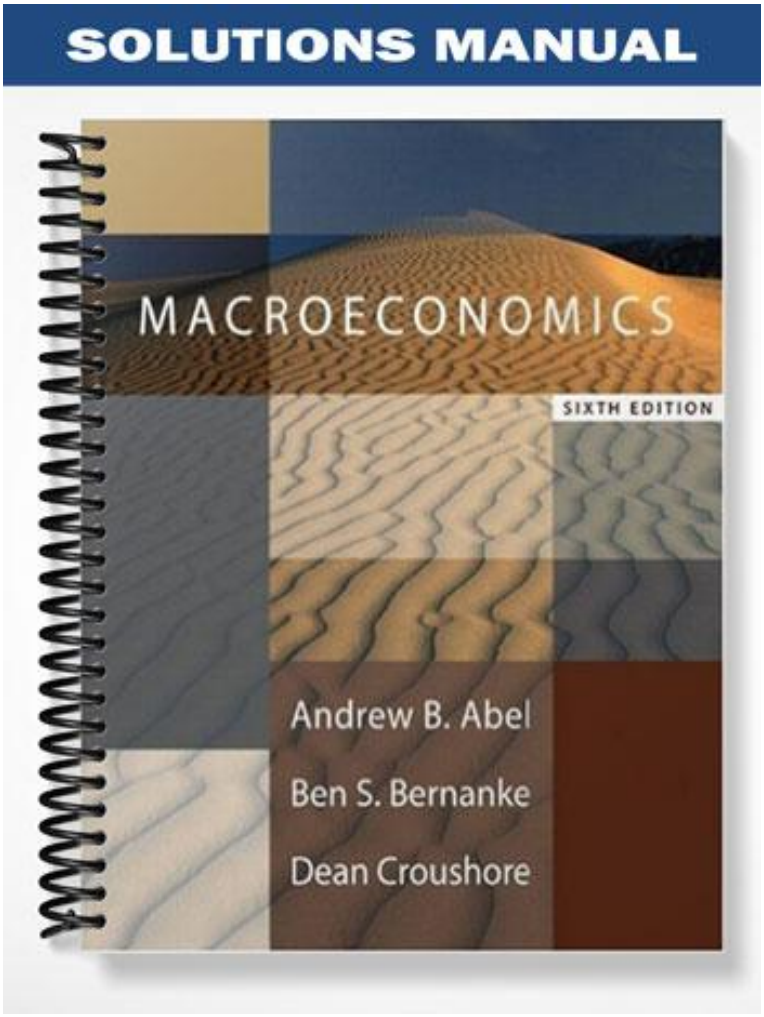
SOLUTIONS MANUAL



Chapter 2
The Measurement and Structure of the National Economy

■ Learning Objectives

I. Goals of Chapter 2

A) National income accounts; relationships among key macroeconomic variables (Sec. 2.1)

B) Gross domestic product—the main measure of output (Sec. 2.2)

C) Saving and wealth—private and government (Sec. 2.3)

D) Real GDP, price indexes, and inflation (Sec. 2.4)

E) Interest rates (Sec. 2.5)

II. Notes to Fifth Edition Users

A) The U.S. government has changed the income approach in the NIPAs, adding several categories. Indirect business taxes no longer exists as a category, and is included in "Taxes on production and imports." Now, the only difference between national income and net national product is the statistical discrepancy. So, be sure to modify your teaching notes to reflect this new material.

B) The application, "Surprise, Surprise, Surprise! Fourth-Quarter 2001 GDP Figures Defy Expectations" has been deleted.

C) A new application, "Wealth Versus Saving," has been added, which discusses the low personal saving rate.

■ Teaching Notes

I. National Income Accounting: The Measurement of Production, Income, and Expenditure (Sec. 2.1)

A) National income accounts: an accounting framework used in measuring current economic activity

B) Three alternative approaches give the same measurements

1. Product approach: the amount of output produced
2. Income approach: the incomes generated by production
3. Expenditure approach: the amount of spending by purchasers

C) Juice business example shows that all three approaches are equal

1. Important concept in product approach: value added = value of output minus value of inputs purchased from other producers

D) Why are the three approaches equivalent?
   1. They must be, by definition
   2. Any output produced (product approach) is purchased by someone (expenditure approach) and results in income to someone (income approach)
   3. The fundamental identity of national income accounting:

$$\text{total production} = \text{total income} = \text{total expenditure} \tag{2.1}$$

II. Gross Domestic Product (Sec. 2.2)

A) The product approach to measuring GDP
   1. GDP (gross domestic product) is the market value of final goods and services newly produced within a nation during a fixed period of time

Data Application

The *period* referred to here is either a quarter or a year. You may want to show students what some of the tables from the National Income and Product Accounts look like, or send them to the library (or the Internet at www.bea.doc.gov) to find the accounts in the *Survey of Current Business*.

Students are also interested in seeing what happens in the financial markets and to public opinion on the day a new GDP report comes out.

   2. Market value: allows adding together unlike items by valuing them at their market prices
      a. Problem: misses nonmarket items such as homemaking, the value of environmental quality, and natural resource depletion

Analytical Problems 1 and 3 both discuss difficulties in counting nonmarket items for GDP, including the important idea that GDP is not the same as welfare.

      b. There is some adjustment to reflect the underground economy
      c. Government services (that aren't sold in markets) are valued at their cost of production
   3. Newly produced: counts only things produced in the given period; excludes things produced earlier
   4. Final goods and services
      a. Don't count intermediate goods and services (those used up in the production of other goods and services in the same period that they themselves were produced)
      b. Final goods & services are those that are not intermediate
      c. Capital goods (goods used to produce other goods) are final goods since they aren't used up in the same period that they are produced
      d. Inventory investment (the amount that inventories of unsold finished goods, goods in process, and raw materials have changed during the period) is also treated as a final good
      e. Adding up value added works well, since it automatically excludes intermediate goods
   5. GNP vs. GDP
      a. GNP (gross national product) = output produced by domestically owned factors of production

         GDP = output produced within a nation
      b. GDP = GNP – NFP (net factor payments from abroad) (2.2)
      c. NFP = payments to domestically owned factors located abroad minus payments to foreign factors located domestically

