GLOBAL EDITION

3E MACROECONOMICS

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Third Edition
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MACROECONOMICS

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forced people with large cash holdings (under their mattresses) to move those cash holdings into the formal banking system, where they are measured and taxed.

Some countries (such as Ireland, Italy, and the United Kingdom) have recently started to include underground economic activity, including illicit drug purchases and prostitution, in their official GDP calculations.

Externalities

Negative externalities occur when an economic activity has a spillover cost that does not affect those directly engaged in the activity. Positive externalities occur when an economic activity has a spillover benefit that does not affect those directly engaged in the activity. Externalities—both negative and positive—are usually omitted from the GDP calculations. Consider a coal-powered electrical plant generating power for thousands of homes and simultaneously belching out a continuous stream of toxic airborne pollutants. GDP counts the electricity produced but fails to subtract the social cost of the pollution.

Sometimes negative externalities even get counted as *positive* contributors to economic output. For example, property crimes, like theft, lead people to purchase locks and other security devices. In some cases, property owners hire guards to safeguard their possessions. All such preventive activity counts as positive contributions to GDP.

The societal cost of pollution is not subtracted from GDP.

Gross Domestic Product versus Gross National Product

As we've already explained, GDP is the market value of everything produced within the borders of a country during a particular period of time. So GDP includes both the production of a country's residents and the production of visitors. For example, if a U.S. worker spends 2 months working in Singapore, her production will be counted in the GDP of Singapore and omitted from U.S. GDP. Likewise, if a Japanese auto company—like Honda —opens a plant in Alabama, the value added of this plant will be counted in U.S. GDP and not in Japanese GDP. This would be the case even if the plant were operated entirely by robots and didn't have one U.S. employee. The plant is operating within the borders of the United States, so its value added is counted in U.S. GDP.

At first glance, you might wonder whether cross-border activities amount to much. In fact, there are large amounts of such activity. For example, about 70 percent of the "Japanese" cars that are sold in the United States are now manufactured at plants in Canada, Mexico, and the United States.

Gross national product (GNP) is the market value of production generated by the factors of production—both capital and labor—possessed or owned by the residents of a particular nation.

With facts like this in mind, economists have constructed a measure of aggregate economic activity that includes only the output of factors of production owned by residents of a particular country: **gross national product (GNP)**. U.S. GNP includes the production of a worker who normally resides in the United States, even if the production occurred when the worker was temporarily working abroad. For example, if a U.S. professor gives a summer course at the National University of Singapore, her salary, which was paid by the National University of Singapore, would be included in U.S. GNP and excluded from Singapore's GNP.

Likewise, U.S. GNP would exclude the value added of machines owned by a Japanese car manufacturer, even if those machines operate in Alabama. In contrast, U.S. GNP would include the value added of U.S. workers who are employed in a Japanese auto plant in Alabama. U.S. GNP is carefully constructed to count only the value added of factors of production possessed or owned by U.S. residents, no matter where those factors of production operate in the world.

GNP is therefore a measure of national production, where the word *national* signifies the factors of production—like capital and labor—possessed or owned by the residents of a particular nation. To calculate GNP, begin with GDP and first add in the production of U.S.-owned factors of production that operate within the borders of foreign countries. Then subtract the production of foreign-owned factors of production that operate within the borders of the United States.

$$\text{Gross national product} = (\text{Gross domestic product}) + (\text{Production of U.S.-owned capital and labor in foreign countries}) - (\text{Production of foreign-owned capital and labor in the United States})$$

Plugging in the actual numbers for 2019, we find that U.S. GNP ($21.7 trillion) is higher than U.S. GDP ($21.4 trillion). Specifically, the market value of production of U.S. capital and labor in foreign countries ($1.2 trillion) exceeds the market value of production of foreign capital and labor within U.S. borders ($0.9 trillion). In 2019, U.S. GNP was about 1 percent larger than U.S. GDP.[4]

For a few countries, GNP and GDP diverge much more substantially. For example, Kuwait—a wealthy oil exporter in the Persian Gulf—owns a very large portfolio of foreign assets, and residents of foreign countries own comparatively few assets inside Kuwait. The income from Kuwait's foreign assets is counted in Kuwait's GNP but excluded from Kuwait's GDP. Accordingly, Kuwait's GNP is substantially larger—generally about 10 percent larger—than its GDP. However, Kuwait's situation is uncommon. For most countries, GNP and GDP are nearly the same.

