sam14893_ch05_088 11/17/00 10:28 AM Page 88

CHAPTER

5

Measuring Economic Activity

When you can measure what you are speaking about, and express it in numbers, you know something about it; when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science.

Lord Kelvin

Of all the concepts in macroeconomics, the single most important measure is the gross domestic product (GDP), which measures the total value of goods and services produced in a country. GDP is part of the *national income and product accounts* (or *national accounts*), which are a body of statistics that enable policymakers to determine whether the economy is contracting or expanding and whether a severe recession or inflation threatens. When economists want to determine the level of economic development of a country, they look at its GDP per capita.

While the GDP and the rest of the national accounts may seem to be arcane concepts, they are truly among the great inventions of the twentieth century. Much as a satellite in space can survey the weather across an entire continent, so can the GDP give an overall picture of the state of the economy. In this chapter, we explain how economists measure GDP and other major macroeconomic concepts.

GROSS DOMESTIC PRODUCT: THE YARDSTICK OF AN ECONOMY'S PERFORMANCE

What is the *gross domestic product?* GDP is the name we give to the total market value of the final goods and services produced within a nation during a given year. It is the figure you get when you apply the measuring rod of money to the diverse goods and services—from apples to zithers—that a country produces with its land, labor, and capital resources. GDP equals the total production of consumption and investment goods, government purchases, and net exports to other lands.

The gross domestic product (GDP) is the most comprehensive measure of a nation's total output of goods and services. It is the sum of the dollar values of consumption (C), gross investment (I), government purchases of goods and services (G), and net exports (X) produced within a nation during a given year.

In symbols:

$$\text{GDP} = C + I + G + X$$

GDP is used for many purposes, but the most important one is to measure the overall performance of an economy. If you were to ask an economic historian what happened during the Great Depression, the best short answer would be:

Between 1929 and 1933, GDP fell from $104 billion to $56 billion. This sharp decline in the dollar value of goods and services produced by the American economy caused high unemployment, hardship, a steep stock market decline, bankruptcies, bank failures, riots, and political turmoil.

sam14893_ch05_089 11/17/00 7:03 AM Page 89

Similarly, if you were to ask what was unusual about the 1990s, a macroeconomist might reply:

> The 1990s were the longest economic expansion in the nation's history. From 1992 to 2000, real GDP grew steadily, increasing by 37 percent with falling unemployment, stable inflation, and rising stock-market prices.

We now discuss the elements of the national income and product accounts. We start by showing different ways of measuring GDP and distinguishing real from nominal GDP. We then analyze the major components of GDP. We conclude with a discussion of the measurement of the general price level and the rate of inflation.

Two Measures of National Product: Goods Flow and Earnings Flow

How do economists actually measure GDP? One of the major surprises is that we can measure GDP in two entirely independent ways. As Figure 5-1 shows, GDP can be measured either as a flow of products or as a sum of earnings.

To demonstrate the different ways of measuring GDP, we begin by considering an oversimplified

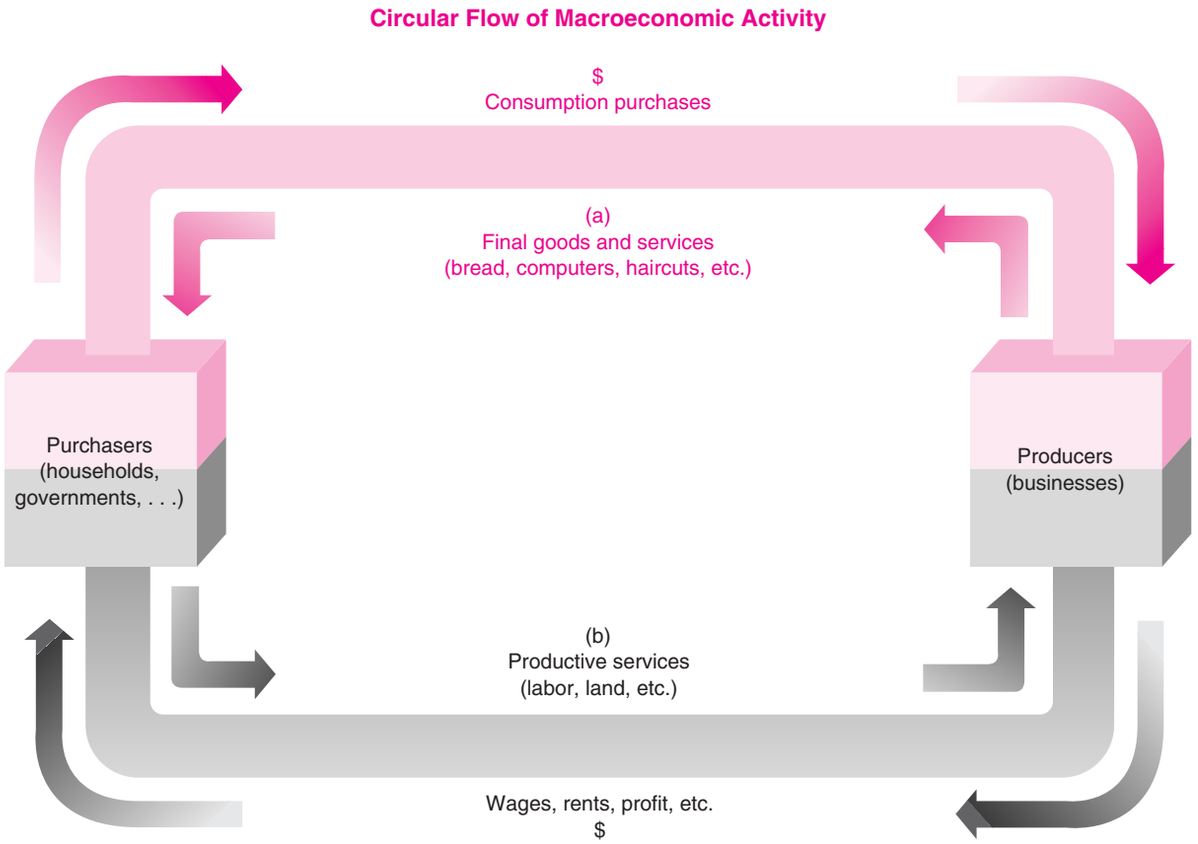

FIGURE 5-1. Gross Domestic Product Can Be Measured Either as (*a*) a Flow of Final Products or, Equivalently, as (*b*) a Flow of Costs

In the upper loop, purchasers buy final goods and services. The total dollar flow of their spending each year is one measure of gross domestic product. The lower loop measures the annual flow of costs of output: the earnings that businesses pay out in wages, rent, interest, dividends, and profits.

The two measures of GDP must always be identical. Note that this figure is the macroeconomic counterpart of Fig. 2-1, which presented the circular flow of supply and demand.

sam14893_ch05_090 11/17/00 10:28 AM Page 90

world in which there is no government, foreign trade, or investment. For the moment, our little economy produces only *consumption goods,* which are items that are purchased by households to satisfy their wants. (Important note: Our first example is oversimplified to show the basic ideas. In the realistic examples that follow, we will add investment, government, and the foreign sector.)

Flow-of-Product Approach. Each year the public consumes a wide variety of final goods and services: goods such as apples, computer software, and blue jeans; services such as health care and haircuts. We include only *final goods*—goods ultimately bought and used by consumers. Households spend their incomes for these consumer goods, as is shown in the upper loop of Figure 5-1. Add together all the consumption dollars spent on these final goods, and you will arrive at this simplified economy's total GDP.

Thus, in our simple economy, you can easily calculate national income or product as the sum of the annual flow of *final* goods and services: (price of blue jeans × number of blue jeans) plus (price of apples × number of apples) and so forth for all other final goods. The gross domestic product is defined as the total money value of the flow of final products produced by the nation.

National accountants use market prices as weights in valuing different commodities because market prices reflect the relative economic value of diverse goods and services. That is, the relative prices of different goods reflect how much consumers value their last (or marginal) units of consumption of these goods.

Earnings or Cost Approach. The second and equivalent way to calculate GDP is the earnings or cost approach. Go to the lower loop in Figure 5-1. Through it flow all the costs of doing business; these costs include the wages paid to labor, the rents paid to land, the profits paid to capital, and so forth. But these business costs are also the earnings that households receive from firms. By measuring the annual flow of these earnings or incomes, statisticians will again arrive at the GDP.

Hence, a second way to calculate GDP is as the total of factor earnings (wages, interest, rents, and profits) that are the costs of producing society's final products.