Data Application

Prior to December 1991, the United States used GNP as its main measure of production; after that time GDP became the main concept. The main reasons for the switch were that GDP is more relevant to production in an open economy (though GNP is more relevant for income), and GDP is more precise than GNP in the advance estimate, since net factor payments are difficult to measure quickly. See *Survey of Current Business*, November 1991, for a discussion of the switch.

d. Example: Engineering revenues for a road built by a U.S. company in Saudi Arabia is part of U.S. GNP (built by a U.S. factor of production), not U.S. GDP, and is part of Saudi GDP (built in Saudi Arabia), not Saudi GNP
e. Difference between GNP and GDP is small for the United States, about 0.2%, but higher for countries that have many citizens working abroad

Data Application

The timeline for national income and product account releases is generally:

Advance release	Last week of month following end of quarter
Preliminary release	Last week of second following month
Final release	Last week of third following month

Revisions occur every July for the following three years, then every fifth year for a new benchmark release. Each new release contains either additional new data that was not available before, or a change in seasonal factors, or a correction of errors made previously.

B) The expenditure approach to measuring GDP
1. Measures total spending on final goods and services produced within a nation during a specified period of time
2. Four main categories of spending: consumption (C), investment (I), government purchases of goods and services (G), and net exports (NX)
3. $Y = C + I + G + NX$, the income-expenditure identity (2.3)
4. Consumption: spending by domestic households on final goods and services (including those produced abroad)
   a. About 2/3 of U.S. GDP
   b. Three categories
      (1) Consumer durables (examples: cars, TV sets, furniture, and major appliances)
      (2) Nondurable goods (examples: food, clothing, fuel)
      (3) Services (examples: education, health care, financial services, and transportation)

Data Application

Note that the consumption category in the national income and product accounts does not correspond to economists' concept of consumption, because it includes the full value of durable goods. When economists study consumption behavior, they must account for this; one way to do so is to assume that durable goods provide services that are proportional to their existing stock. Total consumption is this fraction of the stock of consumer durables, plus nondurables and services.

5. Investment: spending for new capital goods (fixed investment) plus inventory investment
   a. About 1/6 of U.S. GDP
   b. Business (or nonresidential) fixed investment: spending by businesses on structures and equipment and software
   c. Residential fixed investment: spending on the construction of houses and apartment buildings
   d. Inventory investment: increases in firms' inventory holdings

Data Application

A major change in the national income and product accounts came in October 1999, when computer software purchased by businesses and government was classified as investment, rather than an input used up in production. As a result, real GDP and investment were revised up significantly, especially for the 1990s.

6. Government purchases of goods and services: spending by the government on goods or services
   a. About 1/5 of U.S. GDP
   b. Most by state and local governments, not federal government
   c. Not all government expenditures are purchases of goods and services
      (1) Some are payments that are *not* made in exchange for current goods and services
      (2) One type is transfers, including Social Security payments, welfare, and unemployment benefits
      (3) Another type is interest payments on the government debt
   d. Some government spending is for capital goods that add to the nation's capital stock, such as highways, airports, bridges, and water and sewer systems

Data Application

People often don't realize how large transfer programs are relative to federal government consumption expenditures. For example, in 2002, transfer payments were $932 billion, while government consumption expenditures were only $587 billion. Of that amount, most ($387 billion) was for national defense; nondefense consumption expenditures ($200 billion) were less than one-fourth of the amount of transfers. Other federal government expenditures included $306 billion in grants to state and local governments, $208 billion in net interest paid, and $44 billion in net subsidies to government enterprises. Gross investment by the federal government ($107 billion) was just slightly more than depreciation ($102 billion), so net investment was small ($5 billion).

7. Net exports: exports minus imports
   a. Exports: goods produced in the country that are purchased by foreigners
   b. Imports: goods produced abroad that are purchased by residents in the country
   c. Imports are subtracted from GDP, as they represent goods produced abroad, and were included in consumption, investment, and government purchases

Data Application

Behind the scenes at the Bureau of Economic Analysis (BEA), a major change is taking place concerning the national income accounts and the data on GDP. Because the types of goods and services people buy has changed so much in recent years, the BEA has decided to modify how it categorizes industries when it collects data on production. The new system is known as NAICS: the North American Industry Classification System; it replaces a system called SIC: Standard Industrial Classification. NAICS differs from SIC in both principle and in practice.

The key principle governing NAICS is that firms that use similar production processes will be classified in the same industry, which was not true under SIC. The result is that the number of firms in different industries will change; for example, the manufacturing industry is different under NAICS than under SIC.

One of the main reasons for the switch from SIC to NAICS is the growth of service industries and computer-related industries. In the past 70 years, manufacturing output has declined from 54 percent of GDP to 38 percent, while the output of service industries has increased from 35 percent of GDP to 54 percent. The SIC has not been updated to reflect the changes in the economy. NAICS will also improve the compatibility of U.S. statistics with those in other countries.

The disadvantage of the switch from SIC to NAICS is that data from today based on NAICS will not be exactly comparable to data from the past based on SIC. But the BEA believes that the improved quality of the data will justify the loss of historical comparability. In addition, NAICS has the advantage of being very adaptable when industries change; for example, its information sector includes such categories as Internet publishing and broadcasting. Adding new categories will not be difficult as technology changes further and new industries evolve.

C) The income approach to measuring GDP

1. Adds up income generated by production (including profits and taxes paid to the government)
   a. National income = compensation of employees (including benefits) + proprietors' income + rental income of persons + corporate profits + net interest + taxes on production and imports + business current transfer payments + current surplus of government enterprises

Data Application

Note that the definition of income was changed in several ways in 2003. Several categories were broken down in more detail, indirect business taxes were included in the larger category of taxes on production and imports, and less netting was done for transfers, interest, and surplus or subsidies of government enterprises.

   b. National income + statistical discrepancy = net national product
   c. Net national product + depreciation (the value of capital that wears out in the period) = gross national product (GNP)
   d. GNP – net factor payments (*NFP*) = GDP

2. Private sector and government sector income
   a. Private disposable income = income of the private sector = private sector income earned at home (Y or GDP) and abroad (NFP) + payments from the government sector (transfers, TR, and interest on government debt, INT) – taxes paid to government (T) = $Y + NFP + TR + INT - T$ (2.4)
   b. Government's net income = taxes – transfers – interest payments = $T - TR - INT$ (2.5)
   c. Private disposable income + government's net income = GDP + NFP = GNP

Numerical Problems 1, 2, 3, 4, and 5 provide practice in working with the national income and product accounts.

