entrepreneurial talent. Recall that U.S. national income (NI) includes all income earned through the use of American-owned resources, whether they are located at home or abroad. It also includes taxes on production and imports. To derive NI from NDP, we must subtract the aforementioned statistical discrepancy from NDP and add net foreign factor income, since the latter is income earned by Americans overseas minus income earned by foreigners in the United States.

For the United States in 2007:

| | Billions |
|---|---|
| Net domestic product | $12,154 |
| *Less:* Statistical discrepancy | 29 |
| *Plus:* Net foreign factor income | 96 |
| *Equals:* National income | $12,221 |

We know, too, that we can calculate national income through the income approach by simply adding up employee compensation, rent, interest, proprietors' income, corporate profit, and taxes on production and imports.

## Personal Income

**Personal income (PI)** includes all income received, whether earned or unearned. It is likely to differ from national income (income earned) because some income earned—taxes on production and imports, Social Security taxes (payroll taxes), corporate income taxes, and undistributed corporate profits—is not received by households. Conversely, some income received—such as Social Security payments, unemployment compensation payments, welfare payments, disability and education payments to veterans, and private pension payments—is not earned. These transfer payments must be added to obtain PI.

In moving from national income to personal income, we must subtract the income that is earned but not received and add the income that is received but not earned. For the United States in 2007:

| | Billions |
|---|---|
| National income | $12,221 |
| *Less:* Taxes on production and imports | 1009 |
| *Less:* Social Security contributions | 979 |
| *Less:* Corporate income taxes | 467 |
| *Less:* Undistributed corporate profits | 344 |
| *Plus:* Transfer payments | 2237* |
| *Equals:* Personal income | $11,659 |

*Includes statistical discrepancy

## Disposable Income

**Disposable income (DI)** is personal income less personal taxes. Personal taxes include personal income taxes, personal property taxes, and inheritance taxes. Disposable income is the amount of income that households have left over after paying their personal taxes. They are free to divide that income between consumption ($C$) and saving ($S$):

$$DI = C + S$$

**WORKED PROBLEMS**
**W 24.1**
Measuring output and income

For the United States in 2007:

| | Billions |
|---|---|
| Personal income | $11,659 |
| *Less:* Personal taxes | 1482 |
| *Equals:* Disposable income | $10,177 |

Table 24.4 summarizes the relationships among GDP, NDP, NI, PI, and DI. **(Key Question 8)**

## The Circular Flow Revisited

Figure 24.3 is an elaborate flow diagram that shows the economy's four main sectors along with the flows of