Equivalence of the Two Approaches. Now we have calculated GDP by the upper-loop flow-of-product approach and by the lower-loop earnings-flow approach. Which is the better approach? The surprise is that *they are exactly the same.*

We can see why the product and earnings approaches are identical by examining a simple barbershop economy. Say the barbers have no expenses other than labor. If they sell 10 haircuts at $8 each, GDP is $80. But the barbers' earnings (in wages and profits) are also exactly $80. Hence, the GDP here is identical whether measured as flow of products ($80 of haircuts) or as cost and income ($80 of wages and profits).

In fact, the two approaches are identical because we have included "profit" in the lower loop along with other incomes. What exactly is profit? Profit is what remains from the sale of a product after you have paid the other factor costs—wages, interest, and rents. It is the residual that adjusts automatically to make the lower loop's costs or earnings exactly match the upper loop's value of goods.

To sum up:

GDP, or gross domestic product, can be measured in two different ways: (1) as the flow of final products, or (2) as the total costs or earnings of inputs producing output. Because profit is a residual, both approaches will yield exactly the same total GDP.

National Accounts Derived from Business Accounts

You might wonder where on earth economists find all the data for the national accounts. In practice, government economists draw on a wide array of sources, including surveys, income-tax returns, retail-sales statistics, and employment data.

The most important source of data is business accounts. An *account* for a firm or nation is a numerical record of all flows (outputs, costs, etc.) during a given period. We can show the relationship between business accounts and national accounts by constructing the accounts for an economy made up only of farms. The top half of Table 5-1 shows the results of a year's farming operations for a single, typical farm. We put sales of final products on the left-hand side and the various costs of production on the right. The bottom half of Table 5-1 shows how to construct the GDP accounts for our simple agrarian economy in which all final products are produced on 10 million identical farms. The national accounts simply add together or *aggregate* the outputs and costs of the

sam14893_ch05_091 11/17/00 7:04 AM Page 91

(a) Income Statement of Typical Farm

Output in Farming		Earnings	
Sales of goods (corn, apples, etc.)	**$1,000**	**Costs of production:**	
		Wages	$ 800
		Rents	100
		Interest	25
		Profit (residual)	75
Total	$1,000	Total	$1,000

(b) National Product Account (millions of dollars)

Upper-Loop Flow of Product		Lower-Loop Flow of Earnings	
Final output (10 × 1,000)	**$10,000**	**Costs or earnings:**	
		Wages (10 × 800)	$ 8,000
		Rents (10 × 100)	1,000
		Interest (10 × 25)	250
		Profit (10 × 75)	750
GDP Total	$10,000	GDP Total	$10,000

TABLE 5-1. Construction of National Product Accounts from Business Accounts

Part (**a**) shows the income statement of a typical farm. The left side shows the value of production, while the right side shows the farm's costs. Part (**b**) then adds up or aggregates the 10 million identical farms to obtain total GDP. Note that GDP from the product side exactly equals GDP from the earnings side.

10 million identical farms to get the two different measures of GDP.

The Problem of "Double Counting"

We defined GDP as the total production of final goods and services. A *final product* is one that is produced and sold for consumption or investment. GDP excludes *intermediate goods*—goods that are used up to produce other goods. GDP therefore includes bread but not wheat, and home computers but not computer chips.

For the flow-of-product calculation of GDP, excluding intermediate products poses no major complications. We simply include the bread and computers in GDP but avoid including the wheat and dough that went into the bread or the chips and plastic that went into the computers. If you look again at the upper loop in Figure 5-1, you will see that bread and computers appear in the flow of products, but you will not find any flour or computer chips.

What has happened to products like flour and computer chips? They are intermediate products and are simply cycling around inside the block marked "Producers." If they are not bought by consumers, they never show up as final products in GDP.

"Value Added" in the Lower Loop. A new statistician who is being trained to make GDP measurements might be puzzled, saying:

> I can see that, if you are careful, your upper-loop product approach to GDP will avoid including intermediate products. But aren't you in some trouble when you use the lower-loop cost or earnings approach?
>
> After all, when we gather income statements from the accounts of firms, won't we pick up what grain merchants pay to wheat farmers, what bakers pay to grain merchants, and what grocers pay to bakers? Won't this result in double counting or even triple counting of items going through several productive stages?

sam14893_ch05_092 11/17/00 10:29 AM Page 92

These are good questions, but there is an ingenious answer that resolves the problem. In making lower-loop earnings measurements, statisticians are very careful to include in GDP only a firm's value added. **Value added** is the difference between a firm's sales and its purchases of materials and services from other firms.

In other words, in calculating the GDP earnings or value added by a firm, the statistician includes all costs except for payments made to other businesses. Hence business costs in the form of wages, salaries, interest payments, and dividends are included in value added, but purchases of wheat or steel or electricity are excluded from value added. Why are all the purchases from other firms excluded from value added to obtain GDP? Because those purchases will get properly counted in GDP in the values added by other firms.

Table 5-2 uses the stages of bread production to illustrate how careful adherence to the value-added approach enables us to subtract purchases of intermediate goods that show up in the income statements of farmers, millers, bakers, and grocers. The final calculation shows the desired equality between (1) final sales of bread and (2) total earnings, calculated as the sum of all values added in all the different stages of bread production.

Value-added approach: To avoid double counting, we take care to include only final goods in GDP and to exclude the intermediate goods that are used up in making the final goods. By measuring the value added at each stage, taking care to subtract expenditures on the intermediate goods bought from other firms, the lower-loop earnings approach properly avoids all double counting and records wages, interest, rent, and profit exactly one time.

DETAILS OF THE NATIONAL ACCOUNTS

Now that we have an overview of the national income and product accounts, we will proceed, in the rest of this chapter, on a whirlwind tour of the various sectors. Before we start on the journey, look at Table 5-3 to get an idea of where we are going. This table shows a summary set of accounts for both the product and the income sides. If you know the structure

Bread Receipts, Costs, and Value Added (cents per loaf)

Stage of production	(1) Sales receipts	(2) *Less:* Cost of intermediate products		(3) Value added (wages, profit, etc.) (3) = (1) − (2)
Wheat	23	0	=	**23**
Flour	53	23	=	**30**
Baked dough	110	53	=	**57**
Final product: bread	**190**	110	=	**80**
Total	376	186		**190** (sum of value added)

TABLE 5-2. GDP Sums Up Value Added at Each Production Stage

To avoid double counting of intermediate products, we calculate value added at each stage of production. This involves subtracting all the costs of materials and intermediate products bought from other businesses from total sales. Note that every black intermediate-product item both appears in column (1) and is subtracted in the next stage of production in column (2). (How much would we overestimate GDP if we counted all receipts, not just value added? The overestimate would be 186 cents per loaf.)

sam14893_ch05_093 11/17/00 7:04 AM Page 93

Product approach	Earnings approach
Components of gross domestic product:	**Earnings or costs as sources of gross domestic product:**
Consumption (C)	Wages, salaries, and other labor income
+ Gross private domestic investment (I)	+ Interest, rent, and other property income
+ Government purchases (G)	+ Indirect taxes
+ Net exports (X)	+ Depreciation
	+ Profits
Equals: Gross domestic product	**Equals: Gross domestic product**

TABLE 5-3. Overview of the National Income and Product Accounts

This table presents the major components of the two sides of the national accounts. The left side shows the components of the product approach (or upper loop); the symbols C, I, G, and X are often used to represent these four items of GDP. The right side shows the components of the earnings or cost approach (or lower loop). Each approach will ultimately add up to exactly the same GDP.

of the table and the definitions of the terms in it, you will be well on your way to understanding GDP and its family of components.

Real vs. Nominal GDP: "Deflating" GDP by a Price Index

We define GDP as the dollar value of goods and services. In measuring the dollar value, we use the measuring rod of *market prices* for the different goods and services. But prices change over time, as inflation generally sends prices upward year after year. Who would want to measure things with a rubber yardstick—one that stretches in your hands from day to day—rather than a rigid and invariant yardstick?

The problem of changing prices is one of the problems economists have to solve when they use money as their measuring rod. Clearly, we want a measure of the nation's output and income that uses an invariant yardstick. Economists can replace the elastic yardstick with a reliable one by removing the price-increase component so as to create a real or quantity index of national output.

Here is the basic idea: We can measure the GDP for a particular year using the actual market prices of that year; this gives us the **nominal GDP,** or GDP at current prices. But we are usually more interested in determining what has happened to the **real GDP,** which is an index of the volume or quantity of goods and services produced. We measure real GDP by multiplying the quantities of goods by an invariant or fixed set of prices. Hence, nominal GDP is calculated using changing prices while real GDP is calculated using constant prices.

When we divide nominal GDP by real GDP, we obtain the **GDP deflator,** which serves as a measure of the overall price level. We can calculate real GDP by dividing nominal GDP by the GDP deflator.