III. Saving and Wealth (Sec. 2.3)

A) Wealth
   1. Household wealth = a household's assets minus its liabilities
   2. National wealth = sum of all households', firms', and governments' wealth within the nation
   3. Saving by individuals, businesses, and government determine wealth

B) Measures of aggregate saving
   1. Saving = current income – current spending
   2. Saving rate = saving/current income
   3. Private saving = private disposable income – consumption

$$S_{pvt} = (Y + NFP - T + TR + INT) - C \quad (2.6)$$

   4. Government saving = net government income – government purchases of goods and services

$$S_{govt} = (T - TR - INT) - G \quad (2.7)$$

      a. Government saving = government budget surplus = government receipts – government outlays
      b. Government receipts = tax revenue (T)
      c. Government outlays = government purchases of goods and services (G) + transfers (TR) + interest payments on government debt (INT)
      d. Government budget deficit = $-S_{govt}$
      e. Despite the BEA's change in methods that explicitly recognize government investment, the text simplifies matters by counting government investment as government purchases, not investment. This avoids complications when the concepts are introduced and can be modified for further analysis later.
   5. National saving
      a. National saving = private saving + government saving
      b. $S = S_{pvt} + S_{govt}$

$$= [Y + NFP - T + TR + INT - C] + [T - TR - INT - G] \quad (2.8)$$
$$= Y + NFP - C - G = \text{GNP} - C - G$$

C) The uses of private saving
   1. $S = I + (NX + NFP)$ (2.9)

$$S = I + CA \quad (2.10)$$

   Derived from $S = Y + NFP - C - G$ and $Y = C + I + G + NX$
   $CA = NX + NFP$ = current account balance

2. $S_{pvt} = I + (-S_{govt}) + CA$ (2.11)
   {using $S = S_{pvt} + S_{govt}$}
   The uses-of-saving identity—saving is used in three ways:
   a. investment (I)
   b. government budget deficit ($-S_{govt}$)
   c. current account balance (CA)

Analytical Problem 4 has students examine how the uses-of-savings identity would change if we redefined government saving so that government investment was separate from government consumption expenditures, so that $G = GCE + GI$ and $S_{govt} = (T - TR - INT) - GCE$.

D) Relating saving and wealth
   1. Stocks and flows
      a. Flow variables: measured per unit of time (GDP, income, saving, investment)
      b. Stock variables: measured at a point in time (quantity of money, value of houses, capital stock)
      c. Flow variables often equal rates of change of stock variables
   2. Wealth and saving as stock and flow (wealth is a stock, saving is a flow)
   3. National wealth: domestic physical assets + net foreign assets
      a. Country's domestic physical assets (capital goods and land)
      b. Country's net foreign assets = foreign assets (foreign stocks, bonds, and capital goods owned by domestic residents) minus foreign liabilities (domestic stocks, bonds, and capital goods owned by foreigners)
      c. Wealth matters because the economic well-being of a country depends on it
      d. Changes in national wealth
         (1) Change in value of existing assets and liabilities (change in price of financial assets, or depreciation of capital goods)
         (2) National saving ($S = I + CA$) raises wealth
      e. Comparison of U.S. saving and investment with other countries
         (1) The United States is a low-saving country; Japan is a high-saving country
         (2) U.S. investment exceeds U.S. saving, so we have a negative current-account balance

E) Application: Wealth Versus Saving
   1. The personal saving rate has declined dramatically in recent years (Fig. 2.1)
   2. We might not need to worry about the decline in the personal saving rate because:
      a. private saving is the relevant measure of saving
      b. the personal saving rate may be revised upward in the future (Fig. 2.2)
      c. the personal saving rate ignores capital gains; as people's wealth rises, their saving rate declines (Fig. 2.3)

Data Application

The issue about the treatment of capital gains allows you to raise the issue with your students that the NIPAs are good for production but not wealth. Other accounts, such as the flow of funds accounts of the Federal Reserve, provide a look at capital gains and changes in the value of households', firms', and governments' wealth. Integrating the two types of accounts is an ongoing project of several federal agencies. If the accounts were integrated, the misleading measures of saving might be eliminated.

IV. Real GDP, Price Indexes, and Inflation (Sec. 2.4)

A) Real GDP

1. Nominal variables are those in dollar terms
2. Problem: do changes in nominal values reflect changes in prices or quantities?
3. Real variables: adjust for price changes; reflect only quantity changes
4. Example of computers and bicycles
5. Nominal GDP is the dollar value of an economy's final output measured at current market prices
6. Real GDP is an estimate of the value of an economy's final output, adjusting for changes in the overall price level

Data Application

The first time that the national income and product accounts reported *real* GNP was in February 1959; prior to that time, inflation was usually so low that nominal GNP was all that it was thought necessary to examine.

Numerical Problem 5 provides practice in calculating real and nominal GDP and price indexes given several goods with different prices and quantities in two years.

B) Price Indexes

1. A price index measures the average level of prices for some specified set of goods and services, relative to the prices in a specified base year
2. GDP deflator = 100 × nominal GDP/real GDP

Data Application

There are two price indexes available for consumption expenditures: the price index for personal consumption expenditures (PCE) and the consumer price index (CPI). The CPI is available monthly, while the PCE price index is only available quarterly, but provides a better measure of inflation for most purposes, which is why it's the main inflation measure used by the Federal Reserve.

