Solutions for Macroeconomics 10th Edition by Abel

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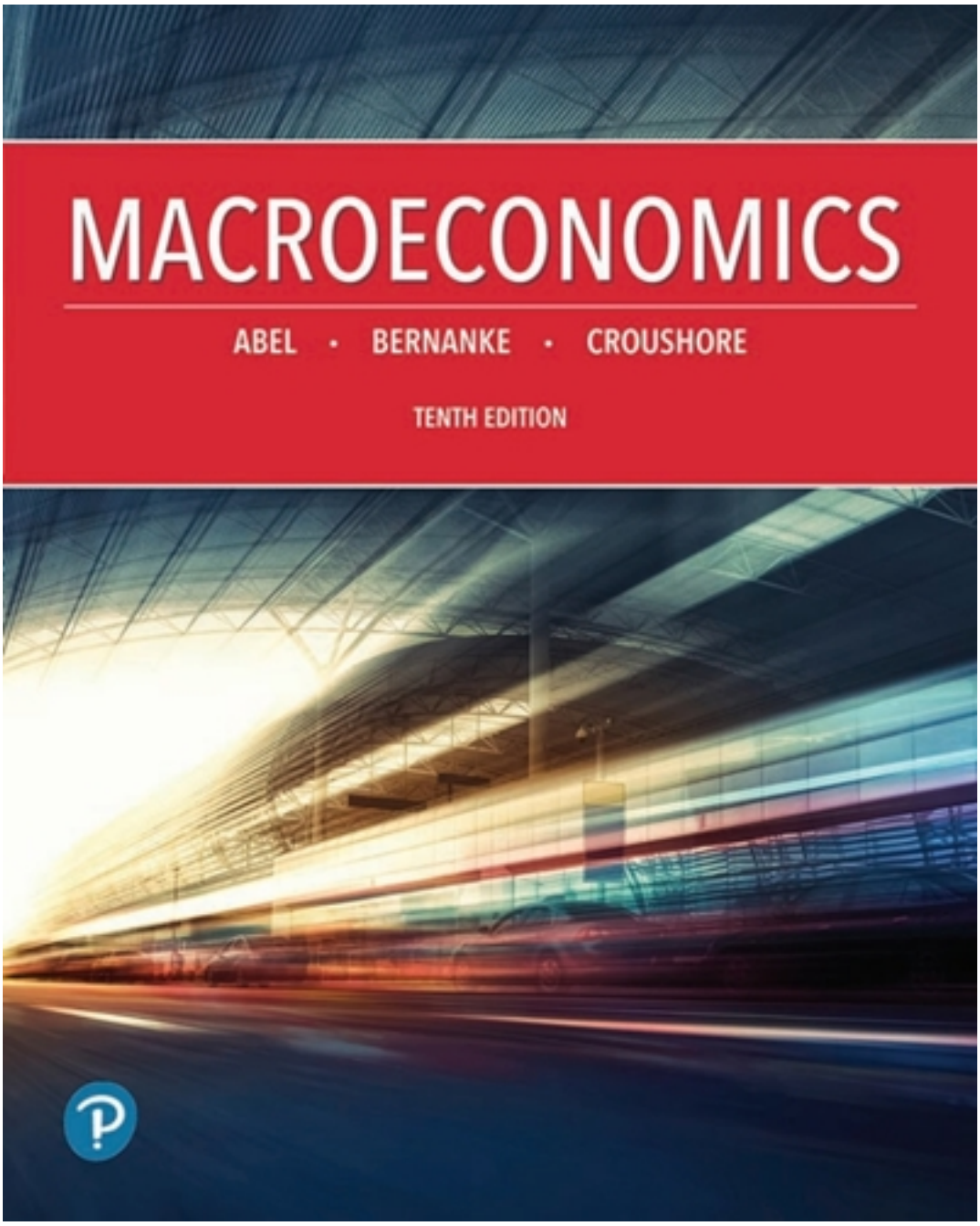


Solutions

Chapter 2
The Measurement and Structure of the National Economy

■ Learning Objectives

I. Section Goals

A. Differentiate among the three approaches to national income accounting (Sec. 2.1)
B. Explain how GDP is measured (Sec. 2.2)
C. Discuss the measurement of aggregate saving and its relation to wealth (Sec. 2.3)
D. Explain the calculations of real GDP, price indexes, and inflation (Sec. 2.4)
E. Define real and nominal interest rates (Sec. 2.5)

II. Notes to Ninth Edition Users

A. In the In Touch box on the National Income and Product Accounts, we added more description of how often the data are revised.
B. In Section 2.4, we added some details on how GDP growth rates are calculated, in terms of quarterly data at annualized growth rates. We also added a discussion of seasonal adjustment of data. Finally, we added a graph showing the annual quarterly GDP growth 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, most easily accessible on the Internet at *www.bea.gov*.
>
> 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, 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 estimate	Last week of month following end of quarter
Second estimate	Last week of second following month
Third estimate	Last week of third following month

Revisions occur every July for the following three years. 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. Periodically, the annual revision in July contains significant changes in the method used to produce the data; these revisions can dramatically change the data going far back in time. [Note: This structure is different now than it was before: Prior to 2009, the first three releases were known as advance, preliminary, and final, and major changes in the methods used to create the data were saved up for a benchmark revision, which took place about every 5 years, instead of being incorporated into the annual release.]

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. Volatile, with fixed investment about 13% to 20% of U.S. GDP
      b. Business (or nonresidential) fixed investment: spending by businesses on structures, equipment, and intellectual property products, such as software, research and development, or artistic originals
      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 July 2013, when the accounts were changed to include intellectual property products, which are treated as capital. Until then, artwork, such as movies, was treated as adding to GDP only in the year it was created. But much artwork continues to have value long after it was created, so it makes sense to treat it as capital. As a result of this change, real GDP and investment were revised up significantly.

   6. Government purchases of goods and services: spending by the government on goods or services
      a. About 1/6 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 2017, transfer payments were $2.7 trillion, while government consumption expenditures were only $1.0 trillion. Gross investment by the federal government ($0.3 trillion) was about the same as depreciation ($0.3 trillion), so net investment was close to zero.