A simple example will illustrate the general idea. Say that a country produces 1000 bushels of corn in year 1 and 1010 bushels in year 2. The price of a bushel is \$1 in year 1 and \$2 in year 2. We can calculate nominal GDP (PQ) as $\$1 \times 1000 = \$1000$ in year 1 and $\$2 \times 1010 = \$2020$ in year 2. Nominal GDP therefore grew by 102 percent between the two years.

But the actual amount of output did not grow anywhere near that rapidly. To find real output, we need to consider what happened to prices. We use year 1 as the base year, or the year in which we measure prices. We set the price index, the GDP deflator, as $P_1 = 1$ in the first, or base, year. From the data in the previous paragraph, we see that the GDP deflator is $P_2 = \$2/\$1 = 2$ in year 2. Real GDP (Q) is equal to nominal GDP (PQ) divided by the GDP deflator (P). Hence real GDP was equal to $\$1000/1 = \$1000$ in year 1 and $\$2020/2 = \$1010$ in year 2. Thus the growth in real GDP, which corrects for the change in prices, is 1 percent and equals the growth in the output of corn, as it should.

sam14893_ch05_094 11/17/00 10:29 AM Page 94

Date	(1) Nominal GDP (current $, billion)	(2) Index number of prices (GDP deflator, 1929 = 1)	(3) Real GDP ($, billion, 1929 prices) (3) = (1)/(2)
1929	104	1.00	$\frac{104}{1.00} = 104$
1933	56	0.77	$\frac{56}{0.77} = 73$

TABLE 5-4. Real (or Inflation-Corrected) GDP Is Obtained by Dividing Nominal GDP by the GDP Deflator

Using the price index of column (2), we deflate column (1) to get real GDP, column (3). (Riddle: Can you show that 1929's real GDP was $80 billion in terms of 1933 prices? *Hint*: With 1933 as a base of 1, 1929's price index is 1.30.)

A 1929–1933 comparison will illustrate the deflation process for an actual historical episode. Table 5-4 gives nominal GDP figures of $104 billion for 1929 and $56 billion for 1933. This represents a 46 percent drop in nominal GDP from 1929 to 1933. But the government estimates that prices on average dropped about 23 percent over this period. If we choose 1929 as our base year, with the GDP deflator of 1 in that year, this means that the 1933 price index was about 0.77. So our $56 billion 1933 GDP was really worth much more than half the $104 billion GDP of 1929. Table 5-4 shows that real GDP fell to only seven-tenths of the 1929 level: in terms of 1929 prices, or dollars of 1929 purchasing power, real GDP fell to $73 billion. Hence, part of the near-halving shown by the nominal GDP was due to the rapidly declining price level, or deflation, during the Great Depression.

The black line in Figure 5-2 shows the growth of nominal GDP since 1929, expressed in the actual dollars and prices that were current in each historical year. Then, for comparison, the real GDP, expressed in 1996 dollars, is shown in blue. Clearly, much of the increase in nominal GDP over the last half-century is due to inflation in the price units of our money yardstick.

Table 5-4 shows the simplest way of calculating real GDP and the GDP deflator. Sometimes these calculations give misleading results, particularly when the prices and quantities of important goods are changing rapidly. For example, over the last two decades, computer prices have been falling very sharply while the quantity of computers produced has risen rapidly (we return to this issue in our discussion of price indexes below).

When relative prices are changing sharply, using prices of a given year will give a misleading estimate of real GDP growth. To correct for this bias, statisticians use *chain weights*. Instead of keeping the relative weights on each good fixed (say, by using prices for a given year, like 1990), chain weights change each year to reflect the evolving spending patterns in the economy. Today, the official U.S. government measures of GDP and GDP price index rely upon chain weights. The technical names for these constructs are "real GDP in chained dollars" and the "chain-type price index for GDP."[1] For simplicity, we

[1] The process of chain weighting involves linking the output or price series together by multiplying the growth rates from one period to another. An example for a haircut economy will show how this works. Say that the value of the haircuts was $300 in 1998. Further suppose that the quantity of haircuts increased by 1 percent from 1998 to 1999 and by 2 percent from 1999 to 2000. Then the value of real GDP in 1998 prices would be $300 in 1998, $300 × 1.01 = $303 in 1999, and $303 × 1.02 = $309.06 in 2000. The same procedure would be used to construct the chain price index. With multiple outputs, we simply add together the outputs of the different components of apples, bananas, catamarans, etc.

sam14893_ch05_095 11/17/00 7:05 AM Page 95

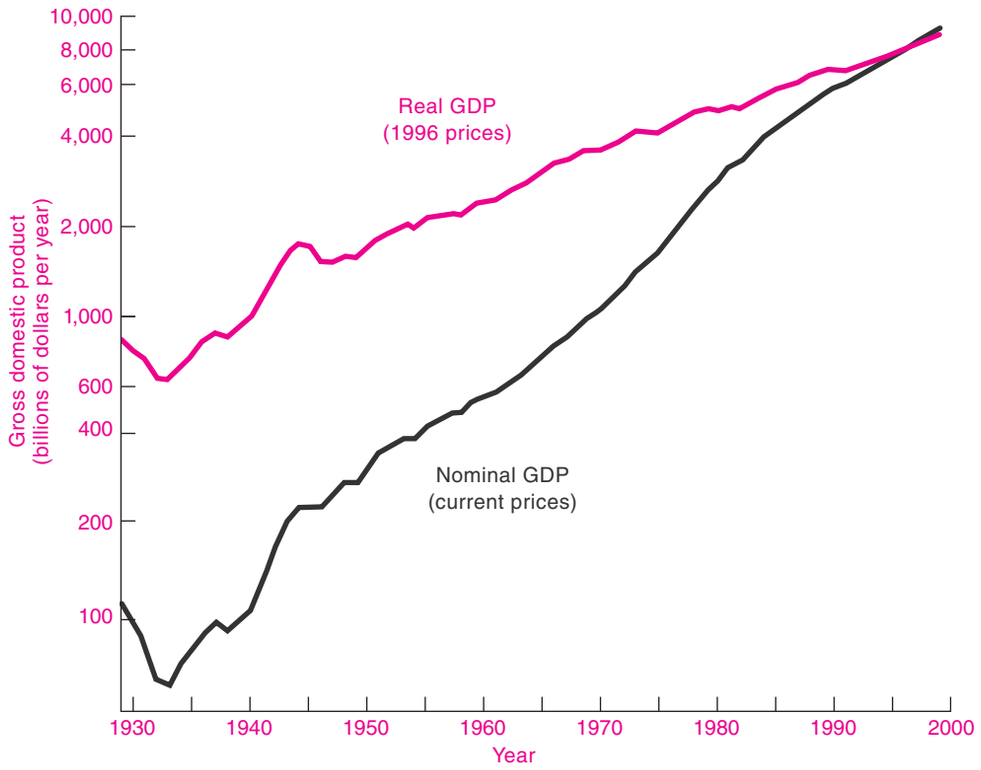

FIGURE 5-2. Nominal GDP Grows Faster than Real GDP Because of Price Inflation

The rise in nominal GDP exaggerates the rise in output. Why? Because growth in nominal GDP includes increases in prices as well as growth in output. To obtain an accurate measure of real output, we must correct GDP for price changes. (Source: U.S. Department of Commerce.)

generally refer to real GDP and the GDP deflator, whose movements track the chain indexes very closely.

To summarize:

Nominal GDP (PQ) represents the total money value of final goods and services produced in a given year, where the values are expressed in terms of the market prices of each year. Real GDP (Q) removes price changes from nominal GDP and calculates GDP in constant prices. The traditional GDP deflator (P) is the "price of GDP" and is defined as follows:

$$Q = \text{real GDP} = \frac{\text{nominal GDP}}{\text{GDP deflator}} = \frac{PQ}{P}$$

To correct for rapidly changing relative prices, the U.S. national accounts use chain weights to construct real GDP and price indexes.