3. Note that base year $P = 100$
4. Consumer Price Index (CPI)
   a. Monthly index of consumer prices; index averages 100 in reference base period (1982 to 1984)
   b. Based on basket of goods in expenditure base period (2003 to 2004)
5. Box 2.2 on the computer revolution and chain-weighted GDP
   a. Choice of expenditure base period matters for GDP when prices and quantities of a good, such as computers, are changing rapidly
   b. BEA compromised by developing chain-weighted GDP
   c. Now, however, components of real GDP don't add up to real GDP, but discrepancy is usually small

Data Application

Calculating chain-weighted indexes is not too hard and you can use the computer-bicycle example in Table 2.4 to illustrate how to do so, as suggested in Box 2.2. Define the Laspeyres quantity index (using year 1 prices) for year 1 as the value of year 1 output at year 1 prices: $L_1 = \$46{,}000$; the Laspeyres quantity index of year 2 output is $L_2 = \$62{,}000$. Define the Paasche quantity index (using year 2 prices) for year 1 as the value of year 1 output at year 2 prices: $P_1 = \$51{,}000$; the Paasche quantity index of year 2 output is $P_2 = \$66{,}000$. (These amounts are all calculated in Table 2.4, they just are not labeled this way.) The chain-weighted index is just the geometric mean of the Laspeyres and Paasche indexes: $C_1 = (L_1 \times P_1)^{1/2} = (46{,}000 \times 51{,}000)^{1/2} = \$48{,}400$; $C_2 = (L_2 \times P_2)^{1/2} = (62{,}000 \times 66{,}000)^{1/2} = \$63{,}970$.

Note that the growth rate of real GDP in this case is (\$63,970 – \$48,400)/\$48,400 = 32.06%, which is close to the average growth rate calculated by the Laspeyres (34.8%) and Paasche (29.4%) indexes, which is 32.095%.

6. Inflation
   a. Calculate inflation rate: $\pi_{t+1} = (P_{t+1} - P_t)/P_t = \Delta P_{t+1}/P_t$
   b. Text Fig. 2.4 shows the U.S. inflation rate since 1960 for the GDP deflator
7. Box 2.3: Does CPI inflation overstate increases in the cost of living?
   a. The Boskin Commission reported that the CPI was biased upwards by as much as one to two percentage points per year
   b. One problem is that adjusting the price measures for changes in the quality of goods is very difficult
   c. Another problem is that price indexes with fixed sets of goods don't reflect the substitution by consumers that goes on when one good becomes relatively cheaper than another; this problem is known as substitution bias

Data Application

A symposium on the CPI appeared in the *Journal of Economic Perspectives* 12 (Winter 1998).

Many different aspects of measurement problems are explored. Although the BLS claims that quality adjustments are made, William Nordhaus points out that other than in the categories of new cars and trucks and women's apparel, only 0.1 percent of all priced commodities were deemed to have quality changes in a recent year.

   d. If inflation is overstated, then real incomes are higher than we thought and we've overindexed payments like Social Security
   e. Latest research (July 2006) suggests bias is still 1% per year or higher

Data Application

There are many problems with price indexes; they are imperfect measures of price changes. What do the indexes do when new goods are introduced? What happens as more efficient stores replaces stores that had higher intermediate costs? How do we account for the fact that people substitute cheaper goods for higher-priced goods? Inadequate treatment of these questions means the measures of prices give an overestimate of the inflation rate. The BLS has fixed a number of these problems in recent years, but some overestimate remains. In a recent comprehensive review of these measurement issues, David E. Lebow and Jeremy B. Rudd ("Measurement Error in the Consumer Price Index: Where Do We Stand?" *Journal of Economic Literature* (March 2003), pp. 159–201) conclude that the overestimate of inflation in the CPI is now about 0.9 percent per year. More recently, Robert Gordon suggests that the overstatement may still exceed 1.0 percent per year ("The Boskin Commission Report: A Retrospective One Decade Later," NBER Working Paper No. 12311, June 2006.).

Numerical Problems 7 and 9 give practice in calculating inflation rates.

V. Interest Rates (Sec. 2.5)

A) Real vs. nominal interest rates

1. Interest rate: a rate of return promised by a borrower to a lender
2. Real interest rate: rate at which the real value of an asset increases over time
3. Nominal interest rate: rate at which the nominal value of an asset increases over time
4. Real interest rate = $i - \pi$ (2.12)

   Text Fig. 2.5 plots nominal and real interest rates for the United States since 1960

B) The expected real interest rate

1. $r = i - \pi^e$ (2.13)
2. If $\pi = \pi^e$, real interest rate = expected real interest rate

Numerical Problem 8 provides practice in calculating real interest rates.

■ Additional Teaching Material

The following material was deleted from the Fifth Edition of the textbook, but is presented here for instructors who wish to present the material in class. You may copy these pages and hand them out to your students.

"Surprise, Surprise, Surprise! Fourth-Quarter 2001 GDP Figures Defy Expectations"

In November 2001, the National Bureau of Economic Research (NBER), the non-profit organization that is the semi-official arbiter of recessions and booms, declared that a recession had begun in the United States in March of that year.[1] The manufacturing sector weakened in the fall of 2000, and the NBER determined that the slowdown had spread to the broader economy by March 2001, the month in which economy wide employment began to fall. The economic disruptions following the September 11, 2001, terrorist attacks worsened the economic downturn. During the two months following September 11, the unemployment rate increased by 0.6 percentage points, and the short-term economic outlook was very gloomy. In November, the Federal Reserve Bank of Philadelphia's regular survey of professional forecasters found that the forecasters were predicting that real GDP would fall at a 1.9% annual rate during the fourth quarter of 2001. But within four months of this pessimistic projection, the Bureau of Economic Analysis (BEA) surprised economy watchers with three pieces of unexpected good news about GDP growth in the fourth quarter.

The BEA regularly releases three successive estimates of quarterly GDP. *Advance* estimates are released about one month after the end of the quarter, *preliminary* estimates are released about two months after the end of the quarter, and *final* estimates are released about three months after the end of the quarter. The *advance* estimates for fourth-quarter 2001 GDP growth, released on January 30, 2002, revealed an unexpected but pleasant development. According to these early estimates, rather than falling as widely predicted, real GDP *grew* at the small but positive annual rate of 0.2% during the fourth quarter of 2001. The primary factors contributing to this growth, according to the advance estimates, were a 5.4% annualized growth in personal consumption expenditures and the 9.2% annualized growth in government purchases. The main source of increased consumption spending, in turn, was expenditure on consumer durable goods, which grew at an annualized rate of 38.4%! The strong growth in durable goods expenditure primarily reflected healthy automobile sales, which were stimulated by aggressive rebate offers and zero percent financing deals by car manufacturers. Increased government spending on security and military preparedness following the terrorist attacks also contributed to a higher real GDP. On the other hand, investment spending declined sharply, at an annual rate of 23.7%, during the fourth quarter.