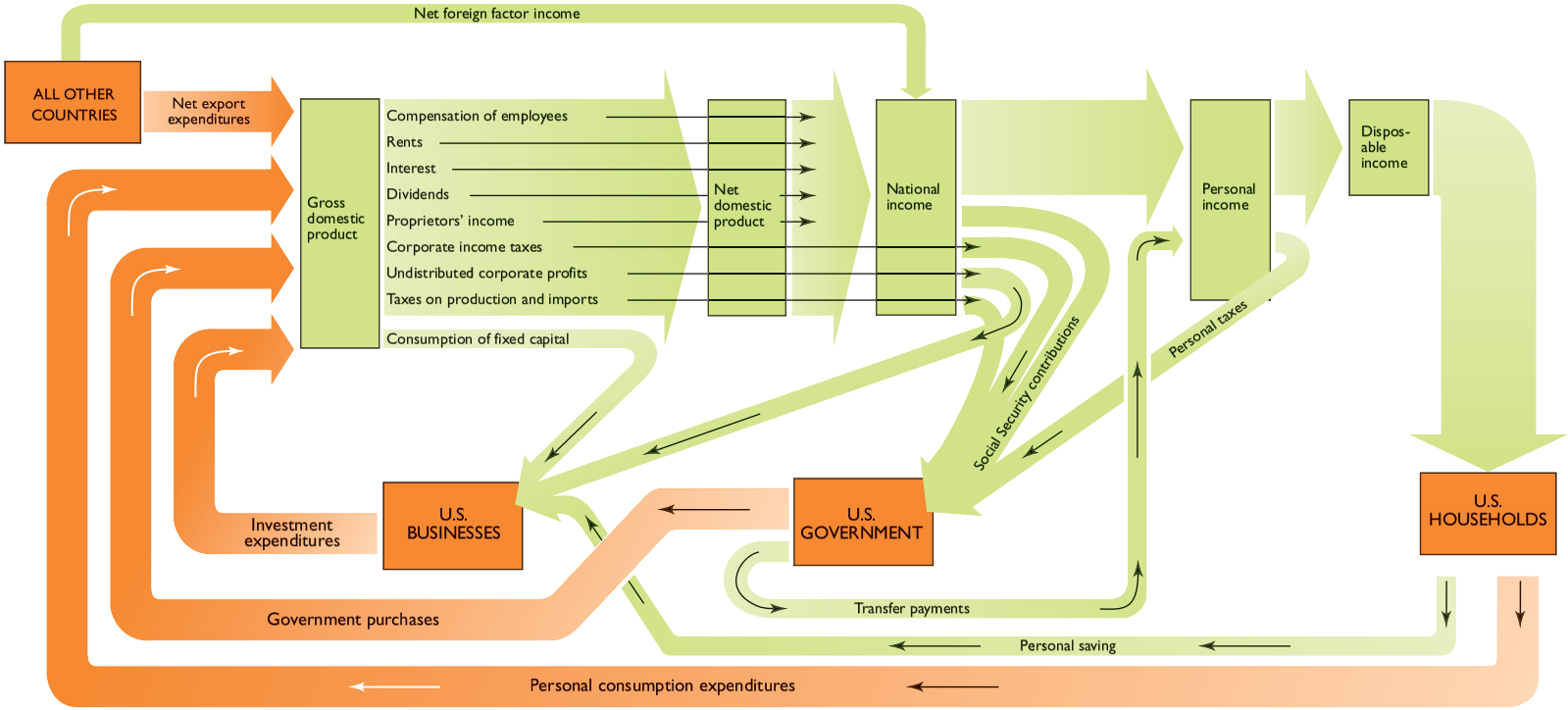
**TABLE 24.4 The Relationship between GDP, NDP, NI, PI, and DI in the United States, 2007***

| | Billions |
|---|---|
| Gross domestic product (GDP) | $13,841 |
| *Less:* Consumption of fixed capital | 1687 |
| *Equals:* Net domestic product | $12,154 |
| Net domestic product (NDP) | $12,154 |
| *Less:* Statistical discrepancy | 29 |
| *Plus:* Net foreign factor income | 96 |
| *Equals:* National income (NI) | $12,221 |
| National income (NI) | $12,221 |
| *Less:* Taxes on production and imports | 1009 |
| *Less:* Social Security contributions | 979 |
| *Less:* Corporate income taxes | 467 |
| *Less:* Undistributed corporate profits | 344 |
| *Plus:* Transfer payments | 2237 |
| *Equals:* Personal income (PI) | $11,659 |
| Personal income (PI) | $11,659 |
| *Less:* Personal taxes | 1482 |
| *Equals:* Disposable income (DI) | $10,177 |

*Some of the items combine categories that appear in the more detailed accounts.

*Source:* Bureau of Economic Analysis, **www.bea.gov.**

**FIGURE 24.3 U.S. domestic output and the flows of expenditure and income.** This figure is an elaborate circular flow diagram that fits the expenditures and allocations sides of GDP to one another. The expenditures flows are shown in orange; the allocations or income flows are shown in green. You should trace through the income and expenditures flows, relating them to the five basic national income accounting measures.



expenditures and allocations that determine GDP, NDP, NI, and PI. The orange arrows represent the spending flows—$C + I_g + G + X_n$—that together measure gross domestic product. To the right of the GDP rectangle are green arrows that show first the allocations of GDP and then the adjustments needed to derive NDP, NI, PI, and DI.

The diagram illustrates the adjustments necessary to determine each of the national income accounts. For example, net domestic product is smaller than GDP because consumption of fixed capital flows away from GDP in determining NDP. Also, disposable income is smaller than personal income because personal taxes flow away from PI (to government) in deriving DI.

Note the three domestic sectors of the economy: households, government, and businesses. The household sector has an inflow of disposable income and outflows of consumption spending and saving. The government sector has an inflow of revenue in the form of types of taxes and an outflow of government disbursements in the form of purchases and transfers. The business sector has inflows of three major sources of funds for business investment and an outflow of investment expenditures.

