6.22: The Power of Sustained Economic Growth

Learning Objectives

- Explain the Power of Compound Growth, including the rule of 72

The Power of Sustained Economic Growth

Nothing is more important for increasing people's standard of living than sustained economic growth. Even small changes in the rate of growth, when sustained and compounded over long periods of time, make an enormous difference in the standard of living. Consider Table 1, in which the rows of the table show several different rates of growth in GDP per capita and the columns show different periods of time. Assume for simplicity that an economy starts with a GDP per capita of 100. The table then applies the following formula to calculate what GDP will be at the given growth rate in the future:

$$\text{GDP at starting date} \times (1 + \text{growth rate of GDP})^{\text{years}} = \text{GDP at end date}$$

For example, an economy that starts with a GDP of 100 and grows at 3% per year will reach a GDP of 209 after 25 years; that is, $100\,(1.03)^{25} = 209$.

Table 1. Growth of GDP over Different Time Horizons

Growth Rate	Value of an original 100 in 10 Years	Value of an original 100 in 25 Years	Value of an original 100 in 50 Years
1%	110	128	164
3%	134	209	438
5%	163	338	1,147
8%	216	685	4,690

The slowest rate of GDP per capita growth in the table, just 1% per year, is similar to what the United States experienced during its weakest years of productivity growth. The second highest rate, 3% per year, is close to what the U.S. economy experienced during the strong economy of the late 1990s and into the 2000s. Higher rates of per capita growth, such as 5% or 8% per year, represent the experience of rapid growth in economies like Japan, Korea, and China.

Table 1 shows that even a few percentage points of difference in economic growth rates will have a profound effect if sustained and compounded over time. For example, an economy growing at a 1% annual rate over 50 years will see its GDP per capita rise by a total of 64%, from 100 to 164 in this example. However, a country growing at a 5% annual rate will see (almost) the same amount of growth—from 100 to 163—over just 10 years. Rapid rates of economic growth can bring profound transformation. If the rate of growth is 8%, young adults starting at age 20 will see the average standard of living in their country more than double by the time they reach age 30, and grow nearly sevenfold by the time they reach age 45.

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The world's great economic success stories in the last few decades began in the 1970s with that group of nations sometimes known as the East Asian Tigers: South Korea, Thailand, Malaysia, Indonesia, and Singapore. The list sometimes includes Hong Kong and Taiwan, although these are often treated under international law as part of China, rather than as separate countries. The economic growth of the Tigers has been phenomenal, typically averaging 5.5% real per capita growth for several decades. In the 1980s, other countries began to show signs of convergence. China began growing rapidly, often at annual rates of 8% to 10% per year. India began growing rapidly, first at rates of about 5% per year in the 1990s, but then higher still in the first decade of the 2000s.

It is worth pausing a moment to marvel at the growth rates of the East Asian Tigers. If per capita GDP grows at, say, 6% per year, then you can apply the formula for compound growth rates—that is $(1 + 0.06)^{30}$—meaning a nation's level of per capita GDP will rise by a multiple of almost six over 30 years. Another strategy is to apply the rule of 72.

The **rule of 72** is an approximation to figure out doubling time. The rule number, 72, is divided by the annual growth rate to obtain the approximate number of years it will take for income to double. So if we have a 6% growth rate, it will take 72/6, or 12 years, for incomes to double. Using this rule here suggests that a Tiger that grows at 6% will double its GDP every 12 years. In contrast, a technological leader, chugging along with per capita growth rates of about 2% per year, would double its income in 36 years.

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HOW ARE COMPOUND GROWTH RATES AND COMPOUND INTEREST RATES RELATED?

The formula for growth rates of GDP over different periods of time, as shown above, is exactly the same as the formula for how a given amount of financial savings grows at a certain interest rate over time. Both formulas have the same ingredients: an original starting amount, in one case GDP and in the other case an amount of financial saving; a percentage increase over time, in one case the growth rate of GDP and in the other case an interest rate; and an amount of time over which this effect happens.

Recall that compound interest is interest that is earned on past interest. It causes the total amount of financial savings to grow dramatically over time. Similarly, compound rates of economic growth, or the *compound growth rate*, means that the rate of growth is being multiplied by a base that includes past GDP growth, with dramatic effects over time.

For example, in 2016, the World Fact Book, produced by the Central Intelligence Agency, reported that South Korea had a GDP of $1.93 trillion with a growth rate of 2.8%. We can estimate that at that growth rate, South Korea's GDP will be $2.22 trillion in five years. If we apply the growth rate to each year's ending GDP for the next five years, we will calculate that at the end of year one, GDP is $1.98 trillion. In year two, we start with the end-of-year one value of $1.98 and increase it by 2.8%. Year three starts with the end-of-year two GDP, and we increase it by 2.8% and so on, as depicted in the Table 2.

Table 2. Estimated End-of-year GDP, from 2016

Year	Starting GDP	Growth Rate 2%	Year-End Amount
1	$1.93 Trillion ×	(1+0.02)	$1.98 Trillion
2	$1.98 Trillion ×	(1+0.02)	$2.04 Trillion
3	$2.04 Trillion ×	(1+0.02)	$2.10 Trillion
4	$2.10 Trillion ×	(1+0.02)	$2.16 Trillion
5	$2.16 Trillion ×	(1+0.02)	$2.22 Trillion

Another way to calculate the growth rate is to apply the following formula:

$$\text{Future Value} = \text{Present Value} \times (1 + g)^n$$

Where "future value" is the value of GDP five years hence, "present value" is the starting GDP amount of $1.93 trillion, "g" is the growth rate of 2.8%, and "n" is the number of periods for which we are calculating growth. Let's look as this as applied to South Korea. At a growth rate of 2.8%, in 5 years, the GDP should from $1.93 trillion to $2.22 trillion.

$$\text{Future Value} = 1.93 \times (1 + 0.028)^5 = \$2.22 \text{ trillion}$$

Learning Objectives

[glossary-page][glossary-term]compound growth rate: [/glossary-term] [glossary-definition]the rate of growth when multiplied by a base that includes past GDP growth[/glossary-definition] [glossary-term]rule of 72:[/glossary-term][glossary-definition] an approximation to figure out doubling time. 72 is divided by the annual growth rate to obtain the approximate number of years it will take for income to double [/glossary-definition] [/glossary-page]

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