A month later, the February 28, 2002 release of *preliminary* estimates contained a second pleasant surprise: According to these more complete data, real GDP had grown at an annual rate of 1.4% during the fourth quarter of 2001. That is, the estimate of real GDP growth was revised upward by 1.2 percentage points, which is more than double the typical size of a revision between the advance and preliminary estimate. Consumer spending that was even stronger than previously reported, together with a higher figure for U.S. exports, accounted for most of the upward revision.

The March 28, 2002 *final* estimates delivered yet a third pleasant surprise, with the report that real GDP grew at an annual rate of 1.7% during the fourth quarter of 2001. An increased estimate of net exports of services was the major factor contributing to the 0.3 percentage point revision above the preliminary estimates. In short, after three rounds of estimates, the fourth quarter of 2001 appears now to have been a period of modest growth rather than sharp contraction.

The surprisingly high estimates of fourth-quarter GDP growth led some to question whether a full-fledged recession had begun in 2001 after all. A common rule of thumb is that a recession corresponds to two consecutive quarters of falling real GDP. Although real GDP fell in the third quarter of 2001, the finding that it actually rose during the fourth quarter means that the economic weakness of 2001 would not qualify as a recession, according to this rule of thumb.

[1] See Chapter 8 for a discussion of the dates of recessions.

The NBER, however, rejects the "two-negative-quarter" rule-of-thumb definition of a recession, for two main reasons. First, the NBER economists prefer not to rely on the behavior of a single economic variable, even one as important as real GDP, to define a recession. They pointed out, for example, that employment had decreased substantially during 2001, as happens during the typical recession. It was only because output per worker—which usually declines during recessions—grew at the surprisingly high annual rate of 5.1% in the fourth quarter of 2001 that total real GDP was able to increase, despite continuing declines in employment. Taking labor market developments into account as well as real GDP, the NBER still viewed the episode as a recession. A second reason for not relying strictly on real GDP for determining whether the economy is in recession is that GDP figures can be revised quite substantially over time—as the experience of 2001 shows quite clearly! Thus one would not want to rely on GDP figures alone in making judgments about the state of the economy.

In fact, the GDP figures were revised yet again, in July 2002, as part of the annual revision to the national income accounts. The annual revisions increase the accuracy of the GDP measures because they incorporate detailed information on people's incomes from data on federal income tax returns and social security taxes and payments. GDP growth rates for all four quarters of 2001 were revised as shown:

	GDP growth rates in 2001			
	Q1	**Q2**	**Q3**	**Q4**
Data as of June 2002	1.3	0.3	–1.3	1.7
Revised data, July 2002	–0.6	–1.6	–0.3	2.7

The growth rates in the July 2002 revision are consistent with the NBER's previously announced determination that a recession began in March 2001. And the GDP growth rate of the fourth quarter was revised up yet again. In fact, in July 2003, the NBER determined that the 2001 recession ended in November 2001.

■ Additional Issues for Classroom Discussion

1. Welfare Does Not Equal GDP

You can get students involved in a useful discussion of how our national-income accounts fail to measure our well-being. GDP covers only market activity. Ask your students to come up with some non-market activities that are valuable to society, but which aren't covered as part of GDP. Then you might discuss some activities that increase GDP but reduce welfare in some way, such as activities that cause pollution.

The San Francisco think tank called "Redefining Progress" collects data on what it labels "genuine progress" and compares it to GDP. The genuine progress indicator (GPI) has been declining since the mid-1960s, even though real GDP has been rising. Unlike GDP, which measures only market activity, the GPI accounts for resource depletion, income distribution, housework and nonmarket transactions, changes in leisure time, unemployment and underemployment, pollution, long-term environmental damage, the lifespan of consumer durables and infrastructure, defensive expenditures, and sustainable investments.

2. More Implications of Price Mismeasurement

Ask your students to explore the ramifications of the bias in the CPI and other price measures. If the CPI has been overstated by one percentage point per year over the past decade, how much lower should Social Security payments be? If you see data that say the real wage has barely grown over the past decade, where real wage growth is measured by taking nominal wage growth and subtracting off the rate of inflation, what does that imply about how fast real wages have truly grown? Some of the same biases to the price index that apply to the CPI also apply to the GDP price index (though not the substitution bias). Using the GDP price index, official government data show that multifactor productivity (a measure of average output that accounts for growth in both capital and labor) has changed little over the past 20 years. But if the price index is biased upwards, what does that imply about both real GDP growth over the past 20 years and about multifactor productivity over that time period? What other macroeconomic variables might be affected by price mismeasurement?

3. Should the CPI Measure Changes in Prices or Changes in the Cost of Living?

The Boskin Commission on the bias in the CPI raised a point that economists have known about for some time. The economic concept that we'd like our price measures to capture is changes in the cost of living, but our price indexes are set up to measure the change in average prices. The difference is subtle, yet important. A great medical breakthrough, like the discovery of the polio vaccine, greatly improves the quality of life, reducing the cost of living. Inventions like the vacuum cleaner or the transistor also changed the things we do in daily life, vastly improving the quality of our lives. More recently, advances in computer technology have changed the way we get information and the way businesses operate. But these great inventions seldom have much of an impact on price indexes like the CPI or output measures like GDP. The quality-of-life improvements engendered by new products are very difficult to measure. So the government record-keepers let the income and price accounts reflect such quality changes in only a limited way. But should they? The Boskin Commission recommended that the government statistical agencies try to measure changes in the quality of life, rather than just measuring the prices of existing goods. Yet there can never be solid knowledge of exactly how much better new inventions make our lives. So should the government agencies simply continue to do what they've been doing, and just measure prices? Or should they take their "best guess" as to the improvement in our lives that new inventions and discoveries cause? Would the fact that such a "guess" influences things like the monthly payments to Social Security recipients affect your decision?

■ Answers to Textbook Problems

Review Questions

1. The three approaches to national income accounting are the product approach, the income approach, and the expenditure approach. They all give the same answer because they are designed that way; any entry based on one approach has an entry in the other approaches with the same value. Whenever output is produced and sold, its production is counted in the product approach, its sale is counted in the expenditure approach, and the funds received by the seller are counted in the income approach.