Finally, note the foreign sector (all other countries) in the flow diagram. Spending by foreigners on U.S. exports adds to U.S. GDP, but some of U.S. consumption, government, and investment expenditures buy imported products. The flow from foreign markets shows that we handle this complication by calculating net exports (U.S. exports minus U.S. imports). The net export flow may be a positive or negative amount, adding to or subtracting from U.S. GDP.

### QUICK REVIEW 24.2

- Net domestic product (NDP) is the market value of GDP minus consumption of fixed capital (depreciation).
- National income (NI) is all income earned through the use of American-owned resources, whether located at home or abroad. NI also includes taxes on production and imports.
- Personal income (PI) is all income received by households, whether earned or not.
- Disposable income (DI) is all income received by households minus personal taxes.

## Nominal GDP versus Real GDP

Recall that GDP is a measure of the market or money value of all final goods and services produced by the economy in a given year. We use money or nominal values as a common denominator in order to sum that heterogeneous output into a meaningful total. But that creates a problem: How can we compare the market values of GDP from year to year if the value of money itself changes in response to inflation (rising prices) or deflation (falling prices)? After all, we determine the value of GDP by multiplying total output by market prices.

Whether there is a 5 percent increase in output with no change in prices or a 5 percent increase in prices with no change in output, the change in the value of GDP will be the same. And yet it is the *quantity* of goods and services that get produced and distributed to households that affects our standard of living, not the price of those goods and services. For instance, the McDonald's hamburger that sold for 89 cents in 2007 yields the same satisfaction as a nearly identical McDonald's hamburger that sold for 18 cents in 1967.

The way around this problem is to *deflate* GDP when prices rise and to *inflate* GDP when prices fall. These adjustments give us a measure of GDP for various years as if the value of the dollar had always been the same as it was in some reference year. A GDP based on the prices that prevailed when the output was produced is called unadjusted GDP, or **nominal GDP.** A GDP that has been deflated or inflated to reflect changes in the price level is called adjusted GDP, or **real GDP.**

### Adjustment Process in a One-Product Economy

There are two ways we can adjust nominal GDP to reflect price changes. For simplicity, let's assume that the economy produces only one good, pizza, in the amounts indicated in Table 24.5 for years 1, 2, and 3. Suppose that we gather revenue data directly from the financial reports of the economy's pizza businesses to measure nominal GDP in various years. After completing our effort, we will have determined nominal GDP for each year, as shown in column 4 of Table 24.5. We will have no way of knowing to what extent changes in price and/or changes in quantity of output have accounted for the increases or decreases in nominal GDP that we observe.

**GDP Price Index** How can we determine real GDP in our pizza economy? One way is to assemble data on the price changes that occurred over various years (column 2) and use them to establish an overall price index for the entire period. Then we can use the index in each year to adjust nominal GDP to real GDP for that year.

A **price index** is a measure of the price of a specified collection of goods and services, called a "market basket," in a given year as compared to the price of an identical (or highly similar) collection of goods and services

**TABLE 24.5** Calculating Real GDP (Base Year = Year 1)

| Year | (1) Units of Output | (2) Price of Pizza per Unit | (3) Price Index (Year 1 = 100) | (4) Unadjusted, or Nominal, GDP, (1) × (2) | (5) Adjusted, or Real, GDP |
|---|---|---|---|---|---|
| 1 | 5 | $10 | 100 | $ 50 | $50 |
| 2 | 7 | 20 | 200 | 140 | 70 |
| 3 | 8 | 25 | 250 | 200 | 80 |
| 4 | 10 | 30 | ___ | ___ | ___ |
| 5 | 11 | 28 | ___ | ___ | ___ |

in a reference year. That point of reference, or benchmark, is known as the base period or base year. More formally,

$$\text{Price index in given year} = \frac{\text{price of market basket in specific year}}{\text{price of same market basket in base year}} \times 100 \qquad (1)$$

By convention, the price ratio between a given year and the base year is multiplied by 100 to facilitate computation. For example, a price ratio of 2/1 (= 2) is expressed as a price index of 200. A price ratio of 1/3 (= .33) is expressed as a price index of 33.