The Increase in Income Inequality

One of the biggest problems with GDP and GDP per capita is the lack of detailed information about how economic output is divided up among individual households. For example, the United States and Norway have very similar levels of per capita GDP. However, the United States has more income inequality. For instance, consider the economic fortunes of households who earn enough income to be in the top 1 percent of earners in each country. In the United States, the top 1 percent of U.S. households earn 18.6 percent of the nation's income, while the remaining 99 percent earn 81.4 percent of national income. In contrast, in Norway the top 1 percent of households earn 8.4 percent of total Norwegian income, leaving 91.6 percent of national income to the remaining 99 percent of the population. These differences in inequality imply that the richest 1 percent of U.S. households are richer than richest 1 percent of Norwegian households and the "bottom" 99 percent of U.S. households are not as well off as the bottom 99 percent of Norwegian households. These differences exist even though the two countries have very similar levels of GDP per capita.

Inequality varies not only across countries but also over time. In most countries, income inequality has approximately followed a U-shaped pattern over the past century: falling until the 1970s and rising thereafter. For example, as we will see in greater detail in Chapter 7, in the United States, the income share of the top 1 percent of households fell from 18.0 percent of the nation's income in 1913 (when records begin) to a low of 8.3 percent in 1975 and rose back to 18.6 percent as of 2017.

The rise in inequality since the 1970s is partially reflected in the income trajectories of different educational groups. U.S. workers with only a high school degree have had flat or declining buying power of their earnings since the early 1970s. Meanwhile, the most skilled workers in the United States, especially those with a post-graduate degree, have experienced substantial gains in income.[5]

Moderate levels of inequality play a useful economic role by incentivizing people to work hard. If everyone were given (or guaranteed) exactly the same income, the incentive to work would collapse. So some reward for hard work, and the inequality that goes with it, is necessary as an incentive. However, high levels of inequality are considered by many to be socially unjust. High levels of inequality might make it impossible for all families to access high-quality education, housing, nutrition, or healthcare. More ominously, high levels of inequality might create social unrest and support for populist politicians offering unsustainable and unworkable remedies to the economic problems facing society.

Leisure

Leisure is another sore spot in the GDP system. The GDP accounts give an economy no credit for producing leisure. However, most people would agree that leisure is a key ingredient in human well-being. For example, in time-use surveys, people report that they are happiest when they are socializing.[6] Likewise, people report that they are the least happy when they are at work or commuting to and from work. When you think about GDP comparisons across countries, you need to remember that different countries are working at different levels of intensity. Of course, the goal in life is not to maximize your income by working every moment that you can. If that were our goal, nobody would ever retire or take a vacation. A more reasonable goal is to maximize human well-being—this is another example of optimization. GDP tells us how many material goods are being produced by an economy, but it does not tell us whether all of those material achievements are being used to optimize human happiness.

Does GDP Buy Happiness?

Despite the omission of leisure, GDP per capita is often used as a summary measure of the well-being of a society. We would like to know whether GDP per capita is actually a good predictor of human happiness. Social scientists do not have a foolproof way of measuring happiness, but we do have a crude way of gauging whether a person is satisfied with life: ask them. It's not an ideal method—for instance, people may not tell the truth: "I'm fine, how are you?"—but it's a start. When survey researchers ask about happiness in millions of interviews around the world, some remarkable patterns appear in the data.

GDP per capita turns out to be a strong predictor of life satisfaction. Exhibit 5.6 displays a positive relationship between GDP per capita and self-reports of life satisfaction in a large sample of countries. The countries with higher levels of GDP per capita report higher levels of life satisfaction. The exhibit plots GDP per capita on the *x*-axis and average life satisfaction on the *y*-axis. Life satisfaction was measured on a 10-point scale. Each circle represents a different country, and the size of the circle reflects the size of the population in that country. The large circle on the right represents the United States. The two large circles on the left are for India and China.

GDP per capita turns out to be a strong predictor of life satisfaction.

