Chapter Key Ideas

An Economic Barometer
A. What exactly is GDP and how do we use it to tell us whether our economy is in a recession or how rapidly our economy is expanding?
B. How do we take the effects of inflation out of GDP to compare economic well-being over time and how do we compare economic well-being across counties?

Outline

I. Gross Domestic Product
A. GDP Defined
1. **GDP** or **Gross domestic product**, is the market value of all final goods and services produced within a country in a given time period.
2. GDP is a market value—goods and services are valued at their market prices.
   a) To add apples and oranges, computers and popcorn, we add the market values so we have a total value of output in dollars.
3. GDP is the value of the **final goods and services** produced.
   a) A **final good** (or service), is an item bought by its final user during a specified time period.
   b) A final good contrasts with an **intermediate good** (or service), which is an item that is produced by one firm, bought by another firm, and used as a component of a final good or service.
   c) Excluding intermediate goods and services avoids **double counting**.
4. GDP measures production within a country—**domestic production**.
5. GDP measures production during a specific time period, normally a year or a quarter of a year.
B. GDP and the Circular Flow of Expenditure and Income
1. GDP measures the value of production, which also equals total expenditure on final goods and total income.

* This is Chapter 21 in *Economics.*
2. The circular flow diagram in Figure 5.1 illustrates the equality of income, expenditure, and the value of production.

**FIGURE 5.1 The Circular Flow of Expenditure and Income**

3. The equality of income and output shows the link between productivity and living standards.
   a) The circular flow diagram shows the transactions among four economic agents—households, firms, governments, and the rest of the world.
   b) The circular flow diagram also shows the three aggregate markets—goods markets, factor markets, and financial markets.

4. Households and firms interact in two markets.
   a) In factor markets households receive income from selling the services of resources to firms. The total income received is *aggregate income*. It includes wages paid to workers, interest for the use of capital, rent for the use of land and natural resources, and profits paid to entrepreneurs; retained profits are part of household income, lent back to firms.
   b) In goods markets households buy and firms sell goods and services that firms produce. The total payments made by households for these goods and services is *consumption expenditure*, \( C \).
   c) Some firms sell, and others buy, capital goods in the goods market. Output produced but not sold is added to inventory. The purchase of new plants, equipment, and buildings and the additions to inventory are *investment*, \( I \).

5. Governments buy goods and services from firms:
   a) Total purchases of goods and services by governments are *government purchases*, \( G \).
   b) Government purchases are financed by net taxes. *Net taxes* are taxes paid to governments minus transfer payments received from governments and minus interest payments on the governments’ debts, \( T \).
c) *Transfer payments* are cash transfers from governments to firms and households that do not buy goods or services, such as social security benefits, unemployment compensation, and subsidies.

6. Firms also interact with the rest of the world.
   a) Goods and services sold to the rest of the world are *exports*, $X$.
   b) Goods and services bought from the rest of the world are *imports*, $M$.
   c) **Net exports** are exports minus imports.

7. GDP equals expenditure equals income.
   a) The circular flow demonstrates how GDP can be measured in two ways.
      i) Aggregate expenditure, which is total expenditure on final goods and services, $C + I + G + (X - M)$, equals the value of the output of final goods and services, which is GDP.
      ii) Aggregate income earned from production of final goods, $Y$, equals the total paid out for the use of resources, wages, interest, rent, and profit. Firms pay out all their receipts from the sale of final goods, so aggregate income equals aggregate expenditure, $Y = C + I + G + (X - M)$.
   b) The national income accounts are built on the foundation of the circular flow model and the diagrams of the circular flow model illustrate that GDP equals aggregate expenditure and equals aggregate income.

C. **Financial Flows**

1. Financial markets finance deficits and investment.
2. Household *saving*, $S$, is the amount that households have left after they have paid their taxes and bought their consumption goods and services.
4. Foreign borrowing pays for a deficit with the rest of the world.

D. **How Investment Is Financed**

1. Investment is financed from three sources: private saving, $S$; the government budget surplus, $(T - G)$; and borrowing from the rest of the world $(M - X)$.
2. We can see these three sources of investment finance by using the fact that aggregate expenditure equals aggregate income. Start with

   $$ Y = C + S + T = C + I + G + (X - M). $$

   Then rearrange to obtain

   $$ I = S + (T - G) + (M - X) $$

2. Private saving $S$ plus government saving $(T - G)$ is called **national saving**.

E. **Gross and Net Domestic Product**

1. “Gross” means before accounting for the depreciation of capital. The opposite of gross is net, which means after accounting for the depreciation of capital.
2. To understand this distinction, we need to distinguish between flows and stocks in macroeconomics.
   a) A **flow** is a quantity per unit of time; a **stock** is the quantity that exists at a point in time.
   b) **Wealth**, the value of all the things that people own, is a stock. *Saving* is the flow that changes the stock of wealth.
c) *Capital*, the plant, equipment, and inventories of raw and semifinished goods that are used to produce other goods and services is a stock. *Investment* is the flow that changes the stock of capital.

i) **Depreciation**, the decrease in the capital stock that results from wear, tear, and obsolescence. *Capital consumption* is another name for depreciation. Depreciation is the flow that subtracts from capital.

ii) **Gross investment** is the total amount spent on purchases of new capital and on replacing depreciated capital.

iii) **Net investment** is the change in the capital stock. Net investment is gross investment minus depreciation.

iv) Figure 5.2 illustrates the relationships among capital, gross investment, depreciation, and net investment.