Consumption

The first important part of GDP is consumption, or "personal consumption expenditures." Consumption is by far the largest component of GDP, equaling about two-thirds of the total in recent years. Figure 5-3 shows the fraction of GDP devoted to consumption over the last six decades. Consumption expenditures are divided into three categories: durable goods such as automobiles, nondurable goods such as food, and services such as medical care. The most rapidly growing sector is services.

sam14893_ch05_096 11/17/00 10:29 AM Page 96

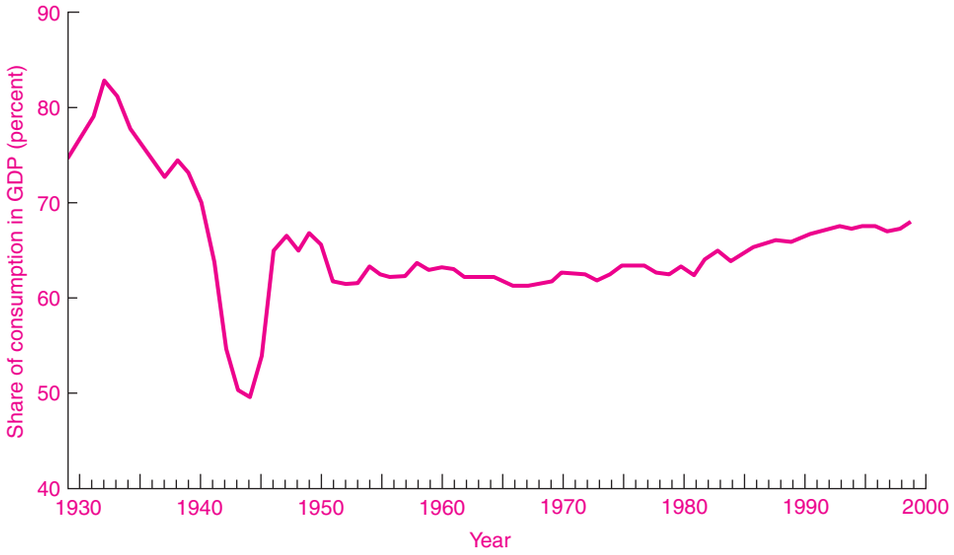

FIGURE 5-3. Share of Consumption in National Output Has Risen Recently

The share of consumption in total GDP rose during the Great Depression as investment prospects soured, then shrank sharply during World War II when the war effort displaced civilian needs. In the last two decades, consumption has grown more rapidly than total output as the national savings rate and government purchases have declined. (Source: U.S. Department of Commerce.)

Investment and Capital Formation

So far, our analysis has banished all capital. In real life, however, nations devote part of their output to production of capital—durable goods that increase future production. Increasing capital requires the sacrifice of current consumption to increase future consumption. Instead of eating more pizza now, people build new pizza ovens to make it possible to produce more pizza for future consumption.

In the accounts, **investment** consists of the additions to the nation's capital stock of buildings, equipment, software, and inventories during a year. The national accounts include mainly tangible capital (such as buildings and computers) but omit most intangible capital (such as research and development or educational expenses).

Real investment versus financial investment

Economists define "investment" (or sometimes *real investment*) as production of durable capital goods. In common usage, "investment" often denotes using money to buy General Motors stock or to open a savings account. For clarity, economists call this *financial investment*. Try not to confuse these two different uses of the word "investment."

If I take $1000 from my safe and buy some Internet stocks, this is not what macroeconomists call investment. I have simply exchanged one financial asset for another. Investment takes place when a physical capital good is produced.

How does investment fit into the national accounts? If people are using part of society's production possibilities for capital formation rather than for consumption, economic statisticians recognize that such outputs must be included in the upper-loop flow of GDP. Investments represent additions to the stock of durable capital goods that increase production possibilities in the future. So we must modify our original definition to read:

Gross domestic product is the sum of all final products. Along with consumption goods and services, we must also include gross investment.

sam14893_ch05_097 11/17/00 7:05 AM Page 97

Net vs. Gross Investment. Our revised definition includes "gross investment" along with consumption. What does the word "gross" mean in this context? It indicates that investment includes all investment goods produced. Gross investment is not adjusted for **depreciation,** which measures the amount of capital that has been used up in a year. Thus gross investment includes all the machines, factories, and houses built during a year—even though some were produced simply to replace some old capital goods that burned down or were thrown on the scrap heap.

If you want to get a measure of the increase in society's capital, gross investment is not a sensible measure. Because it excludes a necessary allowance for depreciation, it is too large—too gross.

An analogy to population will make clear the importance of considering depreciation. If you want to measure the increase in the size of the population, you cannot simply count the number of births, for this would clearly exaggerate the net change in population. To get population growth, you must also subtract the number of deaths.

The same point holds for capital. To find the net increase in capital, you must start with gross investment and subtract the deaths of capital in the form of depreciation, or the amount of capital used up.

Thus to estimate capital formation we measure *net investment.* Net investment is always births of capital (gross investment) less deaths of capital (capital depreciation):

Net investment equals gross investment minus depreciation.

Government

Up to now we have talked about consumers but ignored the biggest buyers of all—federal, state, and local governments. Somehow GDP must take into account the billions of dollars of product a nation *collectively* consumes or invests. How do we do this?

Measuring government's contribution to national output is complicated because most government services are not sold on the marketplace. Rather, government purchases both consumption-type goods (like food for the military) and investment-type items (such as computers or roads). In measuring government's contribution to GDP, we simply add all these government purchases to the flow of consumption, investment, and, as we will see later, net exports.

Hence, all the government payroll expenditures on its employees plus the costs of goods it buys from private industry (lasers, roads, and airplanes) are included in this third category of flow of products, called "government consumption expenditures and gross investment." This category equals the contribution of federal, state, and local governments to GDP.

Exclusion of Transfer Payments. Does this mean that every dollar of government expenditure is included in GDP? Definitely not. GDP includes only government purchases of goods and services; it excludes spending on transfer payments.

Government **transfer payments** are government payments to individuals that are not made in exchange for goods or services supplied. Examples of government transfers include unemployment insurance, veterans' benefits, and old-age or disability payments. These payments meet important social purposes, but, since they are not purchases of current goods or services, they are omitted from GDP.

Thus if you receive a wage from the government because you are a teacher, your wage is a factor payment and would be included in GDP. If you receive a welfare payment because you are poor, that payment is not in return for a service but is a transfer payment and would be excluded from GDP.

One peculiar government transfer payment is the interest on the government debt. Interest is treated as a payment for debt incurred to pay for past wars or government programs and is not considered to be a purchase of a current good or service. Government interest payments are considered transfers and are therefore omitted from GDP.

Finally, do not confuse the way the national accounts measure government spending on goods and services (G) with the official government budget. When the Treasury measures its expenditures, it includes expenditures on goods and services (G) *plus* transfers.

Taxes. In using the flow-of-product approach to compute GDP, we need not worry about how the government finances its spending. It does not matter whether the government pays for its goods and services by taxing, by printing money, or by borrowing. Wherever the dollars come from, the statistician computes the governmental component of GDP as the actual cost to the government of the goods and services.

sam14893_ch05_098 11/17/00 10:29 AM Page 98

But while it is fine to ignore taxes in the flow-of-product approach, we must account for taxes in the earnings or cost approach to GDP. Consider wages, for example. Part of my wage is turned over to the government through personal income taxes. These direct taxes definitely do get included in the wage component of business expenses, and the same holds for direct taxes (personal or corporate) on interest, rent, and profit.

Or consider the sales tax and other indirect taxes that manufacturers and retailers have to pay on a loaf of bread (or on the wheat, flour, and dough stages). Suppose these indirect taxes total 10 cents per loaf, and suppose wages, profit, and other value-added items cost the bread industry 90 cents. What will the bread sell for in the product approach? For 90 cents? Surely not. The bread will sell for $1, equal to 90 cents of factor costs plus 10 cents of indirect taxes.

Thus the cost approach to GDP includes both indirect and direct taxes as elements of the cost of producing final output.

Net Exports

The United States is an open economy engaged in importing and exporting goods and services. The last component of GDP—and an increasingly important one in recent years—is **net exports,** the difference between exports and imports of goods and services.

How do we draw the line between our GDP and other countries' GDPs? The U.S. GDP represents all goods and services produced within the boundaries of the United States. Production differs from sales in the United States in two respects. First, some of our production (Iowa wheat and Boeing aircraft) is bought by foreigners and shipped abroad, and these items constitute our *exports.* Second, some of what we consume (Mexican oil and Japanese cars) is produced abroad and shipped to the United States, and such items are American *imports.*

A Numerical Example. We can use a simple farming economy to understand how the national accounts work. Suppose that Agrovia produces 100 bushels of corn and 7 bushels are imported. Of these, 87 bushels are consumed (in C), 10 go for government purchases to feed the army (as G), and 6 go into domestic investment as increases in inventories (I). In addition, 4 bushels are exported, so net exports (X) are $4 - 7$, or minus 3.

What, then, is the composition of the GDP of Agrovia? It is the following:

$$\begin{aligned}\text{GDP} &= 87 \text{ of } C + 10 \text{ of } G + 6 \text{ of } I - 3 \text{ of } X \\ &= 100 \text{ bushels}\end{aligned}$$

Gross Domestic Product, Net Domestic Product, and Gross National Product

Although GDP is the most widely used measure of national output in the United States, two other concepts are frequently cited: net domestic product and gross national product.