In our pizza-only example, of course, our market basket consists of only one product. Column 2 of Table 24.5 reveals that the price of pizza was $10 in year 1, $20 in year 2, $25 in year 3, and so on. Let's select year 1 as our base year. Now we can express the successive prices of the contents of our market basket in, say, years 2 and 3 as compared to the price of the market basket in year 1:

$$\text{Price index, year 2} = \frac{\$20}{\$10} \times 100 = 200$$

$$\text{Price index, year 3} = \frac{\$25}{\$10} \times 100 = 250$$

For year 1 the index has to be 100, since that year and the base year are identical.

The index numbers tell us that the price of pizza rose from year 1 to year 2 by 100 percent {= [(200 − 100)/100] × 100} and from year 1 to year 3 by 150 percent {= [(250 − 100)/100] × 100}.

### Dividing Nominal GDP by the Price Index

We can now use the index numbers shown in column 3 to deflate the nominal GDP figures in column 4. The simplest and most direct method of deflating is to express the index numbers as hundredths—in decimal form—and then to divide them into corresponding nominal GDP. That gives us real GDP:

$$\text{Real GDP} = \frac{\text{nominal GDP}}{\text{price index (in hundredths)}} \qquad (2)$$

Column 5 shows the results. These figures for real GDP measure the market value of the output of pizza in years 1, 2, and 3 as if the price of pizza had been a constant $10 throughout the 3-year period. In short, real GDP reveals the market value of each year's output measured in terms of dollars that have the same purchasing power as dollars had in the base year.

**WORKED PROBLEMS**
**W 24.2**
Real GDP and price indexes

To test your understanding, extend Table 24.5 to years 4 and 5, using equations 1 and 2. Then run through the entire deflating procedure, using year 3 as the base period. This time you will have to inflate some of the nominal GDP data, using the same procedure as we used in the examples.

**ORIGIN OF THE IDEA**
**O 24.1**
GDP price index

## An Alternative Method

Another way to establish real GDP is to gather separate data on physical outputs (as in column 1) and their prices (as in column 2) of Table 24.5. We could then determine the market value of outputs in successive years *if the base-year price ($10) had prevailed*. In year 2, the 7 units of pizza would have a value of $70 (= 7 units × $10). As column 5 confirms, that $70 worth of output is year 2's real GDP. Similarly, we could determine the real GDP for year 3 by multiplying the 8 units of output that year by the $10 price in the base year.

Once we have determined real GDP through this method, we can identify the price index for a given year

**TABLE 24.6 Steps for Deriving Real GDP from Nominal GDP**

***Method 1***

1. Find nominal GDP for each year.
2. Compute a GDP price index.
3. Divide each year's nominal GDP by that year's price index (in hundredths) to determine real GDP.

***Method 2***

1. Break down nominal GDP into physical quantities of output and prices for each year.
2. Find real GDP for each year by determining the dollar amount that each year's physical output would have sold for if base-year prices had prevailed. (The GDP price index can then be found by dividing nominal GDP by real GDP.)

simply by dividing the nominal GDP by the real GDP for that year:

$$\text{Price index (in hundredths)} = \frac{\text{nominal GDP}}{\text{real GDP}} \qquad (3)$$

Example: In year 2 we get a price index of 200—or, in hundredths, 2.00—which equals the nominal GDP of $140 divided by the real GDP of $70. Note that equation 3 is simply a rearrangement of equation 2. Table 24.6 summarizes the two methods of determining real GDP in our single-good economy. **(Key Question 11)**

## Real-World Considerations and Data

In the real world of many goods and services, of course, determining GDP and constructing a reliable price index are far more complex matters than in our pizza-only economy. The government accountants must assign a "weight" to each of several categories of goods and services based on the relative proportion of each category in total output. They update the weights annually as expenditure patterns change and roll the base year forward year by year using a moving average of expenditure patterns. The GDP price index used in the United States is called the *chain-type annual-weights price index*—which hints at its complexity. We spare you the details.

Table 24.7 shows some of the real-world relationships between nominal GDP, real GDP, and the GDP price index. Here the reference year is 2000, where the value of the index is set at 100. Because the price level has been rising over the long run, the pre-2000 values of real GDP (column 3) are higher than the nominal values of GDP for those years (column 2). This upward adjustment acknowledges that prices were lower in the years before 2000, and thus nominal GDP understated the real output of those years in 2000 prices and must be inflated to show the correct relationship to other years.