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 took place in the 2000s concerning the national income accounts and the data on GDP. Because the types of goods and services people buy changed so much over time, the BEA decided to modify how it categorizes industries when it collects data on production. The new system was known as NAICS: the North American Industry Classification System; it replaced 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 changed; 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 previous 70 years, manufacturing output had declined from 54% of GDP to 38%, while the output of service industries had increased from 35% of GDP to 54%. The SIC had not been updated to reflect the changes in the economy. NAICS improved 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 is not strictly comparable to data from the past based on SIC. But the BEA believed that the improved quality of the data justified 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
   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

$$\text{private disposable income} = Y + NFP + TR + INT - T \tag{2.4}$$

   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. Savings 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

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

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

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

   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 = $-S_{\text{govt}}$
   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. $S = S_{pvt} + S_{govt}$
   $$= [Y + NFP + TR + INT - C - T] + [T - TR - INT - G] \quad (2.8)$$
   $$= Y + NFP - C - G = \text{GNP} - C - G$$
   c. Text Fig. 2.1: plots national saving, private saving, and government saving relative to GDP; note trend decline in ratio of national saving to GDP matches trend decline in government saving relative to GDP

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

   3. Text Fig. 2.2: shows uses-of-savings identity
      a. Private saving, gross private domestic investment, government budget deficit, and current account balance, each as a percentage of GDP
      b. Since early 1990s, current account balance has been negative
      c. Foreigners buying U.S. assets
      d. In some crisis periods, we observe large increases in the government budget deficit accompanied by sharp declines in gross private domestic investment and increases in private saving
      e. In periods of strong growth, we observe a decline in private saving and the government budget deficit, along with a rise in investment

> 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

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
7. Quarterly annualized growth rates of GDP are calculated using the formula

$$\frac{\Delta Y}{Y} = \left(\frac{Y(t)}{Y(t-1)}\right)^4 - 1, \tag{2.12}$$

8. U.S. data are also generally seasonally adjusted
9. Text Figure 2.3 shows quarterly annualized U.S. GDP growth rates

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 PCE price index provides a better measure of inflation for most purposes, which is why it is 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, which is updated periodically
5. In Touch with Data and Research: 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 in the textbook to illustrate how to do so. 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. Does CPI inflation overstate increases in the cost of living?
   a. The Boskin Commission reported that the CPI was biased upward 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 were 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% 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 have overindexed payments like Social Security
   e. Latest research (July 2006) suggests bias is still 1% per year or higher

C. Application: The Fed's preferred inflation measures
   1. The Federal Reserve focuses its attention on the personal consumption expenditures (PCE) price index
      a. The Fed forecasts both the overall PCE price index and the core PCE price index
   2. The PCE price index is superior to the CPI because it avoids substitution bias and is revised when better data are available
   3. Differences between the PCE price index and the CPI include formulas used in their calculation, coverage of different items, and weights given to different items
   4. The Fed uses the core PCE price index to measure the underlying trend in inflation
   5. But the Fed forecasts both the core and overall PCE price index because the Fed needs to keep its eye on both underlying trends but also the actual inflation rate faced by households
   6. The inflation rate in the overall PCE price index tends to revert to the core measure after a period when the two measures deviate (text Fig. 2.5)

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 replace 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 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 became about 0.9% per year. Robert Gordon suggests that the overstatement may still exceed 1.0 % per year ("The Boskin Commission Report: A Retrospective One Decade Later," NBER Working Paper No. 12311, June 2006). More recently, Brent Moulton finds that the bias in CPI in 2018 is about 0.85% as the Bureau of Economic Analysis and Bureau of Labor Statistics have worked to reduce the bias ("The Measurement of Output, Prices, and Productivity: What's Changed Since the Boskin Commission?" Brookings Institution, July 2018, *www.brookings.edu/research/the-measurement-of-output-prices-and-productivity*).

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 = $i - \pi$ (2.13)
   Text Fig. 2.6 plots nominal and real interest rates for the United States since 1960

B. The expected real interest rate

1. $r = i - \pi^e$ (2.14)
2. If $\pi = \pi^e$, real interest rate = expected real interest rate

Numerical Problem 8 provides practice in calculating real interest rates.

■ 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 nonmarket 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 life span 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 upward, 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 that are 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 toward 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. The final output of fish is 500 fish. So in terms of fish, GDP consists of 500 fish worth of coconuts plus 500 fish, with a total value of 1000 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 400 fish, for a total value of 800 fish. Thus, the economy's total consumption is valued at 1000 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 800 coconuts (1000 coconuts minus the 200 coconuts paid to Gilligan) plus 400 fish (500 fish minus 100 fish paid to Gilligan). In terms of fish, the Professor's income has a value of 800 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.

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, and so on.

(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 the homemaker spends his or her income). 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 × $3 = $ 9,000	3000 × $2 = $ 6,000
Bananas	6000 × $2 = $12,000	6000 × $3 = $18,000
Oranges	8000 × $5 = $40,000	8000 × $4 = $32,000
Total	$61,000	$56,000

Current-Year Quantities at Current-Year Prices		**At Base-Year Prices**
Apples	4,000 × $3 = $ 12,000	4,000 × $2 = $ 8,000
Bananas	14,000 × $2 = $ 28,000	14,000 × $3 = $ 42,000
Oranges	32,000 × $5 = $160,000	32,000 × $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] × 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:

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

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, 2014 to January 1, 2016, 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, 2014 to $200 \times (1 + \pi)$ on January 1, 2015, and to $200 \times (1 + \pi) \times (1 + \pi) = 242$ on January 1, 2016. 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, total expenditures (GDP) decline by the same amount, and expenditures equal income. Because income and spending both decline 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, and as a result the 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. From Eq. (2.3), and using *GPDI* for gross private domestic investment,

$$Y = C + GPDI + (GCE + GI) + NX.$$

From Eq. (2.6), $S_{pvt} = Y + NFP - T + TR + INT - C$.

Substituting Eq. (2.3) into (2.6) to eliminate Y, we get

$$S_{pvt} = C + GPDI + (GCE + GI) + NX + NFP - T + TR + INT - C$$

$$= GPDI + (GCE + GI) + NX + NFP - T + TR + INT.$$

Under the new definition, $S_g = T - TR - INT - GCE$.

Then, because $S = S_{pvt} + S_g$,

$$S = GPDI + (GCE + GI) + NX + NFP - T + TR + INT + T - TR - INT - GCE$$

$$= GPDI + GI + NX + NFP.$$

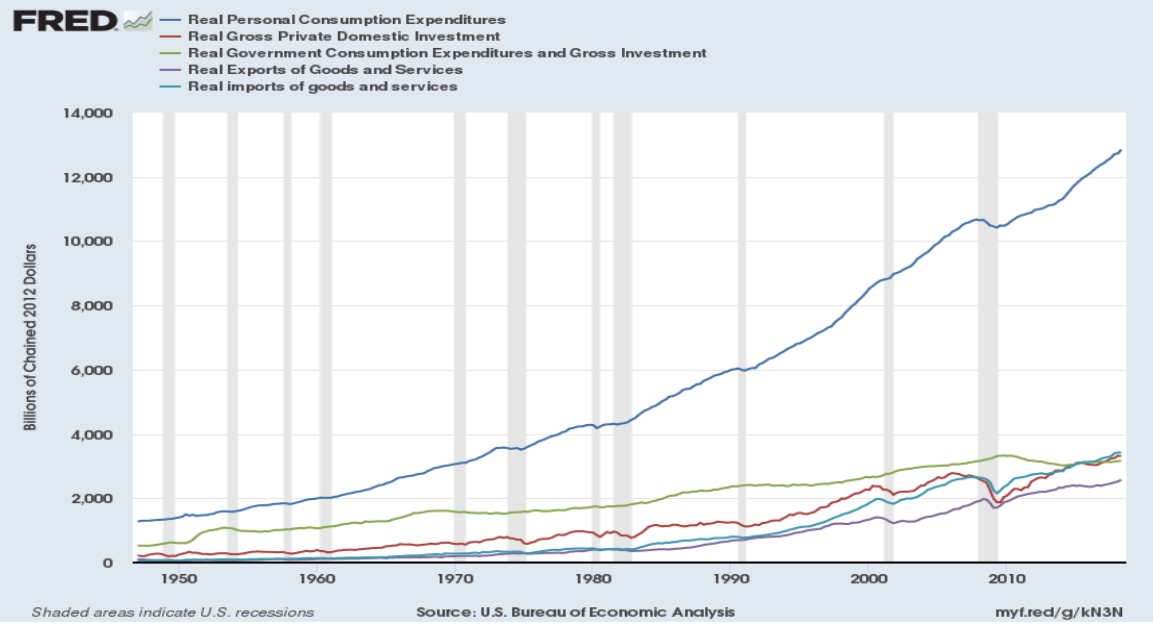
We define $I = GPDI + GI$, and since $CA = NX + NFP$, we have