3. *Gross* profits and GDP include depreciation; similarly, gross investment includes that amount of purchases of new capital goods that replace depreciation; net profits, net domestic product, and net investment subtract depreciation from the gross concepts.

4. Increases in capital are one source of growth in potential real GDP; fluctuations in investment are one source of fluctuations in real GDP.
II. Measuring U.S. GDP

A. The Expenditure Approach

1. The expenditure approach, one of the two approaches the Bureau of Economic Analysis uses to measure GDP, is the sum of consumption expenditure, investment, government purchases of goods and services, and net exports.

2. Table 5.1 shows the expenditure approach with data for 2003.

B. The Income Approach

1. The income approach measures GDP by first adding all the incomes paid to households by firms for the use of the resources firms employ.

2. The National Income and Product Accounts divide incomes into five categories:
   a) Compensation of employees
   b) Net interest
   c) Rental income
   d) Corporate profits.
   e) Proprietors’ income.

3. The sum of these five income components is net domestic income at factor cost. Two adjustments must be made to get GDP:
   a) Indirect taxes minus subsidies are added to get from factor cost to market prices, which gives net domestic product at market prices.
   b) Depreciation (or capital consumption) must be added to get from net domestic product to gross domestic product.

4. Table 5.2 shows the income approach with data for 2003.

III. Real GDP and the Price Level

A. Calculating Real GDP

1. Real GDP is the value of final goods and services produced in a given year when valued at constant prices.
2. The first step in calculating real GDP is to calculate **nominal GDP**, which is the value of goods and services produced during a given year valued at the prices that prevailed in that same year.

   a) The old method of calculating real GDP was to value each year’s output at the prices of a base year—the base year prices method.

3. The new method of calculating real GDP, which is called the **chain-weighted output index** method, uses the prices of two adjacent years (like the data in Tables 5.3 and 5.4) to calculate the real GDP growth rate. This calculation has four steps:

   a) Value last year’s production and this year’s production at *last year’s* prices and then calculate the growth rate of this number from last year to this year as is done in Table 5.5.

   b) Value last year’s production and this year’s production at *this year’s* prices and then calculate the growth rate of this number from last year to this year as is done in Table 5.6.

   c) Calculate the average of the two growth rates in a) and b). This average growth rate is the growth rate of real GDP from last year to this year.

   d) Repeat the previous three steps for each pair of adjacent years, linking real GDP back to the base year’s prices. The base year is currently 2000.

### B. Calculating the Price Level

1. The average level of prices is called the **price level**.

2. One measure of the price level is the **GDP deflator**, which is an average of the current-year prices expressed as a percentage of the base-year prices.

   a) The GDP deflator is calculated as GDP Deflator = \( \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100 \)

### C. Deflating the GDP Balloon

1. Nominal GDP can increase because production increases *and* because prices rise.
2. Using the GDP deflator we deflate nominal GDP to get real GDP as Figure 5.3 illustrates.

![Image: The U.S. GDP Balloon]


IV. Measuring Economic Growth

A. We use real GDP to calculate the economic growth rate.

1. The economic growth rate is the percentage change in the quantity of goods and services produced from one year to the next. It equals \[
\frac{(\text{Real GDP This Year} - \text{Real GDP Last Year})}{\text{Real GDP Last Year}} \times 100.
\]

2. We measure economic growth so we can make
   a) economic welfare comparisons
   b) international welfare comparisons
   c) business cycle forecasts

B. Economic Welfare Comparisons

1. Economic welfare is a comprehensive measure of the general state of economic well-being.

2. Real GDP is an imperfect measure of economic welfare for seven reasons:
   a) *Overadjustment for inflation* The price indexes used to measure inflation give an upward biased estimate of true inflation, so the inflation rate is overstated and real GDP understated.
   b) Real GDP does not include *household production*, that is, productive activities done in and around the house by members of the household.
   c) Real GDP, as measured, omits the *underground economy*, which is the part of the economy that is purposely hidden from the view of the government to avoid taxes and regulations or because the goods and services being produced are illegal.
   d) *Health* and *life expectancy* are not directly included in real GDP.
   e) *Leisure time*, a valuable component of an individual’s welfare, is not included in real GDP.
f) Environmental quality is not included in real GDP.
g) Political freedom and social justice are not included in real GDP.

C. International Comparisons
1. Real GDP is used to compare economic welfare in one country with that in another.
2. Two special problems arise in making these comparisons.
   a) Real GDP of one country must be converted into the same currency units as the real GDP of the other country, so an exchange rate must be used.
   b) The same prices should be used to value the goods and services in the countries being compared, but often are not.
      i) Using the exchange rate to compare GDP in one country with GDP in another country is problematic because prices of particular products in one country might be much less or much more than in the other country.
      ii) Using the exchange rate to value Chinese GDP in dollars leads to an estimate that U.S. real GDP per person was 34 times Chinese real GDP per person.
      iii) Using purchasing power parity prices leads to an estimate that per person GDP in the United States is 6 times that in China. Figure 5.4 illustrates these differences.

D. Business Cycle Forecasts
1. Real GDP is used to measure business cycle fluctuations.
2. These fluctuations are probably accurately timed but the changes in real GDP probably overstate the changes in total production and people’s welfare caused by business cycles.

Reading Between the Lines
As in the previous chapter, a news article discusses the fast growth in the third quarter of 2003, but this time with an emphasis on what components of GDP grew fastest. The increase in GDP was due in part to business investment, which grew at 14 percent.