**TABLE 24.7 Nominal GDP, Real GDP, and GDP Price Index, Selected Years**

| (1) Year | (2) Nominal GDP, Billions of $ | (3) Real GDP, Billions of $ | (4) GDP Price Index (2000 = 100) |
|---|---|---|---|
| 1980 | 2789.5 | 5161.7 | ____ |
| 1985 | 4220.3 | 6053.7 | 69.7 |
| 1990 | 5803.1 | _____ | 81.6 |
| 2000 | 9817.0 | 9817.0 | 100.0 |
| 2003 | 10,960.8 | _____ | 106.4 |
| 2007 | 13,841.3 | 11,566.8 | 119.6 |

*Source:* Bureau of Economic Analysis, **www.bea.gov.**

Conversely, the rising price level of the post-2000 years caused nominal GDP figures for those years to overstate real output. So the statisticians deflate those figures to determine what real GDP would have been in other years if 2000 prices had prevailed. Doing so reveals that real GDP has been less than nominal GDP since 2000.

By inflating the nominal pre-2000 GDP data and deflating the post-2000 data, government accountants determine annual real GDP, which can then be compared with the real GDP of any other year in the series of years. So the real GDP values in column 3 are directly comparable with one another.

Once we have determined nominal GDP and real GDP, we can compute the price index. And once we have determined nominal GDP and the price index, we can calculate real GDP. Example: Nominal GDP in 2007 was $13,841.3 billion and real GDP was $11,566.8 billion. So the price level in 2007 was 119.6 (= $13,841.3/11,566.8 × 100), or 19.6 percent higher than in 2000. If we knew the nominal GDP and the price level only, we could find the real GDP for 2007 by dividing the nominal GDP of $13,841.3 by the 2007 price index, expressed in hundredths (1.1966).

To test your understanding of the relationships between nominal GDP, real GDP, and the price level, determine the values of the price index for 1980 in Table 24.7 and determine real GDP for 1990 and 2003. We have left those figures out on purpose. **(Key Question 12)**

### QUICK REVIEW 24.3

- Nominal GDP is output valued at current prices. Real GDP is output valued at constant base-year prices.
- The GDP price index compares the price (market value) of all the goods and services included in GDP in a given year to the price of the same market basket in a reference year.
- Nominal GDP can be transformed into real GDP by dividing the nominal GDP by the GDP price index expressed in hundredths.

# Shortcomings of GDP

GDP is a reasonably accurate and highly useful measure of how well or how poorly the economy is performing. But it has several shortcomings as a measure of both total output and well-being (total utility).

## Nonmarket Activities

Certain productive activities do not take place in any market—the services of homemakers, for example, and the labor of carpenters who repair their own homes. Such activities never show up in GDP because the accountants who tally up GDP only get data on economic transactions involving *market activities*—that is, transactions in which output or resources are traded for money. Consequently, GDP understates a nation's total output because it does not count *unpaid work*. There is one exception: The portion of farmers' output that farmers consume themselves *is* estimated and included in GDP.

## Leisure

The average workweek (excluding overtime) in the United States has declined since the beginning of the 1900s—from about 53 hours to about 35 hours. Moreover, the greater frequency of paid vacations, holidays, and leave time has shortened the work year itself. This increase in leisure time has clearly had a positive effect on overall well-being. But our system of national income accounting understates well-being by ignoring leisure's value. Nor does the system accommodate the satisfaction—the "psychic income"—that many people derive from their work.

## Improved Product Quality

Because GDP is a quantitative measure rather than a qualitative measure, it fails to capture the full value of improvements in product quality. There is a very real difference in quality between a $200 cell phone purchased today and a cell phone that cost the same amount just a decade ago. Today's cell phone is digital and has greater memory capacity, a viewing screen, and quite likely a camera and an MP3 player.

Obviously quality improvement has a great effect on economic well-being, as does the quantity of goods produced. Although the BEA adjusts GDP for quality improvement for selected items, the vast majority of such improvement for the entire range of goods and services does not get reflected in GDP.

## The Underground Economy

Embedded in our economy is a flourishing, productive underground sector. Some of the people who conduct business there are gamblers, smugglers, prostitutes, "fences" of stolen goods, drug growers, and drug dealers. They have good reason to conceal their incomes.