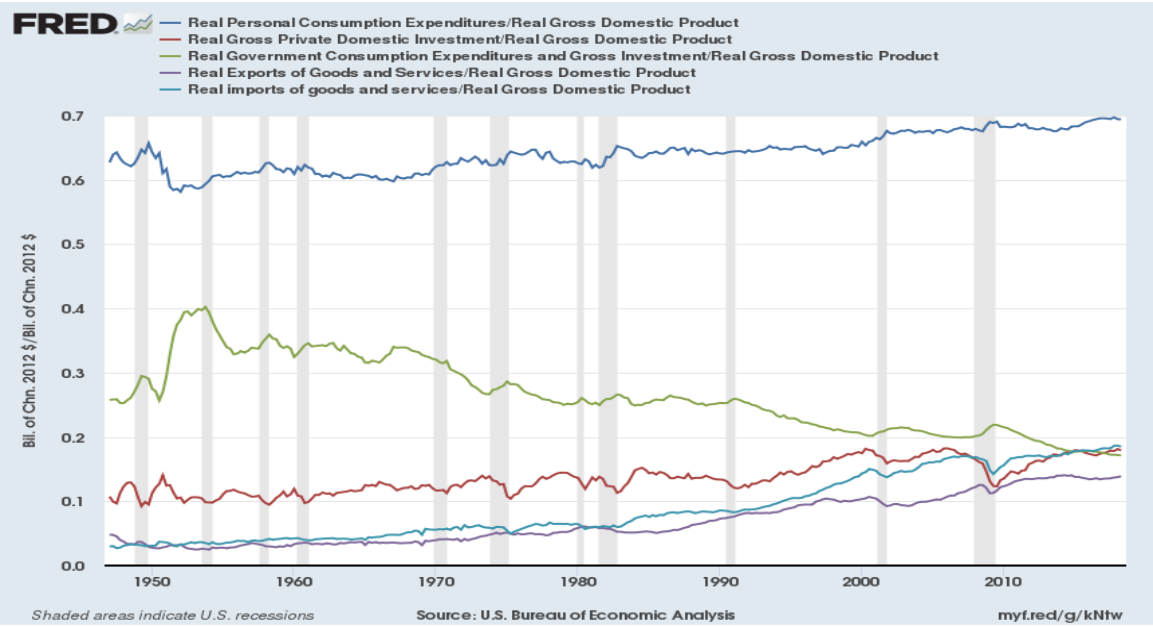
$$S = I + CA.$$

Example from 2015:Q1 (amounts in billions of dollars): Gross saving = 3366.8, gross domestic investment = 3589.2, and current account balance = –475.1. So gross domestic investment + current account balance = 3114.1, which is 252.7 smaller than gross saving. Capital account transactions = 0.4 and the statistical discrepancy is –252.3, so if we add the statistical discrepancy to gross saving, we get 3114.5. If we add capital account transactions to the sum of investment and current account balance, we also get 3114.5.

Working with Macroeconomic Data

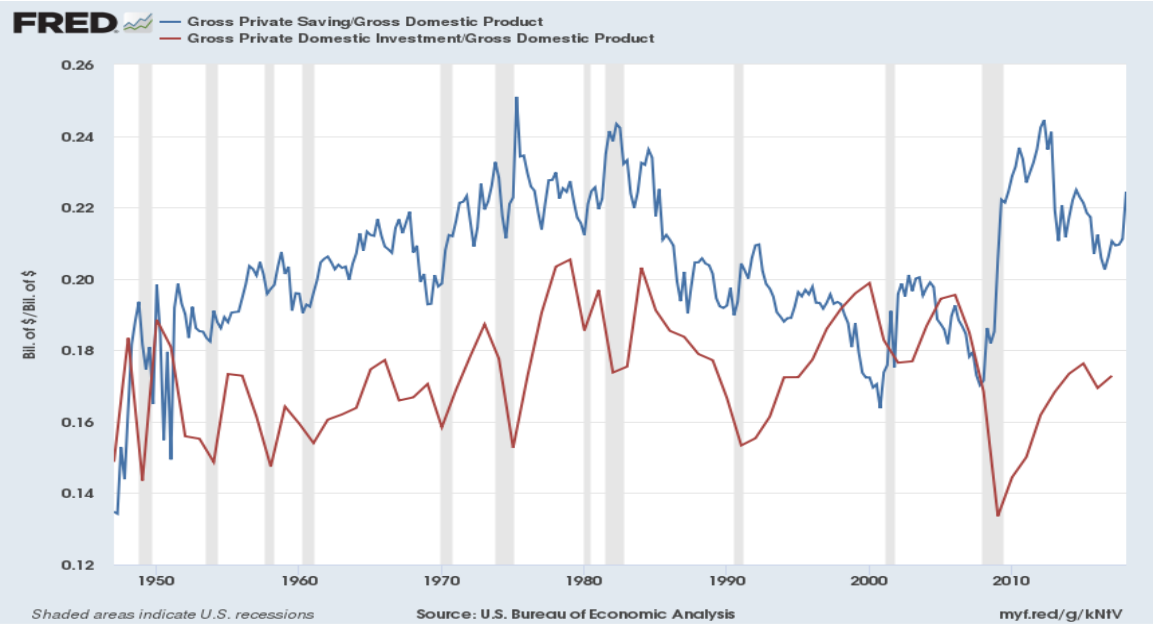
1.