Recall that GDP includes *gross* investment, which is net investment plus depreciation. A little thought

1. **GDP from the product side is the sum of four major components**:
   - Personal consumption expenditure on goods and services (C)
   - Gross private domestic investment (I)
   - Government consumption expenditures and gross investment (G)
   - Net exports of goods and services (X), or exports minus imports
2. **GDP from the cost side is the sum of the following major components**:
   - Wages and salaries, interest, rents, and profit (always with the careful exclusion, by the value-added technique, of double counting of intermediate goods bought from other firms)
   - Indirect business taxes that show up as an expense of producing the flow of products
   - Depreciation
3. **The product and cost measures of GDP are identical** (by adherence to the rules of value-added bookkeeping and the definition of profit as a residual).
4. **Net domestic product (NDP) equals GDP minus depreciation.**

TABLE 5-5. Key Concepts of the National Income and Product Accounts

sam14893_ch05_099 11/17/00 7:06 AM Page 99

suggests that including depreciation is rather like including wheat as well as bread. A better measure would include only *net* investment in total output. By subtracting depreciation from GDP we obtain **net domestic product** (NDP). If NDP is a sounder measure of a nation's output than GDP, why do national accountants focus on GDP? They do so because depreciation is somewhat difficult to estimate, whereas gross investment can be estimated fairly accurately.

An alternative measure of national output, widely used until recently, is **gross national product** (GNP). What is the difference between GNP and GDP? GNP is the total output produced with labor or capital *owned* by U.S. residents, while GDP is the output produced with labor and capital *located inside* the United States. For example, some of the U.S. GDP is produced in Honda plants that are owned by Japanese corporations. The profits from these plants are included in U.S. GDP but not in U.S. GNP because Honda is a Japanese company. Similarly, when an American economist flies to Japan to give a paid lecture on baseball economics, payment for that lecture would be included in Japanese GDP and in American GNP. For the United States, GDP is very close to GNP, but these may differ substantially for very open economies.

To summarize:

Net domestic product (NDP) equals the total final output produced within a nation during a year, where output includes net investment, or gross investment less depreciation:

$$NDP = GDP - \text{depreciation}$$

Gross national product (GNP) is the total final output produced with inputs owned by the residents of a country during a year.

Table 5-5 provides a comprehensive definition of important components of GDP.

GDP and NDP: A Look at Numbers

Armed with an understanding of the concepts, we can turn to a look at the actual data in the important Table 5-6.

Flow-of-Product Approach. Look first at the left side of the table. It gives the upper-loop, flow-of-product approach to GDP. Each of the four major components appears there, along with the production in each component for 1999. Of these, *C* and *G* and their obvious subclassifications require little discussion.

Gross Domestic Product, 1999 (billions of current dollars)

Product Approach			Earnings or Cost Approach	
1. Personal consumption expenditure		$6,257	1. Wages, salaries, and supplements	$5,332
Durable goods	759		2. Net interest	468
Nondurable goods	1,843		3. Rental income of persons	146
Services	3,656		4. Indirect business taxes, adjustments, and statistical discrepancy	815
2. Gross private domestic investment		1,623	5. Depreciation	945
Residential fixed	411		6. Income of unincorporated enterprises	658
Business fixed	1,167		7. Corporate profits before taxes (adjusted)	893
Change in inventories	45		Corporate profit taxes	259
3. Government consumption and investment purchases		1,630	Dividends	365
4. Net exports		−254	Undistributed profits	269
Exports	998			
Imports	1,252			
Gross domestic product		**$9,256**	**Gross domestic product**	**$9,256**

TABLE 5-6. The Two Ways of Looking at the GDP Accounts, in Actual Numbers

The left side measures flow of products (at market prices). The right side measures flow of costs (factor earnings and depreciation plus indirect taxes). (Source: U.S. Department of Commerce.)

sam14893_ch05_100 11/17/00 10:30 AM Page 100

Gross private domestic investment does require one comment. Its total ($1623 billion) includes all new business fixed investment, residential construction, and increase in inventory of goods. This gross total excludes subtraction for depreciation of capital. After subtracting $945 billion of depreciation from gross investment, we obtain $678 billion of net investment.

Finally, note the large negative entry for net exports, −$254 billion. This negative entry represents the fact that in 1999 the United States imported $254 billion more in goods and services than it exported.

Adding up the four components on the left gives the total GDP of $9256 billion. This is the harvest we have been working for: the money measure of the American economy's overall performance for 1999.

Flow-of-Cost Approach. Now turn to the right-hand side of the table, which gives the lower-loop, flow-of-cost approach. Here we have all *net costs of production* plus *taxes* and *depreciation*.

Wages and other employee supplements include all take-home pay, fringe benefits, and taxes on wages. Net interest is a similar item. Remember that interest on government debt is not included as part of *G* or of GDP but is treated as a transfer.

Rent income of persons includes rents received by landlords. In addition, if you own your own home, you are treated as *paying rent to yourself*. This is one of many "imputations" (or derived data) in the national accounts. It makes sense if we really want to measure the housing services the American people are enjoying and do not want the estimate to change when people decide to own a home rather than rent one.

Indirect business taxes are included as a separate item along with some small adjustments, including the inevitable "statistical discrepancy," which reflects the fact that the officials never have every bit of needed data.[2]

[2] Statisticians work with incomplete reports and fill in data gaps by estimation. Just as measurements in a chemistry lab differ from the ideal, so do errors creep into both upper- and lower-loop GDP estimates. These are balanced by an item called the "statistical discrepancy." Along with the civil servants who are heads of units called "Wages," "Interest," and so forth, there actually used to be someone with the title "Head of the Statistical Discrepancy." If data were perfect, that individual would have been out of a job. In fact, during the late 1990s, income-side GDP grew substantially faster than product-side GDP, and in 1999 the statistical discrepancy was $125 billion. Economists are scratching their heads and trying to determine where all that income was hidden.

Depreciation on capital goods that were used up must appear as an expense in GDP, just like other expenses.

Profit comes last because it is the residual—what is left over after all other costs have been subtracted from total sales. There are two kinds of profits: profit of corporations and net earnings of unincorporated enterprises.

Income of unincorporated enterprises consists of earnings of partnerships and single-ownership businesses. This includes much farm and professional income.

Finally, corporate profits before taxes are shown. This entry's $893 billion in Table 5-6 includes corporate profit *taxes* of $259 billion. The remainder then goes to dividends or to undistributed corporate profits; the latter amount of $269 billion is what corporations leave or "plow back" into the business and is called *net corporate saving*.

On the right side, the flow-of-cost approach gives us the same $9256 billion of GDP as does the flow-of-product approach. The right and left sides do agree.

From GDP to Disposable Income

The basic GDP accounts are of interest not only for themselves but also because of their importance for understanding how consumers and businesses behave. Some further distinctions will help illuminate the way the nation's books are kept.

National Income. To help us understand the division of total income among the different factors of production, we construct data on *national income (NI)*. *NI* represents the total incomes received by labor, capital, and land. It is constructed by subtracting depreciation and indirect taxes from GDP. National income equals total compensation of labor, rental income, net interest, income of proprietors, and corporate profits.

The relationship between GDP and national income is shown in the first two bars of Figure 5-4. The left-hand bar shows GDP, while the second bar shows the subtractions required to obtain *NI*.

Disposable Income. A second important concept asks, How many dollars per year do households actually have available to spend? The concept of disposable personal income (usually called **disposable**

sam14893_ch05_101 11/17/00 7:07 AM Page 101

income, or *DI*) answers this question. To get disposable income, you calculate the market and transfer incomes received by households and subtract personal taxes.

Figure 5-4 shows the calculation of *DI*. We begin with national income in the second bar. We then subtract all direct taxes on households and corporations and further subtract net business saving. (Business saving is depreciation plus profits minus dividends. Net business saving is this total minus depreciation.) Finally, we add back the transfer payments that households receive from governments. This constitutes *DI*, shown as the right-hand bar in Figure 5-4. Disposable income is what actually gets into the public's hands for consumers to dispose of as they please.

As we will see in the next chapters, *DI* is what people divide between (1) consumption spending and (2) personal saving.