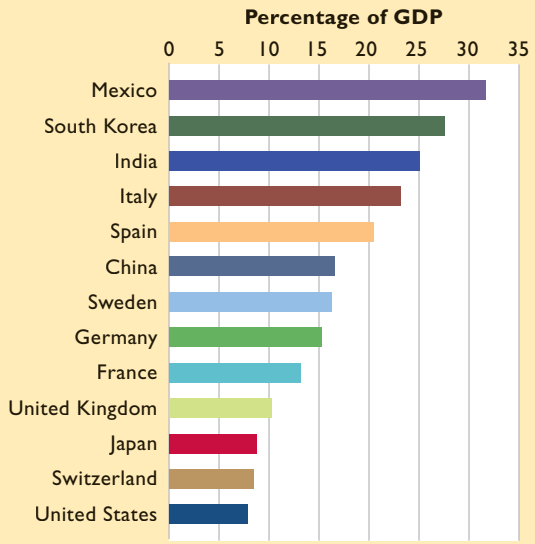
Most participants in the underground economy, however, engage in perfectly legal activities but choose illegally not to report their full incomes to the Internal Revenue Service (IRS). A barista at a coffee shop may report just a portion of the tips received from customers. Storekeepers may report only a portion of their sales receipts. Workers who want to hold on to their unemployment compensation benefits may take an "off-the-books" or "cash-only" job. A brick mason may agree to rebuild a neighbor's fireplace in exchange for the neighbor's repairing his boat engine. The value of none of these transactions shows up in GDP.

The value of underground transactions is estimated to be about 8 percent of the recorded GDP in the United States. That would mean that GDP in 2007 was understated by about $1.1 trillion. Global Perspective 24.2 shows estimates of the relative sizes of underground economies in selected nations.

### GLOBAL PERSPECTIVE 24.2

**The Underground Economy as a Percentage of GDP, Selected Nations**

Underground economies vary in size worldwide. Three factors that help explain the variation are (1) the extent and complexity of regulation, (2) the type and degree of taxation, and (3) the effectiveness of law enforcement.




*Source:* Friedrich Schneider and Domink H. Enste, "Shadow Economies: Size, Causes, and Consequences," Journal of Economic Literature, March 2000, p. 104. Used by permission of Prof. Dr. Friedrich Schneider, Department of Economics, University of Linz and Dr. Dominik H. Enste.

# LAST Word

## Magical Mystery Tour

**The Bureau of Economic Analysis (BEA), an Agency of the Department of Commerce, Compiles the NIPA Tables. Where Does It Get the Actual Data?**

Discussions of national income accounting often leave the impression that the data for the National Income and Product Accounts magically appear from some mysterious place. Let's take a tour to see where economists get their data.

**Consumption** The BEA derives the data for the consumption component of the GDP accounts from four main sources:

- The Census Bureau's *Retail Trade Survey*, which gains sales information from a sample of 22,000 firms.
- The Census Bureau's *Survey of Manufacturers*, which gathers information on shipments of consumer goods from 50,000 establishments.
- The Census Bureau's *Service Survey*, which collects sales data from 30,000 service businesses.
- Industry trade sources. For example, data on auto sales and aircraft are collected directly from auto and aircraft manufacturers.

**Investment** The sources of the data for the investment component of GDP include:

- All the sources above used to determine consumption. Purchases of capital goods are separated from purchases of consumer goods. For example, estimates of investment in equipment and software are based on manufacturers' shipments reported in the *Survey of Manufacturers*, the *Service Survey*, and industry sources.
- Census construction surveys. The Census Bureau's *Housing Starts Survey* and *Housing Sales Survey* produce the data used to measure the amount of housing construction, and the *Construction Progress Reporting Survey* is the source of data on nonresidential construction. The BEA determines changes in business inventories through the *Retail Trade Survey*, the *Wholesale Trade Survey* (of 7100 wholesale firms), and the *Survey of Manufacturing*.

**Government Purchases** The data for government purchases (officially "government consumption and investment expenditures") are obtained through the following sources:

- The U.S. Office of Personnel Management, which collects data on wages and benefits, broken out by the private and public sector. Wages and benefits of government employees are the single largest "purchase" by Federal, state, and local government.
- The previously mentioned Census Bureau's construction surveys, which break out private and public sector construction expenditures.
- The Census Bureau's *Survey of Government Finance*, which provides data on government consumption and investment expenditures.