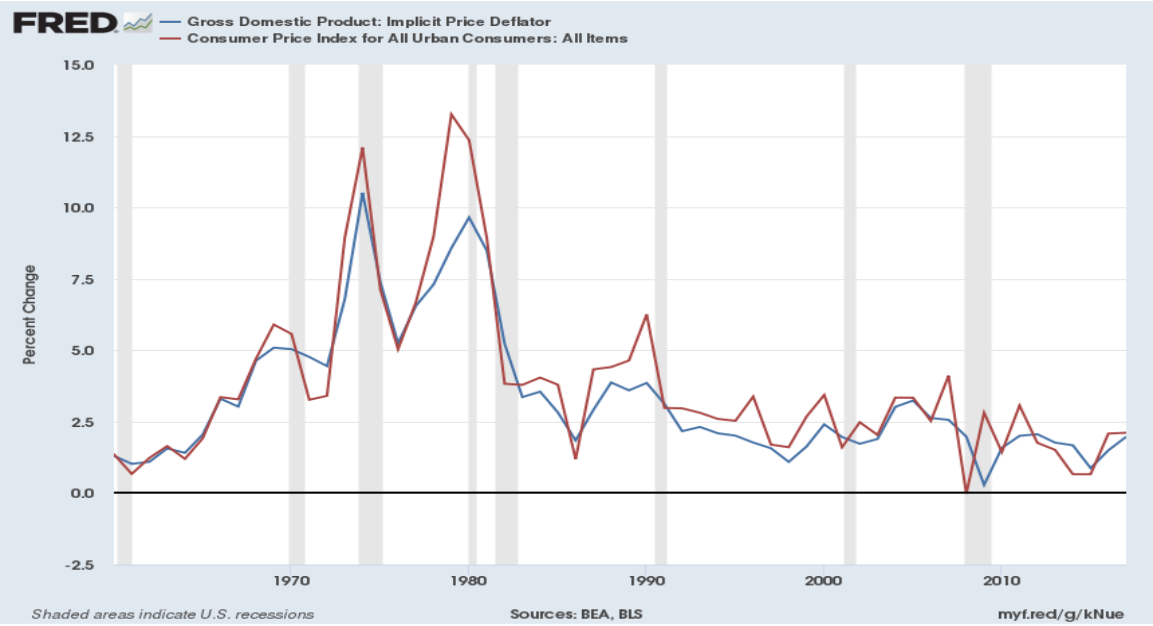
Consumption generally increased as a percentage of GDP from 1965 to 2018. *I*/*GDP* generally increased from 1960 to 2018 but is more volatile than *C*/*GDP*. *G*/*GDP* generally decreased from 1960 to 2018. *X*/*GDP* and *M*/*GDP* generally increased from 1960 to 2018.

2.



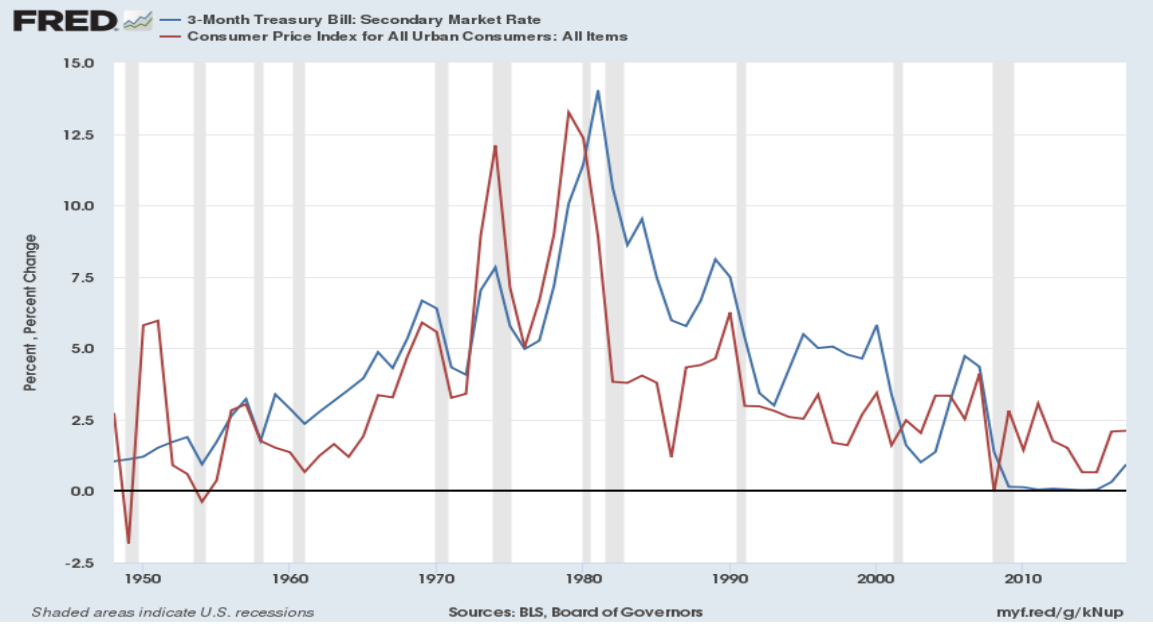
S/*GDP* rose sharply in the recession in 2008-2009, peaked at 24% in 2012, and fell a bit after that before rising in 2018. *I*/*GDP* fell significantly from 2008 to 2010 and rose steadily from 2010 to 2014. National investment can exceed national saving if we borrow from foreign countries.

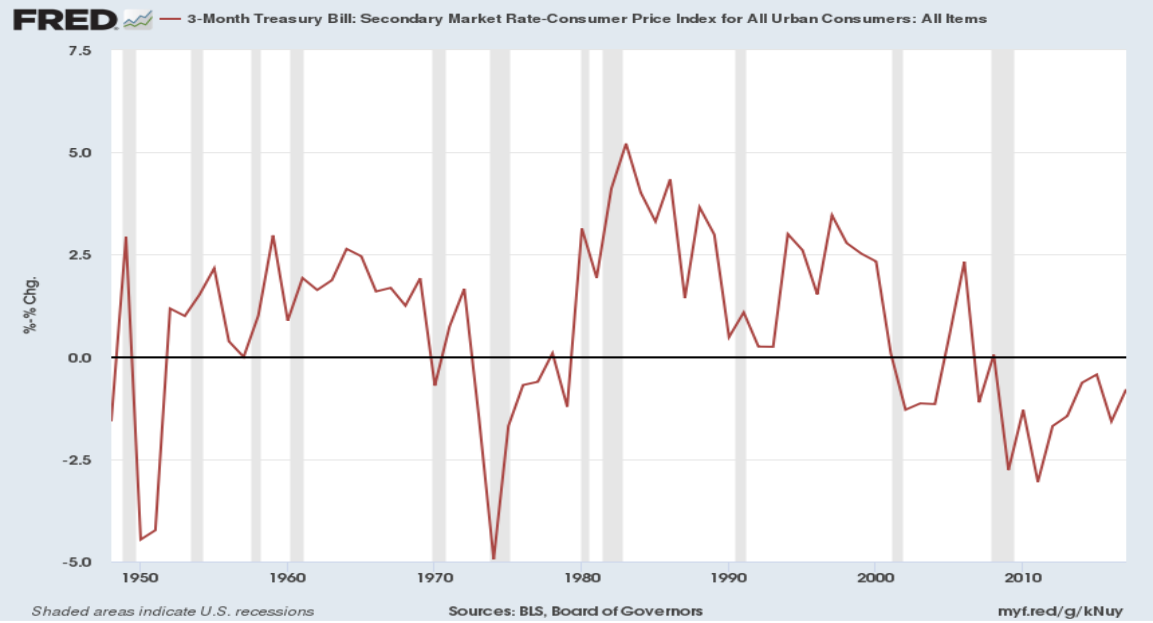
3.