Saving and Investment

As we have seen, output can be either consumed or invested. Investment is an essential economic activity because it increases the capital stock available for future production. One of the most important points about national accounting is the identity between saving and investment. We will show that, under the ac-

From GDP to National Income to Disposable Income

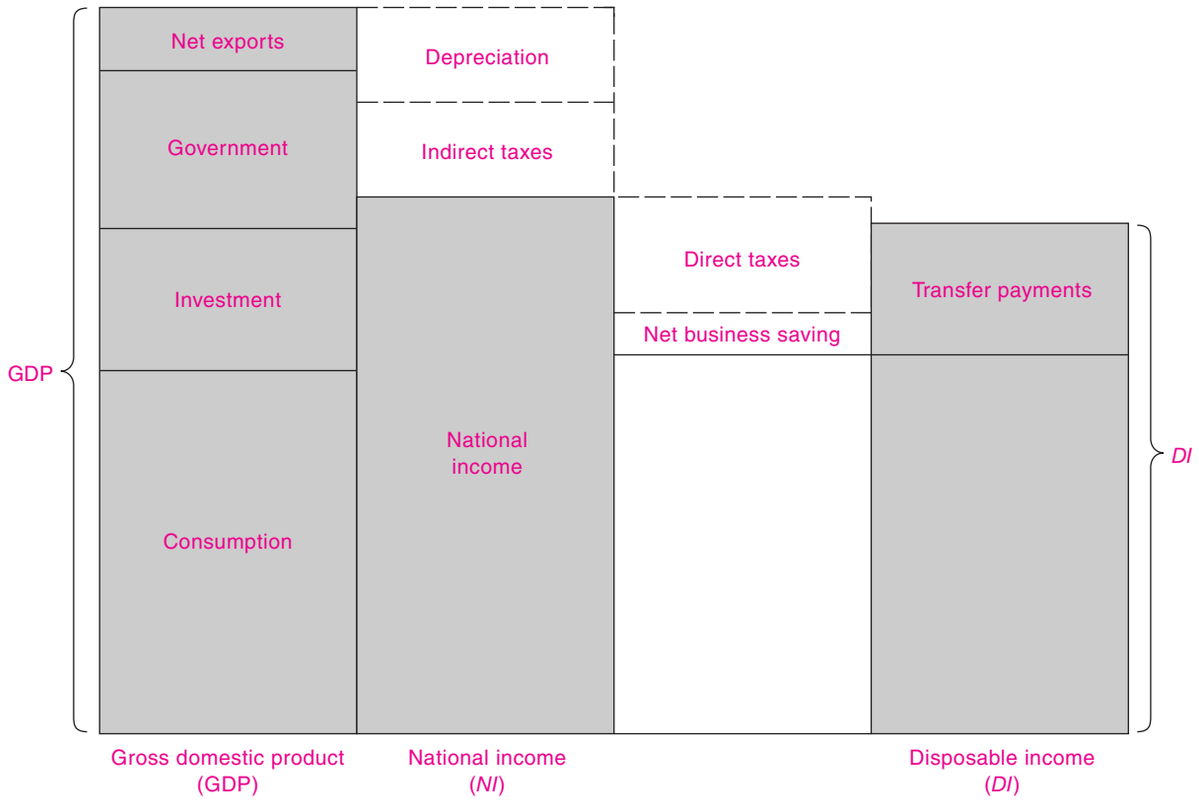

FIGURE 5-4. Starting with GDP, We Can Calculate National Income (*NI*) and Disposable Personal Income (*DI*)

Important income concepts are (1) GDP, which is total gross income to all factors; (2) national income, which is the sum of factor incomes and is obtained by subtracting depreciation and indirect taxes from GDP; and (3) disposable personal income, which measures the total incomes, including transfer payments, but minus taxes, of the household sector.

sam14893_ch05_102 11/17/00 10:30 AM Page 102

counting rules described above, *measured saving is exactly equal to measured investment.* This equality is an *identity*, which means that it must hold by definition.

In the simplest case, assume for the moment that there is no government or foreign sector. Investment is that part of national output which is not consumed. Saving is that part of national income which is not consumed. But since national income and output are equal, this means that saving equals investment. In symbols:

I = product-approach GDP minus C

S = earnings-approach GDP minus C

But the measures always give the same measure of GDP, so

$I = S$: the identity between measured saving and investment

That is the simplest case. We also need to consider the complete case which brings businesses, government, and net exports into the picture. On the saving side, total or *national saving* (S^T) is composed of *private saving* by households and businesses (S^P) along with *government saving* (S^G). Government saving equals the government's budget surplus or the difference between tax revenues and expenditures.

On the investment side, total or *national investment* (I^T) starts with *gross private domestic investment* (I) but also adds *net foreign investment*, which is approximately the same as net exports (X). Hence, the complete saving-investment identity is given by[3]

$$\text{National Investment} = \text{private investment} + \text{net exports} =$$

$$\text{private saving} + \text{government saving} = \text{national saving}$$

or

$$I^T = I + X = S^P + S^G = S^T$$

National saving equals national investment by definition. The components of investment are private domestic investment and foreign investment (or net exports). The sources of saving are private saving (by households and businesses) and government saving (the government budget surplus). Private investment plus net exports equals private saving plus the budget surplus. These identities must hold always, whatever the state of the business cycle.

BEYOND THE NATIONAL ACCOUNTS

Advocates of the existing economic and social system often argue that market economies have produced a growth in real output never before seen in human history. "Look how GDP has grown because of the genius of free markets," say the admirers of capitalism.

But critics point out the deficiencies of GDP. GDP includes many questionable entries and omits many valuable economic activities. As one dissenter said, "Don't speak to me of all your production and your dollars, your gross domestic product. To me, GDP stands for gross domestic pollution!"

What are we to think? Isn't it true that GDP includes government production of bombs and missiles along with salaries paid to prison guards? Doesn't an increase in crime boost sales of home alarms, which adds to the GDP? Doesn't cutting our irreplaceable redwoods show up as a positive output in our national accounts? Doesn't GDP fail to account for environmental degradation such as acid rain and global warming?

In recent years, economists have begun developing new measures to correct the major defects of the standard GDP numbers and better reflect the true satisfaction-producing outputs of our economy. The new approaches attempt to extend the boundaries of the traditional accounts by including important nonmarket activities as well as correcting for harmful activities that are included as part of national output. Let's consider some of the omitted pluses and minuses.

Omitted Nonmarket Activities. Recall that the standard accounts include primarily market activities. Much useful economic activity takes place outside the market. For example, college students are investing in human capital. The national accounts record the tuition, but they omit the opportunity costs of earnings forgone. Studies indicate that inclusion of non-

[3] For this discussion, we consider only private investment and therefore treat all government purchases as consumption. In most national accounts today, government purchases are divided between consumption and tangible investments. If we include government investment, then this amount will add to both national investment and the government surplus.

sam14893_ch05_103 11/17/00 10:30 AM Page 103

market investments in education and other areas would more than double the national saving rate.

Similarly, many household activities produce valuable "near-market" goods and services such as meals, laundering, and child-care services. Recent estimates of the value of unpaid household work indicate that it might be almost 50 percent as large as total market consumption. Perhaps the largest omission from the market accounts is the value of leisure time. On average, Americans spend as much of their time on utility-producing leisure activities as they do on money-producing work activities. Yet the value of leisure time is excluded from our official national statistics.

You might wonder about the many activities in the underground economy, which covers a wide variety of market activities that are not reported to the government. These include activities like gambling, prostitution, drug dealing, work done by illegal immigrants, bartering of services, and smuggling. Actually, much underground activity is intentionally excluded because national output excludes illegal activities—these are by social consensus "bads" and not "goods." A swelling cocaine trade will not enter into GDP. For other, legal but unreported activities, like unreported tips, the Commerce Department makes estimates on the basis of surveys and audits by the Internal Revenue Service.

Omitted Environmental Damage. In addition to omitting activities, sometimes GDP omits some of the harmful side effects of economic activity. An important example is the omission of environmental damages. For example, suppose the residents of Suburbia buy 10 million kilowatt-hours of electricity to cool their houses, paying Utility Co. 10 cents per kilowatt-hour. That $1 million covers the labor costs, plant costs, and fuel costs. But suppose the company damages the neighborhood with pollution in the process of producing electricity. It incurs no monetary costs for this externality. Our measure of output should not only add in the value of the electricity (which GDP does) but also subtract the environmental damage caused by the pollution (which GDP does not).

Suppose that in addition to paying 10 cents of direct costs, the surrounding neighborhood suffers 1 cent per kilowatt-hour of environmental damage. This is the cost of pollution (to trees, trout, streams, and people) not paid by Utility Co. Then the total "external" cost is $100,000. To correct for this hidden cost in a set of augmented accounts, we must subtract $100,000 of "pollution bads" from the $1,000,000 flow of "electricity goods."

Augmented national accounts

Considerable progress has been made in recent years in developing *augmented national accounts*, which are accounts designed to include both nonmarket and market activities. The general principle of augmented accounting is to include as much of economic activity as is feasible, whether or not that activity takes place in the market. Examples of augmented accounts include estimates of the value of nonmarket investments in human capital, the value of unpaid home production, the value of forests, and the value of leisure time.