This positive correlation between GDP and life satisfaction shows up in each country as well. In other words, when economists study household-level data on income and life satisfaction, we find that low-income households in a country report substantially lower life satisfaction than higher-income households in the same country.[7]

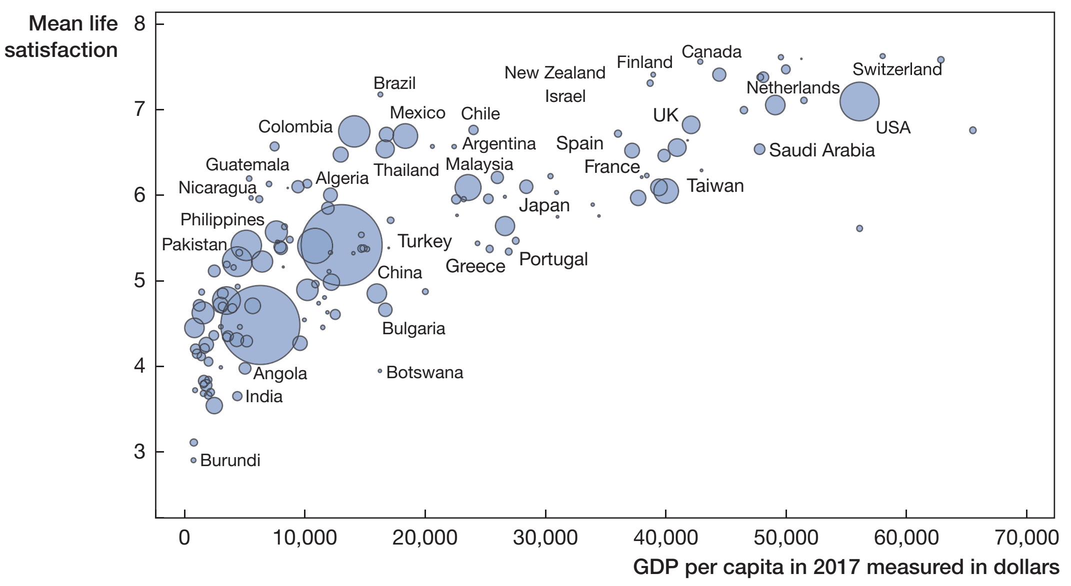

Exhibit 5.6 GDP per Capita and Life Satisfaction

A strong positive relationship is visible when we compare GDP per capita to mean life satisfaction (measured on a 10-point scale) in a large sample of countries.

Source: Data from the World Happiness Report and the Penn World Table version 9.1 (Robert C. Feenstra, Robert Inklaar, and Marcel P. Timmer, September 2019).

5.4 Real versus Nominal

GDP is particularly useful as a tool for determining how the overall economy is growing. To implement this growth analysis, we would like to separate the increase in the value of GDP that is due to overall price increases (in other words, inflation, a concept we define below) from the increase in the value of GDP that is due to increases in the quantity and quality of goods and services.

For example, suppose the country of Fordica makes ten cars in 2019 and ten identical cars in 2020. Here we make the simplifying assumption that the quality of the cars hasn't changed over time. Economists have sophisticated tools for handling improvements in quality, but we'll sidestep those issues to keep the analysis as simple as possible. Holding quality fixed, assume that the price of each car rises from \$30,000 to \$40,000 from 2019 to 2020. In this case, GDP in 2019 would be $(10 \text{ cars} \times \$30{,}000/\text{car}) = \$300{,}000$ and GDP in 2020 would be $(10 \text{ cars} \times \$40{,}000/\text{car}) = \$400{,}000$. At first glance, the economy has grown by 33 percent, or

$$\frac{\text{GDP in 2020} - \text{GDP in 2019}}{\text{GDP in 2019}} = \frac{\$400{,}000 - \$300{,}000}{\$300{,}000} = \frac{1}{3} = 0.33 = 33\%.$$

But the actual number and quality of cars produced hasn't changed at all. It's still ten cars with unchanged quality. If we counted the number of cars, rather than their market value, the growth rate of the economy from 2019 to 2020 would have been 0 percent. We don't want to pat ourselves on the back because prices have gone up (holding car quality fixed, as we are in this example).

Naturally, we would like to separate the growth that is due simply to price increases from the growth that is due to increases in the production of goods and services. To do this, we contrast the concepts of *nominal GDP* and *real GDP*. Nominal GDP is the standard GDP measurement that we've been discussing throughout this chapter. **Nominal GDP** is the total market value of production, using current prices to determine value per unit produced.

Nominal GDP is the total value of production (final goods and services), using current market prices to determine the value of each unit that is produced.

Real GDP is the total value of production (final goods and services), using market prices from a specific base year to determine the value of each unit that is produced.