New in the Seventh Edition
The comparison of economic growth in the United States and China has been updated. All the data are updated and the Reading Between the Lines is new.
Teaching Suggestions

1. **Gross Domestic Product**

   The main challenge in teaching this topic is generating interest in it. Many teachers are bored by it and not surprisingly, they bore their students. If you are one of the many who lean toward boredom, start by recalling just how vital it is that we measure the value of production with reasonable accuracy. It is vital because we use GDP as the basis of measurement of the standard of living, economic welfare, and making international comparisons.

   *Final goods versus intermediate goods.* The distinction between final and intermediate goods is one of the key points in this first section. Use some standard examples to make the key point—tires and autos, chips and computers, and so on. Also, if you want to spend a bit of time on this topic, tell your students about the Bureau of Economic Analysis (BEA) revision in the treatment of business spending on software. The BEA began a major revision in 1998 and published the first revisions to reclassify software from intermediate to final good status in 1999. And, when the 1996 GDP was recalculated to include software, it increased by $115 billion, or 1.5 percent of GDP.

2. **The Circular Flow Model**

   Start with a simpler picture than Figure 5.1—just households and firms and just income, consumption, saving, and investment. (The PowerPoint lecture notes that we’ve made for you build the material up in this way.) Then add the government and the flows of government purchases and net taxes. Finally add the rest of the world and the export and import flows.

   Explain that we’re simplifying things in the picture but are not omitting anything that leads us into a misleading conclusion. For example, we could add business tax payments. The picture envisages all the income being paid to households and households paying all the taxes. Nothing is lost and clarity is gained by this device.

   Emphasize that the blue flows are incomes and the red flows are expenditures on final goods and services. (The expenditures on intermediate goods and services are omitted from the circular flow model.) And emphasize that the green financial flows are not part of the circular flow of expenditure and income and are shown in Figure 5.1 only so that the student can see what happens to the money that isn’t spent and how spenders get the money that they’ve not earned as income.

3. **Measuring U.S. GDP**

   The low cost of economic data. You might like to tell your students that measuring real GDP is actually very cheap. The BEA (in the Department of Commerce) employs fewer than 500 economists, accountants, statisticians, and IT specialists at an annual cost of less that $70 million. It costs each American less than 0.25¢ (a quarter of a cent) to measure the value of the nation’s production. For some further perspective, the National Oceanic and Atmospheric Administration (also in the Department of Commerce), whose mission is to “describe and predict changes in the Earth’s environment, and conserve and manage wisely the nation’s coastal and marine resources so as to ensure sustainable economic opportunities,” employs more than 11,000 scientists and support personnel at an annual cost of $3.2 billion!

   Most of the income data used by the BEA comes from the IRS. Expenditure data comes from a variety of sources.

   Creative accounting and GDP measurement. In recent years, the first estimates of GDP, which are based on companies’ reported profits, have been revised downward when data on company profits as reported to the IRS became available. Enron-style accounting has contaminated the initial estimates of GDP but not the final estimates.

   You can make a nice point with one example of creative accounting. For some years, in its reports to stock holders AOL recorded its advertising expenditure as investment and amortized it over a
number of years. First, you can explain that the correct treatment of this item is as an expenditure on intermediate goods and services by AOL and as a charge against AOL profit. The expenditure on AOL services is the value of AOL’s production. And AOL’s expenditure on advertising is part of the value of the production of the advertising agencies used by AOL. You can go on to explain that AOL accounting practice would misleadingly swell GDP by causing some double counting. On the expenditure approach, AOL’s advertising expenditure shows up as investment in the national accounts. On the income approach, because the expenditure is not a cost, it swells profit, so AOL’s corporate profit increases by the same amount as its “investment.” If AOL filed its income tax return in this same way, the national income accounts wouldn’t get corrected. But if when AOL files its tax returns it calls its advertising a cost and lowers its profits by that amount, the BEA picks up these numbers from the IRS and the national accounts get adjusted appropriately.

4. Measuring Economic Growth

Omissions from GDP. A discussion of omissions from GDP can arouse students’ interest. For example, you might point out that if you mow your own lawn, the value of the your production doesn’t show up in GDP. But if you hire the student to mow your lawn (and if your student reports the income earned correctly to the IRS), the value of the student’s production does show up in GDP. Why don’t we measure all lawn mowing as part of GDP? Some reasons are cost of collecting data and the degree of intrusiveness we’d be willing to tolerate. But note how little we spend on collecting the GDP data and how relatively inexpensive it would be to add some questions about domestic production to either the Labor Force Survey or the Family Expenditure Survey.

The inclusion of the imputed rental of owner-occupied houses, but not owner-used cars and other durables, is a good example.

You might like to explain how the omission of illegal goods and services also leads to some misleading comparisons. For instance, the day before prohibition ended, the production of (illegal) beer was not counted as part of GDP. But the day after prohibition ended, the production of (now legal) beer counted. Ask your students to suggest two good reasons why illegal goods and services are omitted. First, the data are hard (but not impossible) to obtain. Second, there may be the moral position that illegal activities should not be included in GDP. This latter observation can lead to an interesting discussion. Ask the students if they think that the production of, say, marijuana should be included in GDP. Some, maybe even many, of them will see no problem with this. Then ask about the production of murder-for-hire. The response, we hope, will be significantly different. Does such a good have any value?

