

## Measuring U.S. GDP

The Bureau of Economic Analysis (BEA) uses the concepts in the circular flow model to measure GDP and its components in the *National Income and Product Accounts*. Because the value of aggregate production equals aggregate expenditure and aggregate income, there are two approaches available for measuring GDP, and both are used. They are

- The expenditure approach
- The income approach

### The Expenditure Approach

The *expenditure approach* measures GDP as the sum of consumption expenditure ( $C$ ), investment ( $I$ ), government expenditure on goods and services ( $G$ ), and net exports of goods and services ( $X - M$ ). These expenditures correspond to the red flows through the goods markets in the circular flow model in Fig. 21.1. Table 21.1 shows these expenditures and GDP for 2010. The table uses the terms in the *National Income and Product Accounts*.

*Personal consumption expenditures* are the expenditures by U.S. households on goods and services produced in the United States and in the rest of the world. They include goods such as soda and books and services such as banking and legal advice. They also include the purchase of consumer durable goods, such as TVs and microwave ovens. But they do *not* include the purchase of new homes, which the BEA counts as part of investment.

*Gross private domestic investment* is expenditure on capital equipment and buildings by firms and the additions to business inventories. It also includes expenditure on new homes by households.

*Government expenditure on goods and services* is the expenditure by all levels of government on goods and services, such as national defense and garbage collection. It does *not* include *transfer payments*, such as unemployment benefits, because they are not expenditures on goods and services.

*Net exports of goods and services* are the value of exports minus the value of imports. This item includes airplanes that Boeing sells to British Airways (a U.S. export), and Japanese DVD players that Circuit City buys from Sony (a U.S. import).

Table 21.1 shows the relative magnitudes of the four items of aggregate expenditure.

**TABLE 21.1** GDP: The Expenditure Approach

Item	Symbol	Amount in 2010 (billions of dollars)	Percentage of GDP
Personal consumption expenditures	$C$	10,285	70.5
Gross private domestic investment	$I$	1,842	12.6
Government expenditure on goods and services	$G$	2,991	20.5
Net exports of goods and services	$X - M$	-539	-3.7
<b>Gross domestic product</b>	<b><math>Y</math></b>	<b>14,579</b>	<b>100.0</b>

The expenditure approach measures GDP as the sum of personal consumption expenditures ( $C$ ), gross private domestic investment ( $I$ ), government expenditure on goods and services ( $G$ ), and net exports ( $X - M$ ). In 2010, GDP measured by the expenditure approach was \$14,579 billion. More than two thirds of aggregate expenditure is on personal consumption goods and services.

*Source of data:* U.S. Department of Commerce, Bureau of Economic Analysis.

### The Income Approach

The *income approach* measures GDP by summing the incomes that firms pay households for the services of the factors of production they hire—wages for labor, interest for capital, rent for land, and profit for entrepreneurship. These incomes correspond to the blue flow through the factor markets in the circular flow model in Fig. 21.1.

The *National Income and Product Accounts* divide incomes into two big categories:

1. Compensation of employees
2. Net operating surplus

*Compensation of employees* is the payment for labor services. It includes net wages and salaries (called “take-home pay”) that workers receive plus taxes withheld on earnings plus fringe benefits such as Social Security and pension fund contributions.

*Net operating surplus* is the sum of all other factor incomes. It has four components: *net interest*, *rental*

*income, corporate profits, and proprietors' income.*

*Net interest* is the interest households receive on loans they make minus the interest households pay on their own borrowing.

*Rental income* is the payment for the use of land and other rented resources.

*Corporate profits* are the profits of corporations, some of which are paid to households in the form of dividends and some of which are retained by corporations as undistributed profits. They are all income.

*Proprietors' income* is the income earned by the owner-operator of a business, which includes compensation for the owner's labor, the use of the owner's capital, and profit.

Table 21.2 shows the two big categories of factor incomes and their relative magnitudes. You can see that compensation of employees—labor income—is approximately twice the magnitude of the other factor incomes that make up the net operating surplus.

The factor incomes sum to *net domestic income at factor cost*. The term “factor cost” is used because it is the cost of the factors of production used to produce final goods. When we sum the expenditures on final goods, we arrive at a total called *domestic product at market prices*. Market prices and factor cost diverge because of indirect taxes and subsidies.

An *indirect tax* is a tax paid by consumers when they buy goods and services. (In contrast, a *direct tax* is a tax on income.) State sales taxes and taxes on alcohol, gasoline, and tobacco products are indirect taxes. Because of indirect taxes, consumers pay more for some goods and services than producers receive. Market price exceeds factor cost. For example, if the sales tax is 7 percent, you pay \$1.07 when you buy a \$1 chocolate bar. The factor cost of the chocolate bar including profit is \$1. The market price is \$1.07.

A *subsidy* is a payment by the government to a producer. Payments made to grain growers and dairy farmers are subsidies. Because of subsidies, consumers pay less for some goods and services than producers receive. Factor cost exceeds market price.

To get from factor cost to market price, we add indirect taxes and subtract subsidies. Making this adjustment brings us to *net domestic income at market prices*. We still must get from a *net* to a *gross* measure.

Total expenditure is a *gross* number because it includes *gross* investment. Net domestic income at market prices is a net income measure because corporate profits are measured *after deducting depreciation*. They are a *net* income measure. To get from net income to gross income, we must *add depreciation*.