Real GDP is based on the same idea as nominal GDP—summing up the market value of the quantities of final goods and services—but real GDP uses prices from a base year that may be different from the year in which the quantities were produced. To illustrate this idea, let's take 2019 as the base year. In our example, the price of a Ford was \$30,000 in 2019. Now let's assume that ten Fords were produced in 2019 and ten (identical) Fords were produced in 2020. To calculate real GDP, we use the 2019 prices to value the output in both 2019 and 2020. So real GDP was \$300,000 in 2019 and was still \$300,000 in 2020. Using the concept of real GDP, we see that there was no growth between 2019 and 2020. That makes sense—the number and quality of cars produced did not change.

For clarity, economists use the words *nominal* or *real* in their analyses to make certain that the reader knows which of the two concepts is being discussed. However, journalists generally assume that growth of *real* GDP is the only game in town. When a headline announces, "U.S. Growth Slows to 2.2%," readers are assumed to know, without being told, that real growth is being discussed.

So far we have studied real GDP in the simple case of a one-good economy. Naturally, this concept can be applied to an economy with any number of goods and services. To get some practice using this concept, let's consider the case of an economy that manufactures two types of cars: Fords and Chevrolets. Exhibit 5.7 reports the raw data with which we will work.

Let's start by calculating nominal GDP. We simply add up the total market value of goods sold in each year, using current prices. In 2019, nominal GDP is

$$(10 \text{ Fords}) \times (\$30{,}000/\text{Ford}) + (5 \text{ Chevrolets}) \times (\$20{,}000/\text{Chevrolet}) = \$400{,}000.$$

In 2020, nominal GDP is

$$(10 \text{ Fords}) \times (\$40{,}000/\text{Ford}) + (20 \text{ Chevrolets}) \times (\$25{,}000/\text{Chevrolet}) = \$900{,}000.$$

Check these totals against the values in the column of Exhibit 5.7 labeled "Nominal GDP."

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Exhibit 5.7 Quantities and Prices in an Economy with Two Goods

The yellow box contains Ford's quantities and prices in years 2019 and 2020. The orange box contains Chevrolet's quantities and prices. Nominal GDP is the total value of production using prices and quantities from the same year. Real GDP in 2019 using 2019 prices is the same as nominal GDP in 2019. Real GDP in 2020 using 2019 prices is the total value of production using quantities from 2020 and prices from 2019.

	Ford		Chevrolet			
Year	Quantity Produced	Price per Car	Quantity Produced	Price per Car	Nominal GDP	Real GDP Using 2019 Base Prices
2019	10	\$30,000	5	\$20,000	\$400,000	\$400,000
2020	10	\$40,000	20	\$25,000	\$900,000	\$700,000

To calculate real GDP, we use 2019 as the base year. That means that we keep using 2019 prices in the calculation of both 2019 and 2020 real GDP. This doesn't rock the boat for 2019. Real GDP for 2019 is calculated with 2019 quantities and 2019 prices (exactly matching our calculation of nominal GDP in 2019):

$$(10 \text{ Fords}) \times (\$30{,}000/\text{Ford}) + (5 \text{ Chevrolets}) \times (\$20{,}000/\text{Chevrolet}) = \$400{,}000.$$

The boat rocking comes when we calculate real GDP in 2020, using 2019 as the base year. Now we need to use quantities from 2020 and prices from 2019. In 2020, real GDP is

$$(10 \text{ Fords}) \times (\$30{,}000/\text{Ford}) + (20 \text{ Chevrolets}) \times (\$20{,}000/\text{Chevrolet}) = \$700{,}000.$$

By holding prices constant—using prices from a single base year—we are able to make meaningful comparisons across years. Economists say that such analyses use *constant dollars*. In this case, the constant dollars are based on prices from 2019. To make the base year clear to their audience, economists say that the analysis uses "constant 2019 dollars."

Now that you understand how to calculate real GDP, we are able to talk about the growth rate of real GDP, which is usually referred to as **real GDP growth**. For example, the formula for real GDP growth in 2020 is given by

Real GDP growth is the growth rate of real GDP.

$$\text{Real GDP growth in 2020} = \frac{\text{Real GDP in 2020} - \text{Real GDP in 2019}}{\text{Real GDP in 2019}}.$$

By focusing on real GDP growth—which holds prices fixed across time—we compare the total value of real output in 2019 (\$400,000 in our example) and the total value of real output in 2020 (\$700,000 in our example). In this example, real GDP has grown by 75 percent:

$$\frac{\$700{,}000 - \$400{,}000}{\$400{,}000} = \frac{3}{4} = 0.75 = 75\%.$$

The concept of real GDP growth lets us focus on the thing that we care the most about—how much the economy is producing at different points in time—without letting price movements muddy up the comparison.