International comparisons and PPP prices. Students sometimes see estimates of GDP per person in developing nations. Most such estimates are extremely low, and students often ask how people can live on such low incomes. Point out that the estimate is biased downward in two ways. First, in poor nations, more transactions do not go through a market than in rich nations. For example, transportation services in developing nations include a lot of walking, which is not counted as part of GDP. In richer nations, people ride a bus or subway and pay a fare, which is counted as part of GDP. Second, many locally produced and consumed goods and services have extremely low prices in poor nations. For example, a haircut that costs $20 in New York might cost $1 in Calcutta. (You might get a better haircut in New York, but probably not one that is 20 times better!) Converting Indian GDP into U.S. dollars at the market exchange rate leaves this bias in the data. Using purchasing power parity prices to convert India’s GDP into U.S. dollars avoids this bias.
The Big Picture

Where we have been
Chapter 1 discussed the big economic question, what goods and services are produced? Chapter 4 (Chapter 20) then showed how production has changed over time. This chapter lays the first piece of the foundation for answering this question by explaining how production and income are measured.

Where we are going
The circular flow model and the national income accounting explained in this chapter serves as a framework for macroeconomic analysis. The fact that aggregate expenditure equals aggregate income and the value of production is the key to understanding why income measures the standard of living. The explanation of how investment is financed provides a jumping off point for the study of capital, investment, and saving in three chapters hence and economic growth four chapters from now. The components of aggregate expenditure provide an underpinning for the theory of aggregate demand in Chapter 7 (Chapter 23) and the aggregate expenditure model and multiplier in Chapter 13 (Chapter 29).

Overhead Transparencies

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Electronic Supplements

MyEconLab
MyEconLab provides pre- and post-tests for each chapter so that students can assess their own progress. Results on these tests feed an individualized study plan that helps students focus their attention in the areas where they most need help.
Instructors can create and assign tests, quizzes, or graded homework assignments that incorporate graphing questions. Questions are automatically graded and results are tracked using an online grade book.

PowerPoint Lecture Notes
PowerPoint Electronic Lecture Notes with speaking notes are available and offer a full summary of the chapter.
PowerPoint Electronic Lecture Notes for students are available in MyEconLab.

Instructor CD-ROM with Computerized Test Banks
This CD-ROM contains Computerized Test Bank Files, Test Bank, and Instructor’s Manual files in Microsoft Word, and PowerPoint files. All test banks are available in Test Generator Software.
Additional Discussion Questions

1. To estimate GDP you add the value of all the goods and services produced, both final and intermediate goods. Is this procedure correct? Why?

2. What is the relationship between aggregate income and aggregate production? Why does this relationship exist?

3. What is the underground economy? What factors influence the size of the underground economy? Why might income tax rates be an important determinant of the extent of the underground economy?


5. Does my purchase of 100 shares of stock in General Electric add to the nation’s GDP? Why?

6. If a homeowner cuts his or her lawn, is the value of this work included in real GDP? Suppose that the homeowner hires a neighborhood kid to cut the lawn. Is this activity included in real GDP? Comment on your answers.

7. How is a nation’s investment financed?

8. What difference do you think it makes if the inflation rate is overestimated?

9. In 1900, the average work week was 65 hours; today it is approximately 35 hours. How did this change affect economic welfare within the United States? How did it affect real GDP within the United States?

10. In order to use GDP to measure economic welfare, what is the single most important change that you would make? Defend your answer.

11. When the UK switched the base year for measuring real GDP by the old, constant base year prices, method from 1970 to 1980, the estimated growth rate of UK real GDP in the 1970s increased by almost half a percent per year. Why do you suppose this was? [Hint: both oil prices and UK oil production increased dramatically during the 1970s]. How would you expect the growth rate of UK real GDP in the 1970s estimated by the chain-weighted method to compare to the other two estimates? Why?

12. In the United States, many children receive day-care from commercial providers. In Africa, this is unknown; children are almost all cared for by relatives. How would this difference affect comparisons of GDP per person head?
**Answers to the Review Quizzes**

**Page 112** (page 484 in *Economics*)
1. GDP is the market value of all the final goods and services produced within a country in a given time period. A final good and service is a product that is sold to the ultimate user, that is, the final consumer, government, a firm making investment, or a foreign entity. An intermediate good is a product that is wholly used up in producing another good or service. For instance, bread sold to a consumer is a final good, but wheat sold to a baker to make the bread is an intermediate good. Distinguishing between final goods and services and intermediate goods and services is important because only final goods and services must be directly included in GDP; intermediate goods must be excluded to avoid double counting them. For example, counting the wheat that went into the bread as well as the bread would double count the wheat—once as wheat and once as part of the bread.

2. GDP equals aggregate income because one way to value production is by the cost of the factors of production employed. GDP equals aggregate expenditure because another way to value production is by the price that buyers pay for it in the market.

3. Investment is financed from three sources, private saving, the government budget surplus, and borrowing from the rest of the world. National saving is the sum of private saving and the government budget surplus.

4. “Gross” means before subtracting depreciation or capital consumption. “Net” means after subtracting depreciation or capital consumption. The terms apply to investment, business profits, and aggregate production.

**Page 114** (page 486 in *Economics*)
1. The expenditure approach measures GDP by focusing on aggregate expenditures. Data are collected on the different components of aggregate expenditure and then summed. Specifically, the Bureau of Economic Analysis collects data on consumption expenditure, \(C\), investment, \(I\), government purchases of goods and services, \(G\), and net exports, \(NX\). These expenditures are valued at the prices paid for the goods and services, called the market price. GDP is then calculated as \(C + I + G + NX\).