In 1994, the U.S. Commerce Department unveiled its augmented national accounts with the introduction of *environmental accounts* (sometimes called "green accounts") designed to estimate the contribution of natural and environmental resources to the nation's income. The first step was the development of accounts to measure the contribution of subsoil assets like oil, gas, and coal.

Environmental critics have argued that America's wasteful ways are squandering our precious natural capital. Many were surprised by the results of this first assay into green accounting. The estimates take into account that discovery adds to our proven reserves while extraction subtracts from or depletes these reserves. In fact, these two activities just about canceled each other out: the net effect of both discoveries and depletion from 1958 to 1991 was between minus $2 billion and plus $1 billion, depending on the method, as compared to an average GDP over this period of $4200 billion (all these in 1992 prices).

There is much further work needed in this area before we have a full picture of nonmarket economic activity. Economists and environmentalists are watching this exciting new development carefully.

PRICE INDEXES AND INFLATION

We have concentrated in this chapter on the measurement of output. But people are also concerned with price trends, with movements in the overall price level, with inflation. What do these terms mean?

sam14893_ch05_104 11/17/00 10:30 AM Page 104

Let us begin with a careful definition:

A ***price index*** is a measure of the average level of prices. ***Inflation*** denotes a rise in the general level of prices. The ***rate of inflation*** is the rate of change of the general price level and is measured as follows:

$$\text{Rate of inflation (year } t) = \frac{\text{price level (year } t) - \text{price level (year } t-1)}{\text{price level (year } t-1)} \times 100$$

But how do we measure the "price level" that is involved in the definition of inflation? The price level is a weighted average of the prices of the different goods and services in an economy. The government calculates the price level by constructing **price indexes,** which are averages of prices of goods and services.

As an example, take the year 1999. In that year, the prices of most major categories rose modestly—food prices rose 2 percent and medical-care prices rose 3.5 percent, for example. Apparel prices declined, however, primarily because of sharp declines in the prices of imported clothing. Overall, when weighted by total expenditures in different areas, the consumer price index (CPI) rose 2.1 percent in 1999. In other words, the inflation rate was 2.1 percent.

The opposite of inflation is **deflation,** which occurs when the general level of prices is falling. Deflations have been rare in the late twentieth century. In the United States, the last time consumer prices actually fell from one year to the next was 1955. Sustained deflations, in which prices fall steadily over a period of several years, are associated with depressions, such as those that occurred in the United States in the 1930s and the 1890s. More recently, Japan experienced a deflation in the late 1990s as its economy suffered a prolonged recession.

Price Indexes

When newspapers tell us "Inflation is rising," they are really reporting the movement of a price index. A price index is a weighted average of the prices of a number of goods and services. In constructing price indexes, economists weight individual prices by the economic importance of each good. The most important price indexes are the consumer price index, the GDP deflator, and the producer price index.

The Consumer Price Index (CPI). The most widely used measure of inflation is the consumer price index, also known as the CPI, calculated by the Bureau of Labor Statistics (BLS). The CPI measures the cost of buying a standard basket of goods at different times. The market basket includes the prices of food, clothing, shelter, fuel, transportation, medical care, college tuition, and other goods and services purchased for day-to-day living. Prices on 364 separate classes of goods and services are collected from 23,000 establishments in 87 areas of the country.

How are the different prices weighted in constructing price indexes? It would clearly be silly merely to add up the different prices or to weight them by their mass or volume. Rather, a price index is constructed by *weighting each price according to the economic importance of the commodity in question.*

In the case of the traditional CPI, each item is assigned a fixed weight proportional to its relative importance in consumer expenditure budgets; the weights for each item are proportional to the total spending by consumers on that item as determined by a survey of consumer expenditures in the 1993–1995 period. As of December 1999, housing-related costs were the single biggest category in the CPI, taking up more than 40 percent of consumer spending budgets. By comparison, the cost of new cars and other motor vehicles accounts for only 5 percent of the CPI's consumer expenditure budgets. (We are discussing the "traditional CPI" because the government is currently in the process of undertaking a fundamental redesign of the methods for calculating the CPI.)

We can use a numerical example to illustrate how inflation is measured. Assume that consumers buy three commodities: food, shelter, and medical care. A hypothetical budget survey finds that consumers spend 20 percent of their budgets on food, 50 percent on shelter, and 30 percent on medical care.

Using 1998 as the *base year,* we reset the price of each commodity at 100 so that differences in the units of commodities will not affect the price index. This implies that the CPI is also 100 in the base year $[= (0.20 \times 100) + (0.50 \times 100) + (0.30 \times 100)]$. Next, we calculate the consumer price index and the rate of inflation for 1999. Suppose that in 1999

sam14893_ch05_105 11/17/00 10:31 AM Page 105

food prices rise 2 percent to 102, shelter prices rise 6 percent to 106, and medical-care prices are up 10 percent to 110. We recalculate the CPI for 1999 as follows:

$$\begin{aligned}\text{CPI (1999)} &= (0.20 \times 102) + (0.50 \times 106) + (0.30 \times 110) \\ &= 106.4\end{aligned}$$

In other words, if 1998 is the base year in which the CPI is 100, then in 1999 the CPI is 106.4. The rate of inflation in 1999 is then $[(106.4 - 100)/100] \times 100 = 6.4$ percent per year. Note that in a fixed-weight index like the CPI, the *prices* change from year to year but the weights remain the same.

This example captures the essence of how the traditional CPI measures inflation. The only difference between this simplified calculation and the actual one is that the CPI in fact contains many more commodities and regions. Otherwise, the procedure is exactly the same.

GDP Deflator. Another widely used price index is the *GDP deflator*, which we met earlier in this chapter. The GDP deflator is the price of all goods and services produced in the country (consumption, investment, government purchases, and net exports) rather than of a single component (such as consumption). This index also differs from the traditional CPI because it is a variable-weight index that takes into account the changing shares of different goods. In addition, there are deflators for components of GDP, such as for investment goods, computers, personal consumption, and so forth, and these are sometimes used to supplement the CPI.

In recent years, the U.S. government has introduced chain-weighted price indexes that change the weights on each good each period to reflect changes in expenditure shares (see the discussion of chain weights in note 1 on page 94).

The Producer Price Index (PPI). This index, dating from 1890, is the oldest continuous statistical series published by the BLS. It measures the level of prices at the wholesale or producer stage. It is based on approximately 3400 commodity prices, including prices of foods, manufactured products, and mining products. The fixed weights used to calculate the PPI are the net sales of each commodity. Because of its great detail, this index is widely used by businesses.

Getting the prices right

Measuring prices accurately is one of the central issues of empirical economics. Price indexes affect not only obvious things like the inflation rate. They also are embedded in measures of real output and productivity. And through government policies, they affect monetary policy, taxes, government transfer programs like social security, and many private contracts.

The purpose of the consumer price index is to measure the cost of living. You might be surprised to learn that this is a difficult task. Some problems are intrinsic to price indexes. One issue is the *index-number problem*, which involves how the different prices are weighted or averaged. Recall that the traditional CPI uses a fixed weight for each good. As a result, the cost of living is overestimated compared to the situation where consumers substitute relatively inexpensive for relatively expensive goods.

The case of energy prices can illustrate the problem. When gasoline prices rose sharply in the 1970s, people tended to cut back on their purchases and buy smaller cars or travel less. Yet the CPI assumed that they bought the same quantity of gasoline even though gasoline prices tripled. The overall rise in the cost of living was thereby exaggerated. Statisticians have devised ways of minimizing such index-number problems by using different weighting approaches, such as chain weighting, discussed above, but government statisticians are just beginning to experiment with these newer approaches for the CPI.

A more important problem arises because of the difficulty of adjusting price indexes to capture the contribution of *new and improved goods and services*. An example will illustrate this problem. In recent years, consumers have benefited from compact fluorescent lightbulbs; these lightbulbs deliver light at approximately one-fourth the cost of the older, incandescent bulbs. Yet none of the price indexes incorporate the quality improvement. Similarly, as CDs replaced long-playing records, as cable TV with hundreds of channels replaced the older technology with a few fuzzy channels, as air travel replaced rail or road travel, and in thousands of other improved goods and services, the price indexes did not reflect the improved quality.

Recent studies indicate that if quality change had been properly incorporated into price indexes, the CPI would have risen less rapidly in recent years. This problem is especially acute for medical care. In this sector, reported prices have risen sharply in the last two decades. Yet we

sam14893_ch05_106 11/17/00 10:31 AM Page 106

have no adequate measure of the quality of medical care, and the CPI completely ignores the introduction of new products, such as pharmaceuticals which replace intrusive and expensive surgery.