2. Goods are measured at market value in GDP accounting so that different types of goods and services can be added together. Using market prices allows us to count up the total dollar value of all the economy's output. The problem with this approach is that not all goods and services are sold in markets, so we may not be able to count everything. Important examples are homemaking and environmental quality.

3. Intermediate goods and services are used up in producing other goods in the same period (year) in which they were produced, while final goods and services are those that are purchased by consumers or are capital goods that are used to produce future output. The distinction is important, because we want to count only the value of final goods produced in the economy, not the value of goods produced each step along the way.

4. GNP is the market value of final goods and services newly produced by domestic factors of production during the current period, whereas GDP is production taking place within a country. Thus, GNP differs from GDP when foreign factors are used to produce output in a country, or when domestic factors are used to produce output in another country. GDP = GNP – NFP, where NFP = net factor payments from abroad, which equals income paid to domestic factors of production by the rest of the world minus income paid to foreign factors of production by the domestic economy. A country that employs many foreign workers will likely have negative NFP, so GDP will be higher than GNP.

5. The four components of spending are consumption, investment, government purchases, and net exports. Imports must be subtracted, because they are produced abroad and we want GDP to count only those goods and services produced within the country. For example, suppose a car built in Japan is imported into the United States. The car counts as consumption spending in U.S. GDP, but is subtracted as an import as well, so on net it does not affect U.S. GDP. However, it is counted in Japan's GDP as an export.

6. Private saving is private disposable income minus consumption. Private disposable income is total output minus taxes paid plus transfers and interest received from the government. Private saving is used to finance investment spending, the government budget deficit, and the current account. National saving is private saving plus government saving.

7. National wealth is the total wealth of the residents of a country, and consists of its domestic physical assets and net foreign assets. Wealth is important because the long-run economic well-being of a country depends on it. National wealth is related to national saving because national saving is the flow of additions to the stock of national wealth.

8. Real GDP is the useful concept for figuring out a country's growth performance. Nominal GDP may rise because of increases in prices rather than growth in real output.

9. The CPI is a price index that is calculated as the value of a fixed set of consumer goods and services at current prices divided by the value of the fixed set at base-year prices. CPI inflation is the growth rate of the CPI. CPI inflation overstates true inflation because it is hard to measure changes in quality, and because the price index doesn't account for substitution away from goods that become relatively more expensive towards goods that become relatively cheaper.

10. The nominal interest rate is the rate at which the nominal (or dollar) value of an asset increases over time. The real interest rate is the rate at which the real value or purchasing power of an asset increases over time, and is equal to the nominal interest rate minus the inflation rate. The expected real interest rate is the rate at which the real value of an asset is *expected* to increase over time. It is equal to the nominal interest rate minus the expected inflation rate. The concept that is most important to borrowers and lenders is the expected real interest rate, because it affects their decisions to borrow or lend.

Numerical Problems

1. GDP is the value of all final goods and services produced during the year. The final output of coconuts is 1000, which is worth 500 fish, because two coconuts are worth one fish. Of the 500 fish caught during the year, the 100 fish used as fertilizer are an intermediate good, so the final output is 400 fish. So in terms of fish, GDP consists of 500 fish worth of coconuts plus 400 fish, with a total value of 900 fish.

   To find consumption and investment, we must find out what happens to all the coconuts and fish. Gilligan consumes all his 200 coconuts (worth 100 fish) and 100 fish, so his consumption is worth 200 fish. The Professor stores 100 coconuts with a value of 50 fish. In an ideal accounting system, these stored coconuts would be treated as investment. However, in the national income accounts, because it is so difficult to tell when durable goods are consumed and when they are saved, they are counted as consumption. So the Professor's consumption consists of 800 coconuts (value 400 fish) and 300 fish, for a total value of 700 fish. Thus the economy's total consumption is valued at 900 fish and investment is zero.

   In terms of income, Gilligan's income is clearly worth 200 fish (100 fish plus 200 coconuts worth 100 fish). The Professor's income is less easily calculated, because he uses 100 fish to fertilize the coconut trees. These 100 fish are therefore not income to him. Thus the Professor's income is 800 coconuts (1000 coconuts minus the 200 coconuts paid to Gilligan) plus 300 fish (500 fish minus 100 fish paid to Gilligan and minus 100 fish used as fertilizer). In terms of fish, the Professor's income has a value of 700 fish.

   This question illustrates some of the nuances of national income accounting. Many difficult choices and measurement issues are involved in constructing the accounts. Here, for example, it is clear that what we call consumption really isn't just the amount of goods consumers use up during the year, but also includes consumption goods that are purchased but saved for the future. Since there is no way to measure when goods are used after they are purchased, the accounts are unable to distinguish consumption from storage of goods.

   Another subtlety is the treatment of the fish used as fertilizer. If the fertilizer increases *future* output rather than current output, then the fertilizer is not used up during the year and represents investment of 100 fish. In this case, GDP would equal 1000 fish, consumption is 900 fish, investment is 100 fish, the Professor's income is 800 fish, and Gilligan's income is 200 fish.

2. (a) Furniture made in North Carolina that is bought by consumers counts as consumption, so consumption increases by $6 billion, investment is unchanged, government purchases are unchanged, net exports are unchanged, and GDP increases by $6 billion.
   (b) Furniture made in Sweden that is bought by consumers counts as consumption and imports, so consumption increases by $6 billion, investment is unchanged, government purchases are unchanged, net exports fall by $6 billion, and GDP is unchanged.
   (c) Furniture made in North Carolina that is bought by businesses counts as investment, so consumption is unchanged, investment increases by $6 billion, government purchases are unchanged, net exports are unchanged, and GDP increases by $6 billion.
   (d) Furniture made in Sweden that is bought by businesses counts as investment and imports, so consumption is unchanged, investment increases by $6 billion, government purchases are unchanged, net exports decline by $6 billion, and GDP is unchanged.

3. (a) ABC produces output valued at $2 million and has total expenses of $1.3 million ($1 million for labor, $0.1 million interest, $0.2 million taxes). So its profits are $0.7 million. XYZ produces output valued at $3.8 million ($3 million for the three computers that were sold, plus $0.8 million for the unsold computer in inventory) and has expenses of $3.2 million ($2 million for components, $0.8 million for labor, and $0.4 million for taxes). So its profits are $0.6 million.