The CPI measure is based only on consumer prices, while the GDP deflator measures the prices of all goods included in GDP. The inflation measures are roughly similar most of the time.

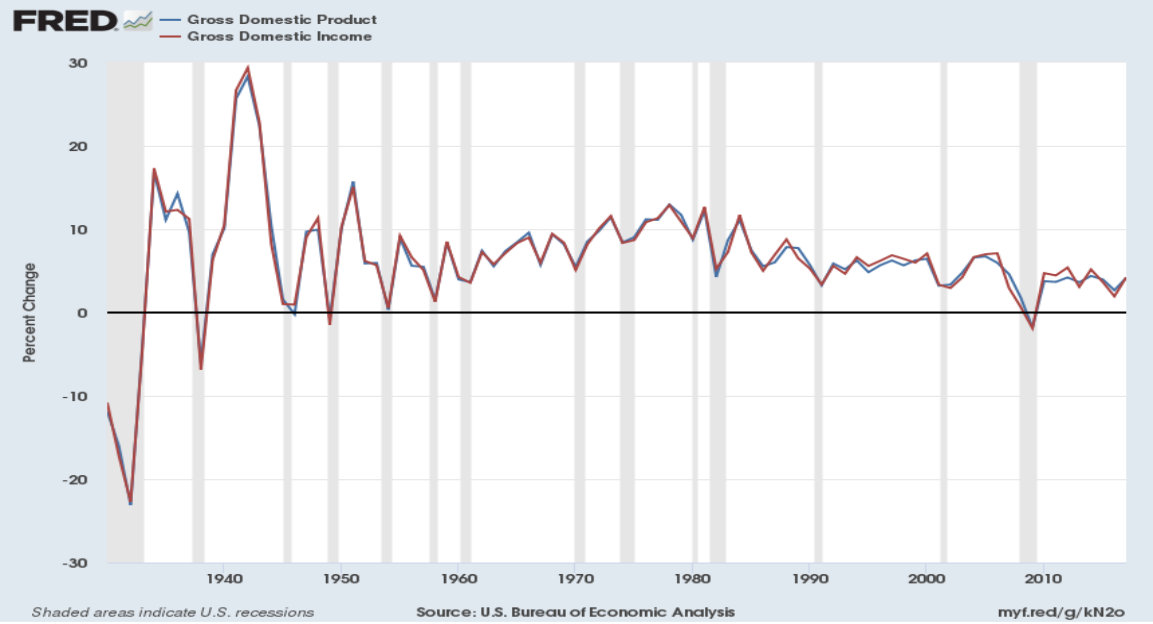
4.





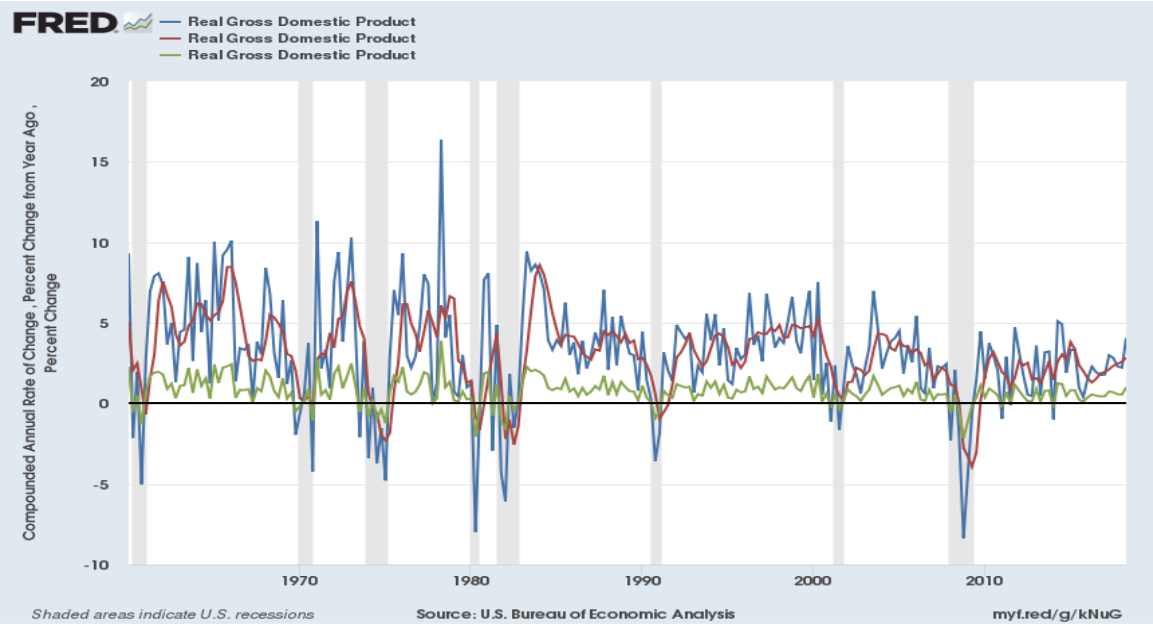
The nominal interest rate sometimes rises with inflation, but other times it moves in the opposite direction. The real interest rate is not constant; it is sometimes positive and sometimes negative.

5.



As of July 2018, the average difference in the growth rates of GDP and GDI in the past five years was 0.2%.