Finally, don't let this teaching example mislead you. Unfortunately, actual growth rates for real GDP are much lower than they are in our illustration. Since 1929, when reliable national income accounts were first created, real GDP growth in the United States has averaged 3.2 percent per year. Even rapidly growing developing countries achieve average real GDP growth of only 5 percent to 10 percent per year. We'll analyze long-run real GDP growth in Chapter 7, and we'll study short-run fluctuations in real GDP growth in Chapter 12.

The GDP Deflator

The **GDP deflator** is 100 times the ratio of nominal GDP to real GDP in the same year. It is a measure of how prices of goods and services produced in a country have risen since the base year.

We can also use real GDP to study the level of prices in the overall economy. Specifically, if we divide nominal GDP by real GDP in the same year and multiply the resulting ratio by 100, we end up with a measure of how much prices of goods and services produced in a country have risen since the base year. This ratio is called the **GDP deflator**:

$$\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100.$$

To understand why this ratio is a measure of rising prices, it helps to write out the formula. Consider again the example in Exhibit 5.7, in which we treat 2019 as the base year for calculations of real GDP. To begin, let's evaluate the GDP deflator for 2019. The expressions for nominal GDP and real GDP are written out here with the quantities shown in blue and the prices in red. Using the data in Exhibit 5.7, you can confirm the numbers used in the formula:

$$\begin{aligned}
\text{GDP deflator}(2019) &= \frac{\text{Nominal GDP}(2019)}{\text{Real GDP}(2019)} \times 100 \\
&= \frac{\text{Cost of buying everything produced domestically in 2019 using 2019 prices}}{\text{Cost of buying everything produced domestically in 2019 using base-year prices}} \times 100 \\
&= \frac{10 \times 30{,}000 + 5 \times 20{,}000}{10 \times 30{,}000 + 5 \times 20{,}000} \times 100 \\
&= 100.
\end{aligned}$$

This first calculation reminds us that in the base year (2019 in this example), nominal GDP matches real GDP. Consequently, in the base year, the GDP deflator is exactly equal to 100.

Now let's consider 2020, the year after the base year. Once again, you can use the data in Exhibit 5.7 to confirm the numbers in the equation:

$$\begin{aligned}
\text{GDP deflator}(2020) &= \frac{\text{Nominal GDP}(2020)}{\text{Real GDP}(2020)} \times 100 \\
&= \frac{\text{Cost of buying everything produced domestically in 2020 using 2020 prices}}{\text{Cost of buying everything produced domestically in 2020 using base-year prices}} \times 100 \\
&= \frac{10 \times 40{,}000 + 20 \times 25{,}000}{10 \times 30{,}000 + 20 \times 20{,}000} \times 100 \\
&= \frac{900{,}000}{700{,}000} \times 100 \\
&= 128.6.
\end{aligned}$$

In the formula for the 2020 GDP deflator, the numerator and the denominator have exactly the same quantities (in blue): 10 Fords and 20 Chevys. These are the quantities that were sold in 2020. The only numbers that change between the numerator and the denominator are the prices (in red). The numerator (top) has the 2020 prices, which are used to calculate nominal GDP in 2020. The denominator (bottom) has the 2019 prices that are used to calculate *real* GDP for 2020—recall that the 2019 prices are the base-year prices.

The numerator shows what it would cost to purchase everything that the economy produced in 2020 using 2020 prices. The denominator shows what it would cost to purchase everything that the economy produced in 2020 using 2019 prices. The GDP deflator is the ratio that reflects the rising cost of buying everything produced in 2020, holding the goods and services produced in 2020 fixed, but changing the prices from the 2020 prices (in the numerator) to the 2019 prices (in the denominator).

The 2020 GDP deflator is telling us how the 2020 prices (in red in the numerator) compare with the 2019 prices (in red in the denominator), holding the quantities fixed in the numerator and the denominator. You can think of the (blue) quantities as weights. The higher the 2020 quantity, the more weight that good or service gets in determining the overall ratio. This makes sense: goods or services with large quantities should get more weight when we form an overall measure of the price level.