**Net Exports** The BEA determines net exports through two main sources:

- The U.S. Customs Service, which collects data on exports and imports of goods.
- BEA surveys of potential domestic exporters and importers of services, which collect data on exports and imports of services.

So there you have it. Not so magical after all!

*Source:* Based on Joseph A. Ritter, "Feeding the National Accounts," Federal Reserve Bank of St. Louis *Review*, March–April 2000, pp. 11–20. For those interested, this article also provides information on the sources of data for the income side of the national accounts.

## GDP and the Environment

The growth of GDP is inevitably accompanied by "gross domestic by-products," including dirty air and polluted water, toxic waste, congestion, and noise. The social costs of the negative by-products reduce our economic well-being. And since those costs are not deducted from total output, GDP overstates our national well-being. Ironically, when money is spent to clean up pollution and reduce congestion, those expenses are added to the GDP!

## Composition and Distribution of Output

The composition of output is undoubtedly important for well-being. But GDP does not tell us whether the currently produced mix of goods and services is enriching or potentially detrimental to society. GDP assigns equal weight to an assault rifle and a set of encyclopedias, as long as both sell for the same price. Moreover, GDP reveals nothing about the way output is distributed. Does 90 percent of the output go to 10 percent of the households, for example, or is the output more evenly distributed? The distribution of output may make a big difference for society's overall well-being.

## Noneconomic Sources of Well-Being

Finally, the connection between GDP and well-being is problematic for another reason. Just as a household's income does not measure its total happiness, a nation's GDP does not measure its total well-being. Many things could make a society better off without necessarily raising GDP: a reduction of crime and violence, peaceful relations with other countries, people's greater civility toward one another, better understanding between parents and children, and a reduction of drug and alcohol abuse.

# Summary

1. Gross domestic product (GDP), a basic measure of an economy's economic performance, is the market value of all final goods and services produced within the borders of a nation in a year.
2. Intermediate goods, nonproduction transactions, and secondhand sales are purposely excluded in calculating GDP.
3. GDP may be calculated by summing total expenditures on all final output or by summing the income derived from the production of that output.
4. By the expenditures approach, GDP is determined by adding consumer purchases of goods and services, gross investment spending by businesses, government purchases, and net exports: GDP = $C + I_g + G + X_n$.
5. Gross investment is divided into (a) replacement investment (required to maintain the nation's stock of capital at its existing level) and (b) net investment (the net increase in the stock of capital). In most years, net investment is positive and therefore the economy's stock of capital and production capacity increase.
6. By the income or allocations approach, GDP is calculated as the sum of compensation to employees, rents, interest, proprietors' income, corporate profits, taxes on production and imports *minus* net foreign factor income, *plus* a statistical discrepancy and consumption of fixed capital.
7. Other national accounts are derived from GDP. Net domestic product (NDP) is GDP less the consumption of fixed capital. National income (NI) is total income earned by a nation's resource suppliers plus taxes on production and imports; it is found by subtracting a statistical discrepancy from NDP and adding net foreign factor income to NDP. Personal income (PI) is the total income paid to households prior to any allowance for personal taxes. Disposable income (DI) is personal income after personal taxes have been paid. DI measures the amount of income available to households to consume or save.
8. Price indexes are computed by dividing the price of a specific collection or market basket of output in a particular period by the price of the same market basket in a base period and multiplying the result (the quotient) by 100. The GDP price index is used to adjust nominal GDP for inflation or deflation and thereby obtain real GDP.
9. Nominal (current-dollar) GDP measures each year's output valued in terms of the prices prevailing in that year. Real (constant-dollar) GDP measures each year's output in terms of the prices that prevailed in a selected base year. Because real GDP is adjusted for price-level changes, differences in real GDP are due only to differences in production activity.
10. GDP is a reasonably accurate and very useful indicator of a nation's economic performance, but it has its limitations. It fails to account for nonmarket and illegal transactions, changes in leisure and in product quality, the composition and distribution of output, and the environmental effects of production. GDP should not be interpreted as a complete measure of well-being.