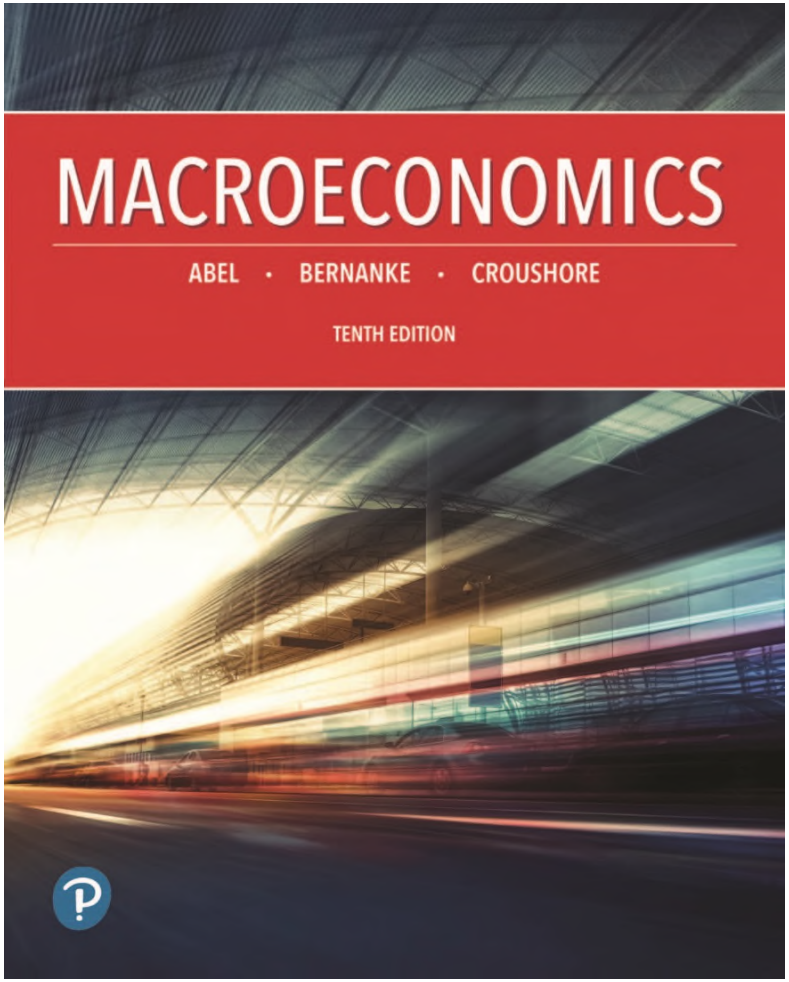
6.



The quarterly data using the percent change from the previous quarter is similar but a muted version of the annualized quarterly growth rate, while the percent change from a year ago is much smoother. Annualized quarterly growth rates are the most volatile, while quarterly data using the percent change from a year ago are the least volatile.

Macroeconomics

Tenth Edition



Chapter 2

The Measurement and Structure of the National Economy

Learning Objectives

2.1 Differentiate among the three approaches to national income accounting (Sec. 2.1: National Income Accounting: The Measurement of Production, Income, and Expenditure)

2.2 Explain how GDP is measured (Sec. 2.2: Gross Domestic Product)

2.3 Discuss the measurement of aggregate saving and its relation to wealth (Sec. 2.3: Saving and Wealth)

2.4 Explain the calculations of real GDP, price indexes, and inflation (Sec. 2.4: Real GDP, Price Indexes, and Inflation)

2.5 Define real and nominal interest rates (Sec. 2.5: Interest Rates)

National Income Accounting (1 of 3)

- National income accounts: an accounting framework used in measuring current economic activity
- Three alternative approaches give the same measurements
  - Product approach: the amount of output produced
  - Income approach: the incomes generated by production
  - Expenditure approach: the amount of spending by purchasers

National Income Accounting (2 of 3)

- Juice business example shows that all three approaches are equal
  - Important concept in product approach:

    value added = value of output minus value of inputs purchased from other producers

National Income Accounting (3 of 3)

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

$$\begin{aligned}\text{total production} &= \text{total income} \\ &= \text{total expenditure}\end{aligned} \qquad (2.1)$$

Gross Domestic Product (1 of 14)

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

Gross Domestic Product (2 of 14)

- Market value: allows adding together unlike items by valuing them at their market prices
  - Problem: misses nonmarket items such as homemaking, the value of environmental quality, and natural resource depletion
  - There is some adjustment to reflect the underground economy
  - Government services (that aren't sold in markets) are valued at their cost of production

Gross Domestic Product (3 of 14)

- Newly produced: counts only things produced in the given period; excludes things produced earlier

Gross Domestic Product (4 of 14)

- Final goods and services
  - 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)
  - Final goods & services are those that are not intermediate
  - 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

Gross Domestic Product (5 of 14)

- Final goods and services
  - 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
  - Adding up value added works well, since it automatically excludes intermediate goods

Gross Domestic Product (6 of 14)

- GNP vs. GDP
  - GNP (gross national product) = output produced by domestically owned factors of production
  - GDP = output produced within a nation
  - $\text{GDP} = \text{GNP} - \text{NFP}$ (2.2)
    - NFP = net factor payments from abroad

      = payments to domestically owned factors located abroad minus payments to foreign factors located domestically

Gross Domestic Product (7 of 14)

- GNP vs. GDP
  - 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
  - Difference between GNP and GDP is small for the United States, about 0.2%, but higher for countries that have many citizens working abroad

Gross Domestic Product (8 of 14)

- The expenditure approach to measuring GDP
  - Measures total spending on final goods and services produced within a nation during a specified period of time
  - Four main categories of spending: consumption (C), investment (I), government purchases of goods and services (G), and net exports (NX)
  - $Y = C + I + G + NX$ (2.3)
    - the income-expenditure identity

Gross Domestic Product (9 of 14)

- The expenditure approach to measuring GDP
  - Consumption: spending by domestic households on final goods and services (including those produced abroad)
    - About 2/3 of U.S. GDP
    - Three categories
      - Consumer durables (examples: cars, TV sets, furniture, major appliances)
      - Nondurable goods (examples: food, clothing, fuel)
      - Services (examples: education, health care, financial services, transportation)

Gross Domestic Product (10 of 14)

- The expenditure approach to measuring GDP
  - Investment: spending for new capital goods (fixed investment) plus inventory investment
    - Volatile, with fixed investment about 13% to 20% of U.S. GDP
    - Business (or nonresidential) fixed investment: spending by businesses on structures, equipment, and intellectual property products, such as software, research and development, or artistic originals
    - Residential fixed investment: spending on the construction of houses and apartment buildings
    - Inventory investment: increases in firms' inventory holdings

Gross Domestic Product (11 of 14)

- The expenditure approach to measuring GDP
  - Government purchases of goods and services: spending by the government on goods or services
    - About 1/6 of U.S. GDP
    - Most by state and local governments, not federal government
    - Not all government expenditures are purchases of goods and services
      - Some are payments that are *not* made in exchange for current goods and services
      - One type is transfers, including Social Security payments, welfare, and unemployment benefits
      - Another type is interest payments on the government debt
    - 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

Gross Domestic Product (12 of 14)

- The expenditure approach to measuring GDP
  - Net exports: exports minus imports
    - Exports: goods produced in the country that are purchased by foreigners
    - Imports: goods produced abroad that are purchased by residents in the country
    - Imports are subtracted from GDP, as they represent goods produced abroad, and were included in consumption, investment, and government purchases

Table 2.1: Expenditure Approach to Measuring GDP in the United States, 2017 (1 of 2)

	Billions of dollars	Percent of GDP
Personal consumption expenditures (C)	**13,321**	**68.4**
Consumer durables	1407	7.2
Nondurable goods	2750	14.1
Services	9165	47.0
Gross private domestic investment (I)	**3368**	**17.3**
Business fixed investment	2588	13.3
Nonresidential structures	585	3.0
Equipment	1150	5.9
Intellectual property products	852	4.4
Residential investment	755	3.9
Inventory investment	26	0.1

Table 2.1: Expenditure Approach to Measuring GDP in the United States, 2017 (2 of 2)

	Billions of dollars	Percent of GDP
Government purchases of goods and services (G)	**3374**	**17.3**
Federal	1265	6.5
National defense	744	3.8
Nondefense	521	2.7
State and local	2109	10.8
Net exports (NX)	**− 578**	**− 3.0**
Exports	2350	12.1
Imports	2929	15.0
Total (equals GDP) (Y)	**19,485**	**100.0**

Note: Numbers may not add to totals shown owing to rounding.
Source: Bureau of Economic Analysis website, www.bea.gov, NIPA Table 1.1.5, July 27, 2018.