   According to the product approach, the GDP contributions of these companies are $3.8 million, the value of the final product of XYZ. ABC's production is of an intermediate good, used completely by XYZ, and so is not counted in GDP.

According to the expenditure approach, the GDP contribution is also $3.8 million, with $3 million (of sold computers) adding to the capital stock (as investment spending), and $0.8 million (the unsold computer) as inventory investment.

The income approach yields the same GDP total contribution. The amounts are:

	ABC	XYZ	TOTAL
Labor	$1.0 million	$0.8 million	$1.8 million
Profit	$0.7 million	$0.6 million	$1.3 million
Taxes	$0.2 million	$0.4 million	$0.6 million
Interest	$0.1 million	$0.0 million	$0.1 million

Total of all incomes = $3.8 million

(b) If ABC pays an additional $.5 million for computer chips from abroad, the results change slightly. The correct answer is easiest to see using the expenditure approach. As in part *a*, there is $3.8 million spent on final goods, but now there are also net exports of –$0.5 million. So the total expenditure on domestically produced goods is only $3.3 million. The product approach gets the same answer because the $0.5 million is a contribution to GDP of the country in which the chips were made, and so must be deducted from the GDP of the United States. The value added in the United States is only $3.3 million. Finally, the income approach gives the same answer as in part *a*, except that the cost of importing the chips reduces ABC's profits by $0.5 million, so the sum of the incomes is only $3.3 million.

4. (a) Product approach: $2 = gas station's value added = $28 product minus $26 value of product produced in the previous year. Expenditure approach: $2 = $28 consumption spending plus inventory investment of –$26. Income approach: $2 paid to the factors of production at the gas station (wages of employees, interest, taxes, profits).

(b) Product approach: $60,000 broker's fee for providing brokerage services. Expenditure approach: $60,000 counts as residential investment made by the homebuyer. The important point here is that the transfer of an existing good, even at a higher value than that at which it was originally sold, does not add to GDP. Income approach: $60,000 income to the broker for wages, profits, etc.

(c) Product approach: $40,000 salary plus $16,000 childcare equals $56,000. Note that there is a sense in which the childcare is an intermediate service and should not be counted, because without it the homemaker would not be able to work. But in practice there is no way to separate such intermediate services from final services, so they are all added to GDP. Expenditure approach: $56,000 ($16,000 consumption spending on child care services plus $40,000 in categories that depend on what job the homemaker has). Income approach: $56,000 ($40,000 compensation of homemaker plus $16,000 income to the factors producing the child care: employees' wages, interest, taxes, profits).

(d) Product approach: $100 million of a capital good. Since it is produced with local labor and materials, and assuming no payments go to Japanese factors of production, this is all added to U.S. GDP. Expenditure approach: $100 million net exports, since the plant is owned by the Japanese. (It is not part of gross domestic investment because the plant is not a capital good owned by U.S. residents.) Income approach: $100 million paid to U.S. factors of production.

(e) Product approach: $0 because nothing is produced. Expenditure approach: $0 because this is a transfer, not a government purchase of goods or services. Income approach: $0, because this is not a payment to a factor of production, just a transfer.

(f) Product approach: \$5,000 worth of advertising services. Expenditure approach: \$5,000 of government purchases. Income approach: \$5,000 compensation of employees.

(g) Product approach: \$120 million composed of \$100 million of new cars produced plus \$20 million of sales services provided by the consortium (\$60 million sales price minus \$40 million cost). Expenditure approach: \$100 million by Hertz as investment plus \$60 million by the public for consumption of the used cars minus \$40 million of investment goods sold by Hertz, for a total of \$120 million. Income approach: \$100 million to the factors of production of GM plus \$20 million in payments to the factors of production and profits for the consortium.

5. Given data: $I = 40$, $G = 30$, $GNP = 200$, $CA = -20 = NX + NFP$, $T = 60$, $TR = 25$, $INT = 15$, $NFP = 7 - 9 = -2$. Since $GDP = GNP - NFP$, $GDP = 200 - (-2) = 202 = Y$. Since $NX + NFP = CA$, $NX = CA - NFP = -20 - (-2) = -18$. Since $Y = C + I + G + NX$, $C = Y - (I + G + NX) = 202 - (40 + 30 + (-18)) = 150$. $S_{pvt} = (Y + NFP - T + TR + INT) - C = (202 + (-2) - 60 + 25 + 15) - 150 = 30$. $S_{govt} = (T - TR - INT) - G = (60 - 25 - 15) - 30 = -10$. $S = S_{pvt} + S_{govt} = 30 + (-10) = 20$.

(a) Consumption = 150

(b) Net exports = –18

(c) GDP = 202

(d) Net factor payments from abroad = –2

(e) Private saving = 30

(f) Government saving = –10

(g) National saving = 20

6.

Base-year quantities at current-year prices		**at base-year prices**
Apples	$3000 \times \$3 = \$\ 9{,}000$	$3000 \times \$2 = \$\ 6{,}000$
Bananas	$6000 \times \$2 = \$12{,}000$	$6000 \times \$3 = \$18{,}000$
Oranges	$8000 \times \$5 = \$40{,}000$	$8000 \times \$4 = \$32{,}000$
Total	\$61,000	\$56,000

Current-year quantities at current-year prices		**at base-year prices**
Apples	$4{,}000 \times \$3 = \$\ 12{,}000$	$4{,}000 \times \$2 = \$\ 8{,}000$
Bananas	$14{,}000 \times \$2 = \$\ 28{,}000$	$14{,}000 \times \$3 = \$\ 42{,}000$
Oranges	$32{,}000 \times \$5 = \$160{,}000$	$32{,}000 \times \$4 = \$128{,}000$
Total	\$200,000	\$178,000

(a) Nominal GDP is just the dollar value of production in a year at prices in that year. Nominal GDP is \$56 thousand in the base year and \$200 thousand in the current year. Nominal GDP grew 257% between the base year and the current year: $[(\$200{,}000/\$56{,}000) - 1] \times 100\% = 257\%$.