**TABLE 21.2** GDP: The Income Approach

Item	Amount in 2010 (billions of dollars)	Percentage of GDP
Compensation of employees	7,929	54.4
Net interest	924	6.3
Rental income	299	2.1
Corporate profits	1,210	8.3
Proprietors' income	<u>1,050</u>	<u>7.2</u>
<i>Net domestic income at factor cost</i>	11,412	78.3
Indirect taxes <i>less</i> subsidies	<u>1,127</u>	<u>7.7</u>
<i>Net domestic income at market prices</i>	12,539	86.0
Depreciation	<u>1,860</u>	<u>12.8</u>
<b>GDP (income approach)</b>	<b>14,399</b>	<b>98.8</b>
Statistical discrepancy	<u>180</u>	<u>1.2</u>
<b>GDP (expenditure approach)</b>	<b>14,579</b>	<b>100.0</b>

The sum of factor incomes equals *net domestic income at factor cost*. GDP equals net domestic income at factor cost plus indirect taxes less subsidies plus depreciation.

In 2010, GDP measured by the income approach was \$14,399 billion. This amount is \$180 billion less than GDP measured by the expenditure approach—a statistical discrepancy of \$151 billion or 1.2 percent of GDP.

Compensation of employees—labor income—is by far the largest part of aggregate income.

*Source of data:* U.S. Department of Commerce, Bureau of Economic Analysis.

We've now arrived at GDP using the income approach. This number is not exactly the same as GDP using the expenditure approach. For example, if a waiter doesn't report all his tips when he fills out his income tax return, they get missed in the income approach but they show up in the expenditure approach when he spends his income. So the sum of expenditures might exceed the sum of incomes. Also the sum of expenditures might exceed the sum of incomes because some expenditure items are estimated rather than directly measured.

The gap between the expenditure approach and the income approach is called the *statistical discrepancy* and it is calculated as the GDP expenditure total minus the GDP income total. The discrepancy is never large. In 2010, it was 1.2 percent of GDP.

### Nominal GDP and Real GDP

Often, we want to *compare* GDP in two periods, say 2000 and 2010. In 2000, GDP was \$9,952 billion and in 2010, it was \$14,579 billion—46 percent higher than in 2000. This increase in GDP is a combination of an increase in production and a rise in prices. To isolate the increase in production from the rise in prices, we distinguish between *real* GDP and *nominal* GDP.

**Real GDP** is the value of final goods and services produced in a given year when *valued at the prices of a reference base year*. By comparing the value of production in the two years at the same prices, we reveal the change in production.

Currently, the reference base year is 2005 and we describe real GDP as measured in 2005 dollars—in terms of what the dollar would buy in 2005.

**Nominal GDP** is the value of final goods and services produced in a given year when valued at the prices of that year. Nominal GDP is just a more precise name for GDP.

Economists at the Bureau of Economic Analysis calculate real GDP using the method described in the Mathematical Note on pp. 506–507. Here, we’ll explain the basic idea but not the technical details.

### Calculating Real GDP

We’ll calculate real GDP for an economy that produces one consumption good, one capital good, and one government service. Net exports are zero.

Table 21.3 shows the quantities produced and the prices in 2005 (the base year) and in 2010. In part (a), we calculate nominal GDP in 2005. For each item, we multiply the quantity produced in 2005 by its price in 2005 to find the total expenditure on the item. We sum the expenditures to find nominal GDP, which in 2005 is \$100 million. Because 2005 is the base year, both real GDP and nominal GDP equal \$100 million.

In Table 21.3(b), we calculate nominal GDP in 2010, which is \$300 million. Nominal GDP in 2010 is three times its value in 2005. But by how much has production increased? Real GDP will tell us.

In Table 21.3(c), we calculate real GDP in 2010. The quantities of the goods and services produced are those of 2010, as in part (b). The prices are those in the reference base year—2005, as in part (a).

For each item, we multiply the quantity produced in 2010 by its price in 2005. We then sum these expenditures to find real GDP in 2010, which is \$160 million. This number is what total expenditure

**TABLE 21.3** Calculating Nominal GDP and Real GDP

Item	Quantity (millions)	Price (dollars)	Expenditure (millions of dollars)
<b>(a) In 2005</b>			
C T-shirts	10	5	50
I Computer chips	3	10	30
G Security services	1	20	20
Y Real and Nominal GDP in 2005			100
<b>(b) In 2010</b>			
C T-shirts	4	5	20
I Computer chips	2	20	40
G Security services	6	40	240
Y Nominal GDP in 2010			300
<b>(c) Quantities of 2010 valued at prices of 2005</b>			
C T-shirts	4	5	20
I Computer chips	2	10	20
G Security services	6	20	120
Y Real GDP in 2010			160

In 2005, the reference base year, real GDP equals nominal GDP and was \$100 million. In 2010, nominal GDP increased to \$300 million. But real GDP in 2010 in part (c), which is calculated by using the quantities of 2010 in part (b) and the prices of 2005 in part (a), was only \$160 million—a 60 percent increase from 2005.

would have been in 2010 if prices had remained the same as they were in 2005.

Nominal GDP in 2010 is three times its value in 2005, but real GDP in 2010 is only 1.6 times its 2005 value—a 60 percent increase in production.

### REVIEW QUIZ

- 1 What is the expenditure approach to measuring GDP?
- 2 What is the income approach to measuring GDP?
- 3 What adjustments must be made to total income to make it equal GDP?
- 4 What is the distinction between nominal GDP and real GDP?
- 5 How is real GDP calculated?

You can work these questions in Study Plan 21.2 and get instant feedback.