2. The income approach measures GDP by focusing on aggregate income. This approach sums all the incomes paid to households by firms for the use of resources. The standard national income accounts divide incomes into five categories: compensation of employees; net interest; rental income; corporate profits; and proprietors’ income. Adding these income components does not quite equal GDP, because it values the output at the factor cost rather than the market price and omits depreciation. So, further adjustments must be made to estimate GDP: Indirect taxes and depreciation must be added and subsidies subtracted.

3. Total income is net domestic product at factor cost. To convert it to gross domestic product at market prices, we must add back the depreciation of capital and add indirect taxes minus subsidies.

**Page 117** (page 489 in *Economics*)
1. Nominal GDP values output at the actual prices that existed at the time the output was produced. Real GDP corrects this measure for changes in the price level and is what the value of output produced in a given year when valued at constant prices.

2. The traditional method of calculating real GDP is to value each year’s GDP at the constant prices of a fixed base year.
3. The new method of calculating real GDP is to estimate the growth of real GDP from each year to the next as the average of growth between the two years measured by valuing both years’ GDP at the first year’s prices, and then measured by valuing both years’ GDP at the second year’s prices. These annual real growth rates are calculated from the chosen base year and then applied to the previous year’s real GDP to give the chain-weighted output index estimate of real GDP.

4. The GDP deflator is defined as \( \frac{\text{nominal GDP}}{\text{real GDP}} \times 100 \).

Page 121  
(page 493 in Economics)

1. Real GDP is sometimes used to measure economic welfare but is misleading for several reasons. Real GDP often does not accurately take into account quality improvements. Goods and services might dramatically improve in quality but, if their price is mismeasured by not taking into account the increase in quality, measured real GDP (inaccurately) will not increase as much as is warranted. Real GDP does not include household production, productive activities done in and around the house by the homeowner. Because these tasks often are an important component of people’s work, this omission creates a major measurement problem. Real GDP omits the underground economy, economic activity that is legal but unreported or that is illegal. In many countries the underground economy is an important part of economic activity, and its omission creates a serious measurement problem. Real GDP does not include a measurement of people’s health and life expectancy, both factors that obviously affect economic welfare. The value of leisure time is not included in real GDP. People value their leisure hours, and an increase in people’s leisure that enhances people’s economic welfare can lower the nation’s real GDP and hence (apparently!) lower the nation’s well-being. Environmental damage is excluded from real GDP. So an economy wherein real GDP grows but at the expense of its environment, as was the case with Eastern European countries, falsely appears to offer more welfare than a similar economy that grows slightly more slowly but at less environmental cost. Real GDP does not indicate the extent of political freedom and social justice enjoyed by a nation’s citizens.

2. As listed in the answer above, GDP does not measure all production of goods and services. The two areas of omission are:
   a. Household production.
   b. The underground economy.

3. In order to make the most valid international comparisons of real GDP, we need to value each nation’s production using purchasing power parity prices than by using exchange rates. As a result, the real GDP of each country is valued using the same prices.

4. To the extent that real GDP is mismeasured, it does not measure long-term real growth accurately. The less reliable our GDP measures are, for whatever reason, the less accurate our measurement of long-term growth since growth is measured by the percentage change in real GDP.

5. Even though our measurements of real GDP might be inaccurate, our ability to accurately measure the business cycle is not significantly hindered. The reason for this is that the omissions that bias real GDP measures are consistent over time. They do not systematically change with the business cycle, so they will not cause wrong assessment of business cycle phases.
**Answers to the Problems**

1. a. Aggregate expenditure is $120 million.  
Aggregate expenditure is the sum of consumption expenditure, investment, government purchases, and net exports. In the figure, $B$ is consumption expenditure, $D$ is investment, $C$ is government purchases, and $E$ is net exports. Therefore aggregate expenditure equals $60 million plus $30 million plus $24 million plus $6 million, which is $120 million.

b. Aggregate income is $120 million.  
Aggregate income equals aggregate expenditure, which from 1(a) is $120 million.

c. GDP is $120 million.  
GDP equals aggregate expenditure, which from 1(a) is $120 million.

d. Government budget deficit is $4 million.  
Government budget deficit equals government purchases minus net taxes. $C$ is government purchases, and $A$ is net taxes. So the government budget deficit equals $24 million minus $20 million, which is $4 million.

e. Household saving is $40 million.  
Household saving equals aggregate income minus consumption expenditure minus net taxes. From 1(b), income is $120 million. In the figure, $B$ is consumption expenditure and $A$ is net taxes. Therefore household saving equals $120 million minus $60 million minus $20 million, which is $40 million.

f. Government saving is minus $4 million.  
Government saving equals taxes minus government purchases. In the figure, $A$ is net taxes and $C$ is government expenditure. Therefore government saving equals $20 million minus $24 million, which is $-4$ million.

g. National saving is $36 million.  
National saving equals the sum of household saving and government saving. Household saving is $40 million (see answer 1e). Government saving is minus $2 million (see answer 1f). Therefore national saving equals $40 million minus $2 million, which is $36 million.

h. Borrowing from the rest of the world is minus $6 million.  
Borrowing from the rest of the world equals minus net exports. $E$ is net exports, and net exports equals $6 million. We are in surplus, so foreigners are in deficit and they must borrow from us to pay for their deficit.

