0, the standard of living rises (falls).

7. **Rule of 70**: The number of years it takes for the level of any variable to double is approximately 70 divided by the annual % growth rate of the variable.



Growth rate (percent per year)	Years for level to double
1	70.0
2	35.0
3	23.3
4	17.5
5	14.0
6	11.7
7	10.0
8	8.8
9	7.8
10	7.0
11	6.4
12	5.8

The number of years it takes for the level of a variable to double is approximately 70 divided by the annual percentage growth rate of the variable.

********.

Example 1.

$G_{Y/Pop}$	**years for Y/Pop (RGDP per person) to double**
1%	70/1 = 70
5%	70/5 = 14
7%	70/7 = 10

Example 2.

Suppose in 2010, US's Y/Pop = 40 and China's Y/Pop = 10. How long would it take China's Y/Pop to reach of US's Y/Pop = 40 in 2010?

Assume that China's $G_{Y/Pop}$ = 7%.

In the end of 10^{th} years, i.e., 2020: Y/Pop = 20. In the end of 20^{th} years, i.e., 2030: Y/Pop = 40.. **It will take 20 years for China's Y/Pop to reach 40**.

********.

Labor productivity growth

8. RGDP grows when labor (L) and labor productivity grow (Y/L).
9. RGDP per person grows when labor productivity grows.

10. Quantity of labor (L) = labor force x (average hour per labor);
11. **Labor productivity** is RGDP per hour of labor.
    Labor productivity = RGDP/Aggregate hours = Y/L.

********.

Example:

Y(RGDP) = $8,000 billion and L = aggregate hours = 200 billion.

Labor productivity = Y/L = $8,000billion/200 billion = $40 per hour.

********.

12. **Y(RGDP) = aggregate hours x labor productivity = L x (Y/L).**
This shows that labor productivity↑→Y↑→Y/Pop↑→ standard of living improves.

13. **Sources of labor productivity growth**

(1) **Physical capital**: It consists of human made resources such as buildings and machines.
(2) **Human capital**: It is the improvement in labor productivity created by the education and knowledge embodied in the workhorse.
(3) **Technology**: It is technical means for the production of goods and services.

14. Economic Model: Productivity Curve
Assumptions:
(1) Other things equal
Human capital per worker (H/L) and technology (T) are held fixed.
(2) **Diminishing marginal returns to physical capital** (K/L) apply.
(3) A given period of time (ex. a year, a quarter).

Model:

Verbal statement: The productivity curve shows the relationship between RGDP per labor (Y/L) and the quantities of physical capital per labor (K/L) when human capital per worker (H/L) and the state of technology (T) are held constant.

Math equation:

$Y/L = f(K/L, H/L, T)$

where Y = RGDP, L = number of labor, Y/L = RGDP per labor, K/L = physical capital per labor, H/L = human capital per labor, T = technology.

Table:

Y/L	Δ(Y/L)	K/L	Δ(K/L)	Δ(Y/L)/Δ(K/L)
0	-	0	-	-
7	7	10	10	7/10 = 0.7
13	6	20	10	6/10 = 0.6
18	5	30	10	5/10 = 0.5
22	4	40	10	4/10 = 0.4 .

Diminishing marginal returns to physical capital:
A productivity curve exhibits diminishing marginal returns to physical capital when, holding the amount of human capital (H/L) and the state of technology (T) fixed, each successive increase in the amount of physical capital leads to a smaller increase in production.