Gross Domestic Product (13 of 14)

- The income approach to measuring GDP
  - Adds up income generated by production (including profits and taxes paid to the government)
    - 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
    - National income + statistical discrepancy = net national product
    - Net national product + depreciation (the value of capital that wears out in the period) = gross national product (GNP)
    - GNP − net factor payments (*NFP*) = GDP

Gross Domestic Product (14 of 14)

- The income approach to measuring GDP
  - Private sector and government sector income
    - 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

$$(T) = Y + NFP + TR + INT - T \qquad (2.4)$$

    - $\text{Government's net income} = \text{taxes} - \text{transfers} - \text{interest payments} = T - TR - INT$ (2.5)
    - $\text{Private disposable income} + \text{government's net income} = \text{GDP} + NFP = \text{GNP}$

Table 2.2: Income Approach to Measuring GDP in the United States, 2017 (1 of 2)

	Billions of dollars	Percent of GDP
Compensation of employees	10,407	53.4
Proprietor's income	1501	7.7
Rental income of persons	730	3.7
Corporate profits	2099	10.8
Net interest	576	3.0
Taxes on production and imports	1286	6.6
Business current transfer payments	161	0.8
Current surplus of government enterprises	− 5	0.0
Total (equals **National Income**)	**16,756**	**86.0**

Table 2.2: Income Approach to Measuring GDP in the United States, 2017 (2 of 2)

	Billions of dollars	Percent of GDP
Plus Statistical discrepancy	− 143	− 0.7
Equals **Net National Product**	**16,613**	**85.3**
Plus Consumption of fixed capital	3116	16.0
Equals **Gross National Product (GNP)**	**19,729**	**101.3**
Less Factor income received from rest of world	957	4.9
Plus Payments of factor income to rest of world	713	3.7
Equals **Gross Domestic Product (GDP)**	**19,485**	**100.0**

Note: Numbers may not add to totals shown owing to rounding.
Source: Bureau of Economic Analysis website, www.bea.gov, NIPA Tables 1.7.5 and 1.12, July 27, 2018.

Saving and Wealth (1 of 10)

- Wealth
  - Household wealth = a household's assets minus its liabilities
  - National wealth = sum of all households', firms', and governments' wealth within the nation
  - Savings by individuals, businesses, and government determine wealth

Saving and Wealth (2 of 10)

- Measures of aggregate saving
  - Saving = current income − current spending
  - Saving rate = saving/current income
  - Private saving = private disposable income − consumption

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

Saving and Wealth (3 of 10)

- Measures of aggregate saving
  - Government saving = net government income − government purchases of goods and services

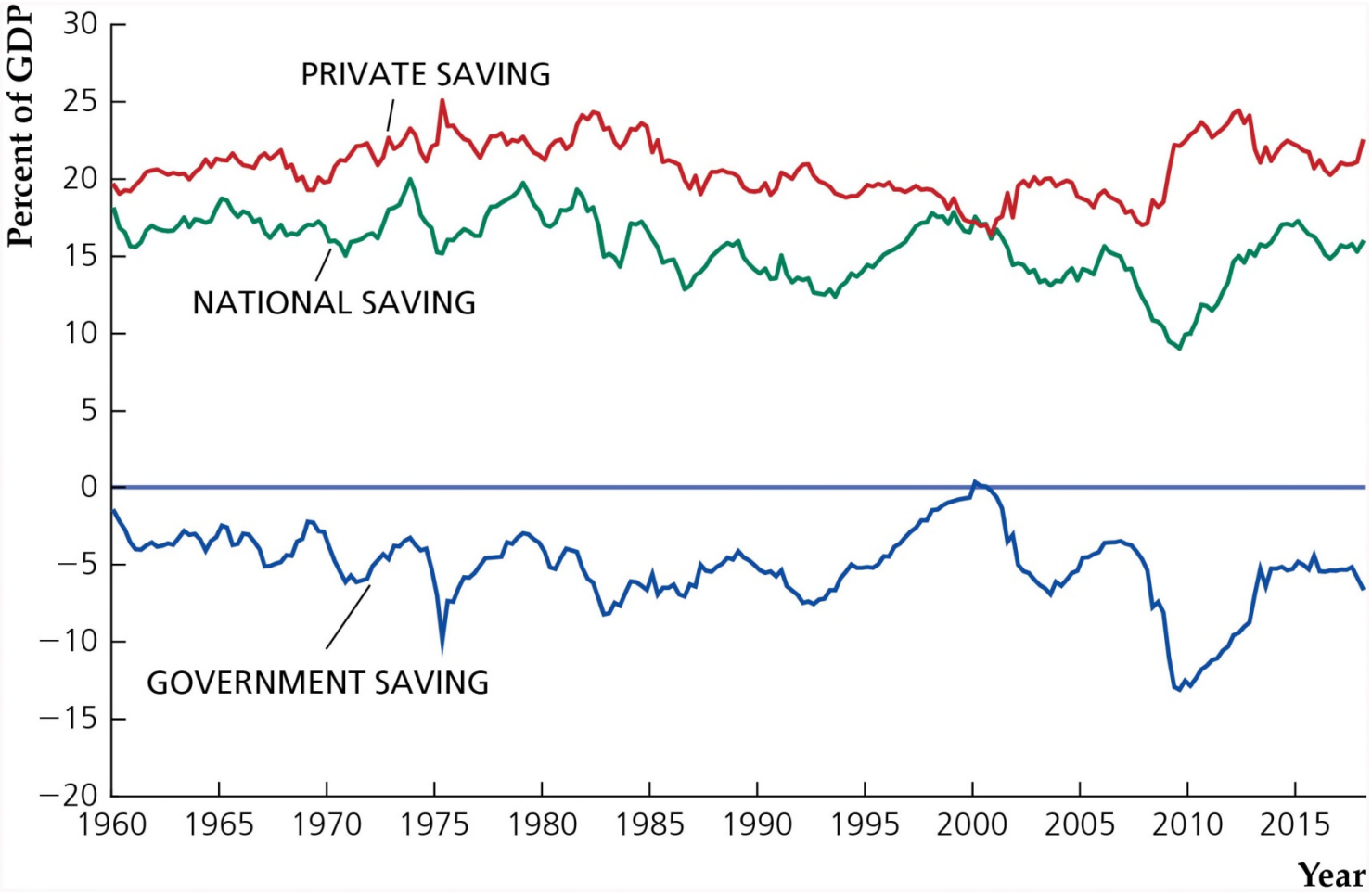
$$S_{\text{govt}} = (T - TR - INT) - G \qquad (2.7)$$