2. a. Aggregate expenditure is $150 million.  
Aggregate expenditure is the sum of consumption expenditure, investment, government purchases, and net exports. In the figure, $B$ is consumption expenditure, $D$ is investment, $C$ is government purchases, and $E$ is net exports. Therefore aggregate expenditure equals $100 million plus $30 million plus $30 million minus $10 million, which is $150 million.

b. Aggregate income is $150 million.  
Aggregate income equals aggregate expenditure, which from 2a is $150 million.

c. GDP is $150 million.  
GDP equals aggregate expenditure, which from 2a is $150 million.

d. The government budget deficit is $5 million.  
The government budget deficit equals government purchases minus taxes. $C$ is government purchases, and $A$ is net taxes. So the government budget deficit equals $30 million minus $25 million, which is $5 million.

e. Household saving is $25 million.  
Household saving equals aggregate income minus consumption expenditure minus net taxes. From 1(b), income is $150 million. In the figure, $B$ is consumption expenditure and $A$ is net taxes.
Therefore household saving equals $150 million minus $100 million minus $25 million, which is $25 million.

f. Government saving is minus $20 million.

Government saving equals taxes minus government purchases. In the figure, A is net taxes and C is government expenditure. Therefore government saving equals $25 million minus $30 million, which is $5 million.

g. National saving is $10 million.

National saving equals the sum of household saving and government saving. Household saving is $25 million (see answer 2e). Government saving is minus $5 million (see answer 2f). Therefore national saving equals $25 million minus $5 million, which is $20 million.

h. Borrowing from the rest of the world is $10 million.

Borrowing from the rest of the world equals minus net exports. E is net exports, and net exports equals $10 million. We are in deficit, so foreigners are in surplus and we must borrow from them to pay for our deficit.

3. Martha’s initial capital stock is 10 copiers, depreciation is 1 copier per year, gross investment is 5 copiers, net investment is 4 copiers, and the final capital stock is 14 copiers. Final capital stock equals initial capital stock plus net investment. Net investment equals gross investment minus depreciation.

4. Wendy’s initial capital stock is 20 looms, depreciation is 1 loom per year, gross investment is 5 looms, net investment is 4 looms, and the final capital stock is 24 looms. Final capital stock equals initial capital stock plus net investment. Net investment equals gross investment minus depreciation.

5. a. Ecoland’s GDP is $1,100,000.

GDP equals the sum of consumption expenditure plus investment plus government purchases plus exports minus imports. That is, GDP equals $600,000 plus $250,000 plus $200,000 plus $300,000 minus $250,000. GDP equals $1,100,000.

b. Expenditure approach. Income approach cannot be used because there are no data on interest, rent, depreciation, and indirect taxes and subsidies.

c. Investment is financed by private saving plus government saving plus borrowing from the rest of the world.

Private saving equals GDP minus consumption expenditure minus net taxes, which is $300,000. Government saving equals the budget surplus, which equals net taxes minus government purchases. Net taxes equal taxes ($250,000) minus transfer payments ($50,000), which is $200,000. Government saving equals net taxes ($200,000) minus government purchases ($200,000), which is zero. Private saving exceeds investment by $50,000 and this amount is lent to the rest of the world.

6. a. Highland’s GDP is $610,000.

GDP equals the sum of consumption expenditure plus investment plus government purchases plus exports minus imports. That is, GDP equals $350,000 plus $150,000 plus $130,000 plus $120,000 minus $140,000. GDP equals $610,000.

b. To calculate net domestic product at factor cost, we need data on interest and rent.

Net domestic product at factor cost is the sum of wages paid for labor services, interest paid for the use of capital, rent paid for the use of land, and profit.

c. Investment is financed by private saving plus government saving plus borrowing from the rest of the world.

Private saving equals $135,000. Government saving equals net taxes ($125,000) minus government purchases ($130,000), which is minus $5,000. Borrowing from the rest of the world equals imports ($140,000) minus exports ($120,000), which is $20,000.
7. a. In 2002, nominal GDP is $7,000. In 2003, nominal GDP is $7,500. Nominal GDP in 2002 is equal to total expenditure on the goods and services produced by Bananaland in 2002. Expenditure on bananas is 1,000 bunches at $2 a bunch, which is $2,000. Expenditure on sunscreen is 500 bottles at $10 a bottle, which is $5,000. Total expenditure is $7,000. So nominal GDP in 2002 is $7,000.

Nominal GDP in 2003 is equal to total expenditure on the goods and services produced by Bananaland in 2003. Expenditure on bananas is 1,100 bunches at $3 a bunch, which is $3,300. Expenditure on sunscreen is 525 bottles at $8 a bottle, which is $4,200. Total expenditure is $7,500. So nominal GDP in 2002 is $7,500.

b. Real GDP in 2003 using base-year prices method is $7,450.

The base-year prices method is to calculate the market value of the 2003 quantities at the base-year prices of 2002. To value the 2003 output at 2002 prices, expenditure on bananas is 1,100 bunches at $2 a bunch (which is $2,200), and expenditure on sunscreen is 525 bottles at $10 a bottle (which is $5,250). So real GDP in 2003 using the base-year prices method is $7,450.

8. a. In 2003, nominal GDP is $25,000. In 2004, nominal GDP is $33,800. Nominal GDP is equal to total expenditure on the goods and services produced by Sea Island in 2003. Expenditure on lobsters is 1,000 at $20 each, which is $20,000. Expenditure on crabs is 500 at $10 each, which is $5,000. Total expenditure is $25,000. So nominal GDP in 2003 is $25,000.

Nominal GDP in 2004 is equal to total expenditure on the goods and services produced by Sea Island in 2003. Expenditure on lobsters is 1,100 at $25 each, which is $27,500. Expenditure on crabs is 525 bottles at $12 each, which is $6,300. Total expenditure is $33,800. So GDP is $33,800.

b. Real GDP in 2004 is $27,250.