Figure 1. (K/L)↑ → (Y/L)↑ with (H/L) → and T→

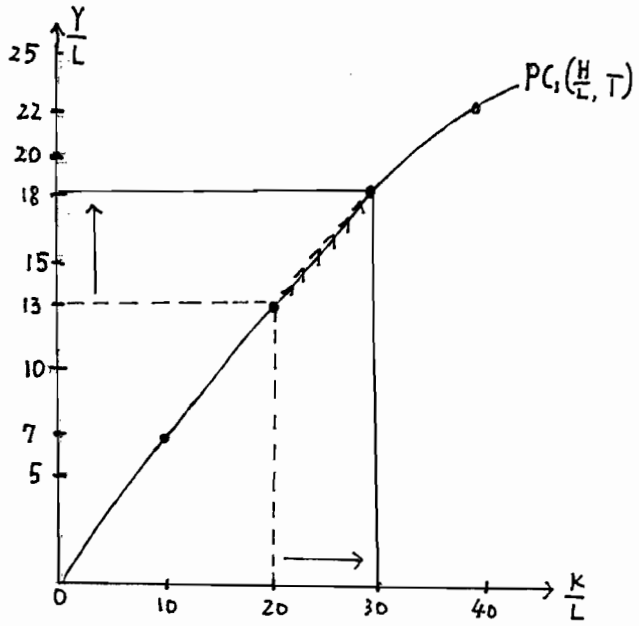
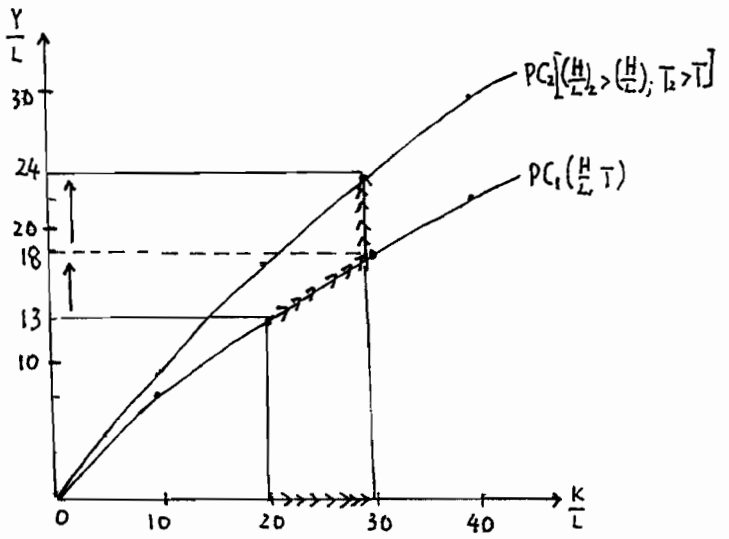


Figure 2. (H/L)↑ and T↑ → (Y/L)↑.

$(Y/L)^1$	$(Y/L)^2$	K/L
0	0	0
7	9	10
13	17	20
18	22	30
22	30	40.

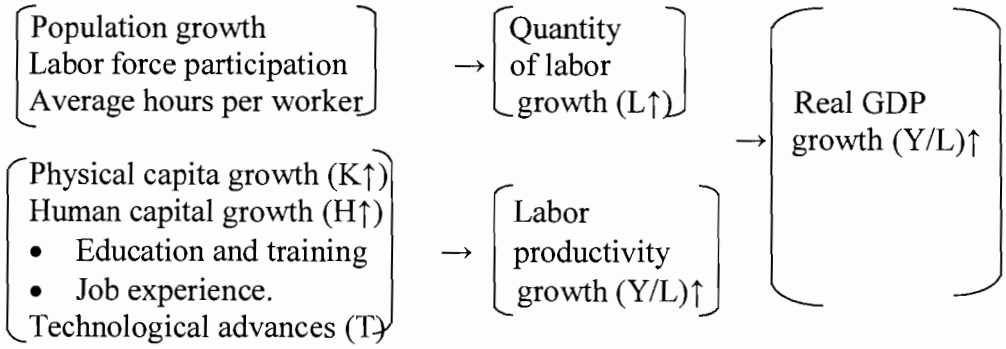


From Figure 1 and Figure 2, we can see that Y/L (labor productivity) grows when K/L and H/L grow or when persistent advances in technology. In other words,

Y/L = f(K/L,H/L, T). (K/ L)↑, (H/L)↑, or T↑ → (Y/L)↑.

(a) (K/L)↑ comes from saving (S) and investment (I).
(b) (H/L)↑ comes from (1) education and training, (2) job experience, and (3) health and diet.
(c) T (technology) ↑ comes from the discovery and application of new technologies. This is the most important contribution to the growth of labor productivity.

15. **Sources of Economic Growth**



Theories of Economic Growth

16. **Classical growth theory predicts that** economic growth will end because a population explosion will lower RGDP per person to its subsistence level. This theory is sometimes called the **Mathusian theory**. It is also called **the Doomsday theory**.

17. **New growth theory** predicts that capital accumulation (K↑), human capital growth (H↑) and technological change (T↑) respond to incentives can bring persistent growth in labor productivity.

Achieving Faster Growth

18. **Preconditions for Economic Growth**
Growth theory shows us to achieve **faster** economic growth and **raise** standard of living, we must have **an incentive system** created by

(1) **Economic freedom**: a condition in which people are able to make personal choices, their private property is protected by the rule of law, and they are free to buy and sell in markets;
(2) **Property right**: the social arrangements that govern the protection of private property;
(3) **Markets**: buyers and sellers get information and do business with each other in markets.

19. **Policies to achieve faster growth**
To achieve faster economic growth, we must have policies which will increase *the growth rate of physical capital* (K), *the growth rate of human capital* (H) and *the pace of technological advance* (T). The main suggestions for achieving these objectives are:

(a) **Stimulating saving**: S↑→I↑→K↑→ (K/L)↑→ (Y/L)↑.
(b) **Stimulating R&D (research and development)**: (H/L)↑ and T↑→ (Y/L)↑.
(c) **Encourage international trade**: Trade + specialization + CA → efficiency.
(d) **Improve the quality of education**: (H/L)↑ and T↑→ (Y/L)↑.