A panel of distinguished economists led by Stanford's Michael Boskin (chief economist to President George Bush) recently estimated that the upward bias in the CPI was slightly more than 1 percent per year. This is a small number with large implications. It indicates that our real output numbers may have been *overdeflated* by the same amount. If the CPI bias carries through to the GDP deflator, then output per worker-hour in the United States has grown at 2 percent per year over the last two decades rather than the 1 percent per year as measured in the official national accounts.

This finding also implies that cost-of-living adjustments (which are used for social security benefits and in many labor agreements) have overcompensated people for movements in the cost of living. The Boskin panel estimated that if the government were to index transfer programs according to their bias estimate rather than using the current CPI, this would by 2008 reduce the government deficit by $180 billion and lower the U.S. national debt by more than $1 trillion over a decade. These findings indicate that the economics of accounting and of index numbers are no longer just abstruse concepts of interest only to a handful of technicians. Proper construction of price and output indexes affects our government budgets, our retirement programs, and even the way we assess our national economic performance.

In response to its own research and to its critics, the BLS has undertaken a major overhaul of the CPI. The most important planned change is to fix the index-number problem by replacing the fixed-weight price index with a system (like the chain weights used in the GDP accounts) that accounts for consumer substitution. Measuring quality change accurately is a much tougher nut and is unlikely to be cracked soon.[4]

ACCOUNTING ASSESSMENT

This chapter has examined the way economists measure national output and the overall price level. Having reviewed the measurement of national output and analyzed the shortcomings of the GDP, what should we conclude about the adequacy of our measures? Do they capture the major trends? Are they adequate measures of overall social welfare? The answer was aptly stated in a review by Arthur Okun:

> It should be no surprise that national prosperity does not guarantee a happy society, any more than personal prosperity ensures a happy family. No growth of GDP can counter the tensions arising from an unpopular and unsuccessful war, a long overdue self-confrontation with conscience on racial injustice, a volcanic eruption of sexual mores, and an unprecedented assertion of independence by the young. Still, prosperity . . . is a precondition for success in achieving many of our aspirations.[5]

[4] See this chapter's Further Reading section for a symposium on CPI design.

[5] *The Political Economy of Prosperity* (Norton, New York, 1970), p. 124.

SUMMARY

1. The national income and product accounts contain the major measures of income and product for a country. The gross domestic product (GDP) is the most comprehensive measure of a nation's production of goods and services. It comprises the dollar value of consumption (C), gross private domestic investment (I), government purchases (G), and net exports (X) produced within a nation during a given year. Recall the formula:

$$\text{GDP} = C + I + G + X$$

This will sometimes be simplified by combining private domestic investment and net exports into total gross national investment ($I^T = I + X$):

$$\text{GDP} = C + I^T + G$$

2. Because of the way we define residual profit, we can match the upper-loop, flow-of-product measurement of GDP with the lower-loop, flow-of-cost measurement, as shown in Figure 5–1. The flow-of-cost approach uses factor earnings and carefully computes value added to

sam14893_ch05_107 11/17/00 7:08 AM Page 107

eliminate double counting of intermediate products. And after summing up all (before-tax) wage, interest, rent, depreciation, and profit income, it adds to this total all indirect tax costs of business. GDP does not include transfer items such as interest on government bonds or welfare payments.

3. By use of a price index, we can "deflate" nominal GDP (GDP in current dollars) to arrive at a more accurate measure of real GDP (GDP expressed in dollars of some base year's purchasing power). Use of such a price index corrects for the "rubber yardstick" implied by changing levels of prices.
4. Net investment is positive when the nation is producing more capital goods than are currently being used up in the form of depreciation. Since depreciation is hard to estimate accurately, statisticians have more confidence in their measures of gross investment than in those of net investment.
5. National income and disposable income are two additional official measurements. Disposable income (*DI*) is what people actually have left—after all tax payments, corporate saving of undistributed profits, and transfer adjustments have been made—to spend on consumption or to save.
6. Using the rules of the national accounts, measured saving must exactly equal measured investment. This is easily seen in a hypothetical economy with nothing but households. In a complete economy, *private saving and government surplus equal domestic investment plus net foreign investment.* The identity between saving and investment is just that: saving must equal investment no matter whether the economy is in boom or recession, war or peace. It is a consequence of the definitions of national income accounting.
7. Gross domestic product and even net domestic product are imperfect measures of genuine economic welfare. In recent years, statisticians have started correcting for nonmarket measures such as unpaid work at home and environmental externalities.
8. Inflation occurs when the general level of prices is rising (and deflation occurs when it is falling). We measure the overall price level and rate of inflation using price indexes—weighted averages of the prices of thousands of individual products. The most important price index is the consumer price index (CPI), which traditionally measured the cost of a fixed market basket of consumer goods and services relative to the cost of that bundle during a particular base year. Recent studies indicate that the CPI trend has a major upward bias because of index-number problems and omission of new and improved goods, and the government has undertaken steps to correct some of this bias.

CONCEPTS FOR REVIEW

national income and product accounts (national accounts)
real and nominal GDP
GDP deflator
GDP = $C + I + G + X$
net investment = gross investment − depreciation
GDP in two equivalent views:
  product (upper loop)
  earnings (lower loop)
intermediate goods, value added
NDP = GDP − depreciation
government transfers
disposable income (*DI*)
investment-saving identity
  $I = S$
  $I^T = I + X = S^P + S^G = S^T$
inflation, deflation
price index:
  CPI
  GDP deflator
  PPI

FURTHER READING AND INTERNET WEBSITES

Further Reading

A magnificent compilation of historical data on the United States is contained in *Historical Statistics of the United States* (Washington, D.C., Government Printing Office, 1975, two volumes). A review of the issues involving measuring the consumer price index is contained in "Symposium on the CPI," *Journal of Economic Perspectives*, Winter 1998.

Websites

The premium site for the U.S. National Income and Product Accounts is from the Bureau of Economic Analysis (BEA) at www.bea.doc.gov. This site also contains recent issues of *The Survey of Current Business*, which discusses recent economic trends.

sam14893_ch05_108 11/17/00 10:31 AM Page 108

A comprehensive launching pad for government data in many sectors can be found at www.lib.umich.edu/libhome/Documents.center/stats.html. The best single statistical source for data on the United States is *The Statistical Abstract of the United States*, published annually. It is available online at www.census.gov/statab/www.

A recent review of alternative approaches to augmented and environmental accounting is contained in a report by the National Academy of Sciences in William Nordhaus and Edward Kokkelenberg, eds., *Nature's Numbers: Expanding the National Accounts to Include the Environment* (Washington, D.C., National Academy Press, 1999) available at www.nap.edu.

QUESTIONS FOR DISCUSSION

1. Define carefully the following and give an example of each:
   a. Consumption
   b. Gross private domestic investment
   c. Government consumption and investment purchase (in GDP)
   d. Government transfer payment (not in GDP)
   e. Exports
2. You sometimes hear, "You can't add apples and oranges." Show that we can and do add apples and oranges in the national accounts. Explain how.
3. Examine the data in the appendix to Chapter 4. Locate the figures for nominal and real GDP for 1999 and 1998. Calculate the GDP deflator. What were the rates of growth of nominal GDP and real GDP for 1999? What was the rate of inflation (as measured by the GDP deflator) for 1999?
4. Robinson Crusoe produces upper-loop product of $1000. He pays $750 in wages, $125 in interest, and $75 in rent. What must his profit be? If three-fourths of Crusoe's output is consumed and the rest invested, calculate Crusoeland's GDP with both the product and the income approaches and show that they must agree exactly.
5. Here are some brain teasers. Can you see why the following are not counted in U.S. GDP?
   a. The gourmet meals produced by a fine chef
   b. The purchase of a plot of land
   c. The purchase of an original Rembrandt painting
   d. The value I get in 2000 from playing a 1997 compact disc
   e. Damage to houses and crops from pollution emitted by electric utilities
   f. Profits earned by IBM on production in a British factory
6. Consider the country of Agrovia, whose GDP is discussed in "A Numerical Example" on page 98. Construct a set of national accounts like that in Table 5–6 assuming that wheat costs $5 per bushel, there is no depreciation, wages are three-fourths of national output, indirect business taxes are used to finance 100 percent of government spending, and the balance of income goes as rent income to farmers.
7. Review the discussion of bias in the CPI. Explain why failure to consider the quality improvement of a new good leads to an upward bias in the trend of the CPI. Pick a good you are familiar with. Explain how its quality has changed and why it might be difficult for a price index to capture the increase in quality.
8. In recent decades, women have worked more hours in paid jobs and fewer hours in unpaid housework.
   a. How would this increase in work hours affect GDP?
   b. Explain why this increase in measured GDP will overstate the true increase in output. Also explain how a set of augmented national accounts which includes home production would treat this change from nonmarket work to market work.
   c. Explain the paradox, "When a person marries his or her gardener, GDP goes down."