Using the base-year prices method, real GDP in 2004 is equal to Sea Island’s 2004 output valued at base-year prices (2003 prices). To value the 2004 output at 2003 prices, expenditure on lobsters is 1,100 bunches at $20 each (which is $22,000), and expenditure on crabs is 525 at $12 each (which is $5,250). So real GDP in 2004 is $27,250.

9. a. The growth rate of real GDP in 2003 is 6.79 percent.

The chain-weighted output index method uses the prices of 2002 and 2003 to calculate the growth rate in 2003.

The value of the 2002 quantities at 2002 prices is $7,000. The value of the 2003 quantities at 2002 prices is $7,450. We now compare these values. The increase in the value is $450. The percentage increase is ($450 ÷ $7,000) × 100, which is 6.43 percent

The value of the 2002 quantities at 2003 prices is $7,000. The value of the 2003 quantities at 2003 prices is $7,500. We now compare these values. The increase in the value is $500. The percentage increase is ($500 ÷ $7,000) × 100, which is 7.14 percent.

The chain-weighted output index calculates the growth rate as the average of these two percentage growth rates. That is, the growth rate in 2003 is 6.79 percent.

b. The GDP deflator in 2003 is 100.33.

GDP deflator equals nominal GDP in 2003 divided by real GDP in 2003, multiplied by 100. Real GDP in 2003 is 6.79 percent higher than real GDP in 2002. Real GDP in 2002 is $7,000, so real GDP in 2003 is $7,475.3.

GDP deflator equals ($7,500 ÷ $7,475.3) × 100 = 100.33.

c. Real GDP in 2003 using the base-year prices method is $7,450. Real GDP in 2003 using the chain-weighted output index method is $7,475.3. The base-year prices method measure real GDP growth as being slower than the chain-weighted index measure.

The value of the 2003 quantities at 2003 prices is $25,000. The value of the 2003 quantities at 2004 prices is $27,250. We now compare these values. The increase in the value is $2,250. The percentage increase is \( \frac{2,250}{25,000} \times 100 \), which is 9 percent.

The value of the 2003 quantities at 2004 prices is $31,000. The value of the 2003 quantities at 2004 prices is $33,800. We now compare these values. The increase in the value is $2,800. The percentage increase is \( \frac{2,800}{31,000} \times 100 \), which is 9.032 percent.

The chain-weighted output index calculates the growth rate as the average of these two percentage growth rates. That is, the growth rate in 2004 is 9.016 percent.

b. The GDP deflator in 2004 is 124.02.

The GDP deflator equals nominal GDP in 2004 divided by real GDP in 2004, multiplied by 100.0

Real GDP in 2004 is 9.016 percent higher than real GDP in 2003. Real GDP in 2003 is $25,000, so real GDP in 2004 is $27,254.

The GDP deflator equals \( \frac{33,800}{27,254} \times 100 = 124.02 \).

c. Real GDP in 2004 using the base-year prices method is $27,250. Real GDP in 2004 using the chain-weighted output index method is $27,254. The base-year prices method measure real GDP growth as being slightly slower than the chain-weighted index measure.
Additional Problems

1. The figure on page 125 (page 497 in Economics) of the textbook shows the flows of expenditure and income on Lotus Island. During 2002, \( A \) was $45 million, \( B \) was $90 million, \( C \) was $40 million, \( D \) was $45 million, and \( E \) was $-15 million. Calculate
   a. Aggregate expenditure.
   b. Aggregate income.
   c. GDP.
   d. The government budget deficit.
   e. Household saving.
   f. Government saving.
   g. National saving.
   h. Borrowing from the rest of the world.

2. Jeannie owns a tax accounting business that has 3 PCs. One PC wears out each year and is replaced. In addition, this year Jeannie will expand her business to 5 PCs. Calculate Jeannie’s initial capital stock, depreciation, gross investment, net investment, and final capital stock.

3. The transactions in Jupiter last year were

<table>
<thead>
<tr>
<th>Item</th>
<th>Dollars</th>
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<tbody>
<tr>
<td>GDP</td>
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<tr>
<td>Consumption expenditure</td>
<td>700,000</td>
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<tr>
<td>Net taxes</td>
<td>350,000</td>
</tr>
<tr>
<td>Transfer payments</td>
<td>150,000</td>
</tr>
<tr>
<td>Profits</td>
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</tr>
<tr>
<td>Investment</td>
<td>350,000</td>
</tr>
<tr>
<td>Exports</td>
<td>400,000</td>
</tr>
<tr>
<td>Saving</td>
<td>400,000</td>
</tr>
<tr>
<td>Imports</td>
<td>350,000</td>
</tr>
</tbody>
</table>

   a. Calculate Jupiter’s government purchases.
   b. Calculate Jupiter’s government budget deficit.

4. Desert Kingdom produces only sand and camel rides. The base year is 2003, and the tables give the quantities produced and the prices.

<table>
<thead>
<tr>
<th>Quantities</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dates (pounds)</td>
<td>1,000</td>
<td>1,100</td>
</tr>
<tr>
<td>Camel rides</td>
<td>50</td>
<td>60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prices</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dates</td>
<td>$1 per pound</td>
<td>$2 per pound</td>
</tr>
<tr>
<td>Camel ride</td>
<td>$100 per ride</td>
<td>$120 per ride</td>
</tr>
</tbody>
</table>

   Calculate Desert Kingdom’s
   b. Real GDP in 2004 using the base-year prices method.