(b) Real GDP is calculated by finding the value of production in each year at base-year prices. Thus, from the table above, real GDP is \$56,000 in the base year and \$178,000 in the current year. In percentage terms, real GDP increases from the base year to the current year by

$$[(\$178{,}000/\$56{,}000) - 1] \times 100\% = 218\%.$$

(c) The GDP deflator is the ratio of nominal GDP to real GDP. In the base year, nominal GDP equals real GDP, so the GDP deflator is 1. In the current year, the GDP deflator is \$200,000/\$178,000 = 1.124. Thus the GDP deflator changes by $[(1.124/1) - 1] \times 100\% = 12.4\%$ from the base year to the current year.

(d) Nominal GDP rose 257%, prices rose 12.4%, and real GDP rose 218%, so most of the increase in nominal GDP is because of the increase in real output, not prices. Notice that the quantity of oranges quadrupled and the quantity of bananas more than doubled.

7. Calculating inflation rates:

$$\text{1929–30: } [(50.0/51.3) - 1] \times 100\% = -2.5\%$$
$$\text{1930–31: } [(45.6/50.0) - 1] \times 100\% = -8.8\%$$
$$\text{1931–32: } [(40.9/45.6) - 1] \times 100\% = -10.3\%$$
$$\text{1932–33: } [(38.8/40.9) - 1] \times 100\% = -5.1\%$$

These all show deflation (prices are declining over time), whereas recently we have had nothing but inflation (prices rising over time).

8. The nominal interest rate is $[(545/500) - 1] \times 100\% = 9\%$. The inflation rate is $[(214/200) - 1] \times 100\% = 7\%$. So the real interest rate is 2% (9% nominal rate – 7% inflation rate). Expected inflation was only $[(210/200) - 1] \times 100\% = 5\%$, so the expected real interest rate was 4% (9% nominal rate – 5% expected inflation rate).

9. (a) The annual rate of inflation from January 1, 2005, to January 1, 2007, is 10%. This can be found by calculating the constant rate of inflation that would raise the deflator from 200 to 242 in two years. This gives the equation $(1 + \pi)(1 + \pi) = (242/200)$, which has the solution $\pi = 10\%$.

An easy way to think about this question is this. A constant inflation rate of π raises the deflator from 200 on January 1, 2005, to $200 \times (1 + \pi)$ on January 1, 2006, and to $200 \times (1 + \pi) \times (1 + \pi) = 242$ on January 1, 2007. So we need to solve the expression $(1 + \pi)^2 = 242/200$.

(b) By similar reasoning, the inflation rate over the three-year period is $(1 + \pi)^3 = 266.2/200$, or $\pi = 10\%$.

(c) We can derive a general expression in the same way:

$$1 + \pi = P_1/P_0$$
$$1 + \pi = P_2/P_1$$
$$\cdots$$
$$\cdots$$
$$\cdots$$
$$1 + \pi = P_n/P_{n-1}$$

Multiplying all these lines together, we get:

$$(1 + \pi)^n = (P_1/P_0) \times (P_2/P_1) \times \cdots \times (P_n/P_{n-1}) = P_n/P_0$$

Analytical Problems

1. The key to this question is that real GDP is not the same thing as well-being. People may be better off even if real GDP is lower; for example, this may occur because the improvement in the health of workers is more valuable to society than the loss of GDP due to the regulation. Ideally, we would like to be able to compare the costs and benefits of such regulations; they should be put in place if the overall costs (the reduced GDP in this case) are valued less than the overall benefits (the workers' health).

2. National saving does not rise because of the switch to CheapCall because although consumption spending declines by $2 million, so have total expenditures (GDP), which equal total income. Since income and spending both declined by the same amount, national saving is unchanged.

3. (a) The problem in a planned economy is that prices do not measure market value. When the price of an item is too low, then goods are really more expensive than their listed price suggests—we should include in their market value the value of time spent by consumers waiting to make purchases. Because the item's value exceeds its cost, measured GDP is too low.

   When the price of an item is too high, goods stocked on the shelves may be valued too highly. This results in an overvaluation of firms' inventories, so that measured GDP is too high.

   A possible strategy for dealing with this problem is to have GDP analysts estimate what the market price should be (perhaps by looking at prices of the same goods in market economies) and use this "shadow" price in the GDP calculations.

   (b) The goods and services that people produce at home are not counted in the GDP figures because they are not sold on the market, making their value difficult to measure. One way to do it might be to look at the standard of living relative to a market economy, and estimate what income it would take in a market economy to support that standard of living.

4. Under the old definition, $S_{\text{govt}}^{\text{old}} = (T - TR - INT) - G$; under the new definition, $S_{\text{govt}}^{\text{new}} = (T - TR - INT) - GCE$, where GCE = government consumption expenditures, $G = GCE + GI$, and GI = government investment. With those definitions:

$$\begin{aligned} S_{\text{govt}}^{\text{old}} &= (T - TR - INT) - G \\ &= (T - TR - INT) - (GCE + GI) \\ &= [(T - TR - INT) - GCE] - GI \\ &= S_{\text{govt}}^{\text{new}} - GI. \end{aligned}$$

The uses-of-savings identity is

$$\begin{aligned} S_{pvt} &= I + \left(-S_{\text{govt}}^{\text{old}}\right) + CA \\ &= I - \left(S_{\text{govt}}^{\text{new}} - GI\right) + CA \\ &= I + GI + \left(-S_{\text{govt}}^{\text{new}}\right) + CA. \end{aligned}$$

Using data for 2002, the old uses-of-savings identity is (where sd is the statistical discrepancy):

$$\begin{aligned} S_{\text{pvt}} + sd &= \text{I} + \left(-S_{\text{govt}}^{\text{old}}\right) + CA \\ 1595 + (-117) &= 1593 + 374 + (-489) \\ 1478 &= 1478 \text{ so the identity holds.} \end{aligned}$$

The new uses-of-savings identity is:

$$\begin{aligned} S_{\text{pvt}} + sd &= I + GI + \left(-S_{\text{govt}}^{\text{new}}\right) + CA \\ 1595 + (-117) &= 1593 + 352 + 22 + (-489) \\ 1478 &= 1478 \end{aligned}$$

so the identity holds.