5. Desert Kingdom (described in problem 4) decides to use the chain-weighted output index method of calculating real GDP. Using this method, calculate
b. The GDP deflator in 2004.
c. Compare and comment on the differences in real GDP using the base-year prices and chain-weighted output index methods.
Solutions to Additional Problems

1. a. Aggregate expenditure is $160 million. Aggregate expenditure is the sum of consumption expenditure, investment, government purchases, and net exports. In the figure, $B$ is consumption expenditure, $D$ is investment, $C$ is government purchases, and $E$ is net exports. Therefore aggregate expenditure equals $90 million plus $45 million plus $40 million minus $15 million, which is $160 million.

b. Aggregate income is $160 million. Aggregate income equals aggregate expenditure, which from 1(a) is $160 million.

c. GDP is $160 million. GDP equals aggregate expenditure, which from 1(a) is $160 million.

d. The government budget deficit is minus $5 million. The government budget deficit equals government purchases minus taxes. $C$ is government purchases, and $A$ is net taxes. So the government budget deficit equals $40 million minus $45 million, which is minus $5 million—a surplus of $5 million.

e. Household saving is $25 million. Household saving equals aggregate income minus consumption expenditure minus taxes. From 1(b), income is $160 million. In the figure, $B$ is consumption expenditure and $A$ is net taxes. Therefore household saving equals $160 million minus $90 million minus $45 million, which is $25 million.

f. Government saving is $5 million. Government saving equals taxes minus government purchases. In the figure, $A$ is net taxes and $C$ is government expenditure. Therefore government saving equals $45 million minus $40 million, which is $5 million.

g. National saving is $30 million. National saving equals the sum of household saving and government saving. Household saving is $25 million (see answer 1(e)). Government saving is $5 million (see answer 1(f)). Therefore national saving equals $25 million plus $5 million, which is $30 million.

h. Borrowing from the rest of the world is $15 million. Borrowing from the rest of the world equals minus net exports. $E$ is net exports, and net exports equals minus $15 million. We are in deficit, so foreigners are in surplus and we must borrow from them to pay for our deficit.

2. Jeannie’s initial capital stock is 3 PCs, depreciation is 1 PC per year, gross investment is 3 PCs, net investment is 2 PCs, and the final capital stock is 5 PCs. Final capital stock equals initial capital stock plus net investment. Net investment equals gross investment minus depreciation.

3. a. Jupiter’s government purchases were $300,000. GDP equals the sum of consumption expenditure plus investment plus government purchases plus exports minus imports. That is, $1,400,000 equals $700,000 plus $350,000 plus government purchases plus $400,000 minus $350,000. Solving this equation for government purchases gives $300,000.

b. Jupiter’s government budget deficit is $100,000. The budget deficit equals government purchases plus transfer payments minus taxes. That is $300,000 plus $150,000 minus $350,000, which equals $100,000.

4. a. In 2003, nominal GDP is $6,000. In 2004, nominal GDP is $9,400.
Nominal GDP in 2003 is equal to total expenditure on the goods and services produced by Desert Kingdom in 2003. Expenditure on dates is 1,000 dates at $1 a date, which is $1,000. Expenditure on camel rides is 50 rides at $100 a ride, which is $5,000. Total expenditure is $6,000. So nominal GDP in 2003 is $6,000.
Nominal GDP in 2004 is equal to total expenditure on the goods and services produced by Desert Kingdom in 2004. Expenditure on dates is 1,100 dates at $2 a date, which is $2,200. Expenditure on camel rides is 60 rides at $120 a ride, which is $7,200. Total expenditure is $9,400. So nominal GDP in 2004 is $9,400.
b. Real GDP in 2004 using base-year prices method is $7,100. The base-year prices method is to calculate the market value of the 2004 quantities at the base-year prices of 2003. To value the 2004 output at 2003 prices, expenditure on dates is 1,100 dates at $1 a date (which is $1,100), and expenditure on camel rides is 60 rides at $100 a ride (which is $6,000). So real GDP in 2004 using the base-year prices method is $7,100.

5. a. The growth rate of real GDP in 2004 is 17.9 percent. The chain-weighted output index method uses the prices of 2003 and 2004 to calculate the growth rate in 2004.

The value of the 2003 quantities at 2003 prices is $6,000. The value of the 2004 quantities at 2003 prices is $7,100. We now compare these values. The increase in the value is $1,100. The percentage increase is \( \frac{1,100}{6,000} \times 100 \), which is 18.33 percent.

The value of the 2003 quantities at 2004 prices is $8,000. The value of the 2004 quantities at 2004 prices is $9,400. We now compare these values. The increase in the value is $1,400. The percentage increase is \( \frac{1,400}{8,000} \times 100 \), which is 17.5 percent.

The chain-weighted output index calculates the growth rate as the average of these two percentage growth rates. That is, the growth rate in 2004 is 17.9 percent.

b. The GDP deflator in 2004 is 132.9. The GDP deflator equals nominal GDP in 2004 divided by real GDP in 2004, multiplied by 100.

Real GDP in 2004 is 17.9 percent higher than real GDP in 2003. Real GDP in 2003 is $6,000, so real GDP in 2004 is $7,074.

The GDP deflator equals \( \frac{7,500}{7,074} \times 100 = 100.33 \).

c. Real GDP in 2004 using the base-year prices method is $7,100. Real GDP in 2004 using the chain-weighted output index method is $7,074. The base-year prices method measures real GDP growth as being faster than the chain-weighted index measure.