    - Government saving = government budget surplus = government receipts − government outlays
    - Government receipts = tax revenue (T)
    - Government outlays = government purchases of goods and services (G) + transfers (TR) + interest payments on government debt (INT)
    - Government budget deficit = $-S_{\text{govt}}$
    - Simplification: count government investment as government purchases, not investment

Saving and Wealth (4 of 10)

- Measures of aggregate saving
  - National saving
    - National saving = private saving + government saving
    - $$\begin{aligned} S &= S_{pvt} + S_{govt} \\ &= [Y + NFP + TR + INT - C - T] + [T - TR - INT - G] \\ &= Y + NFP - C - G = \text{GNP} - C - G \end{aligned} \quad (2.8)$$
    - Figure 2.1 plots national saving, private saving, and government saving relative to GDP

Figure 2.1: U.S. saving measures as a percentage of GDP, 1960Q1–2018Q1



Saving and Wealth (5 of 10)

- The uses of private saving

$$S = I + (NX + NFP) \qquad (2.9)$$

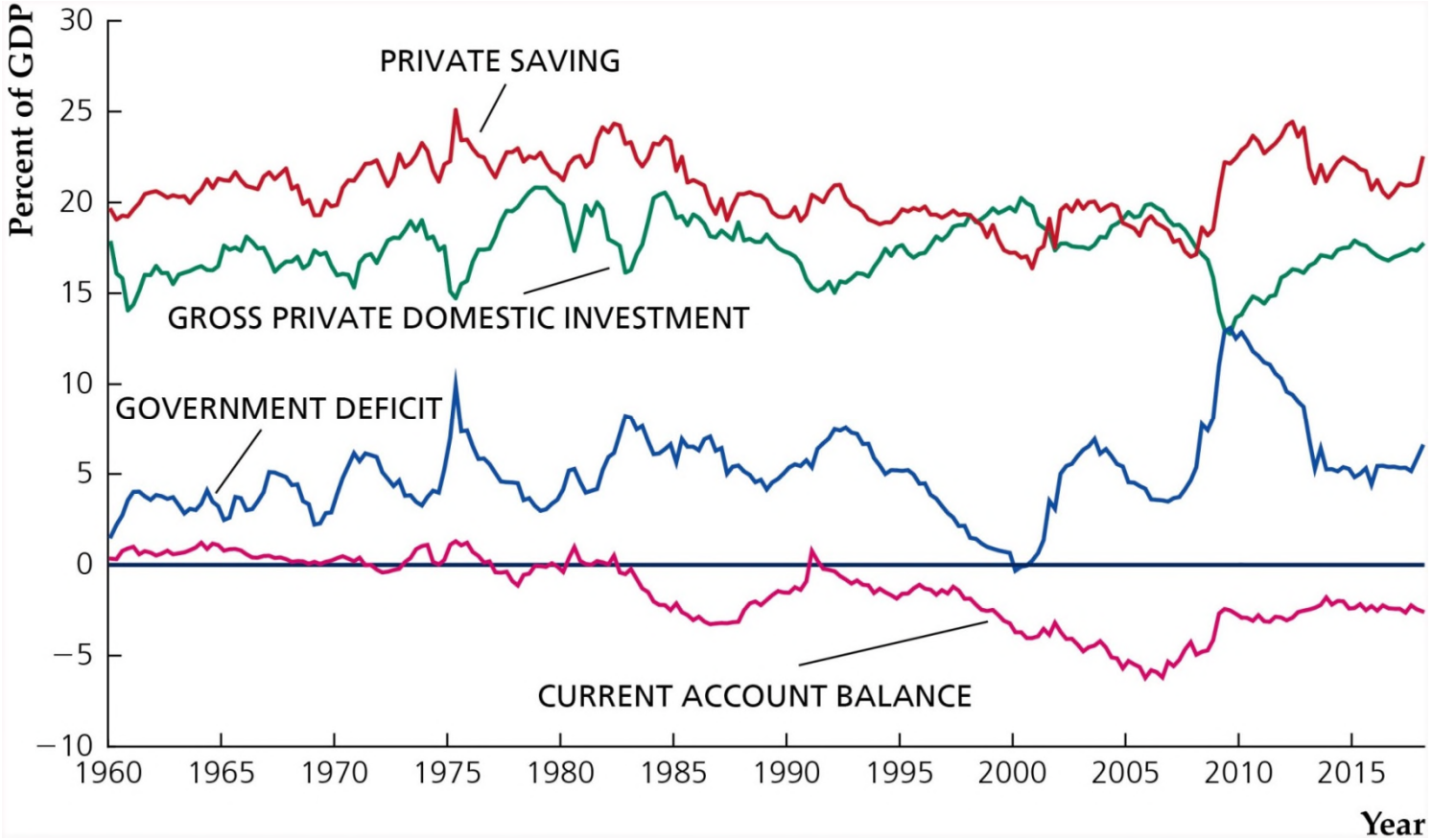
$$S = I + CA \qquad (2.10)$$

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

Saving and Wealth (6 of 10)

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

Figure 2.2: Components of the U.S. uses-of-saving identity, 1960Q1–2018Q1



Saving and Wealth (7 of 10)

- The uses-of-saving identity (Fig. 2.2)
  - Private saving, gross private domestic investment, government budget deficit, and current account balance, each as a percentage of GDP
  - Since early 1990s, current account balance has been negative
  - Foreigners buying U.S. assets
  - In some crisis periods, we observe large increases in the government budget deficit accompanied by sharp declines in gross private domestic investment and increases in private saving
  - In periods of strong growth, we observe a decline in private saving and the government budget deficit, along with a rise in investment

Saving and Wealth (8 of 10)

- Relating saving and wealth
  - Stocks and flows
    - Flow variables: measured per unit of time (GDP, income, saving, investment)
    - Stock variables: measured at a point in time (quantity of money, value of houses, capital stock)
    - Flow variables often equal rates of change of stock variables
  - Wealth and saving as stock and flow (wealth is a stock, saving is a flow)

Saving and Wealth (9 of 10)

- Relating saving and wealth
  - National wealth: domestic physical assets + net foreign assets
    - Country's domestic physical assets (capital goods and land)
    - 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)
    - Wealth matters because the economic well-being of a country depends on it

Saving and Wealth (10 of 10)

- Relating saving and wealth
  - National wealth: domestic physical assets + net foreign assets
    - Changes in national wealth
      - Change in value of existing assets and liabilities (change in price of financial assets, or depreciation of capital goods)
      - National saving $(S = I + CA)$ raises wealth
    - Comparison of U.S. saving and investment with other countries
      - The United States is a low-saving country; Japan is a high-saving country
      - U.S. investment exceeds U.S. saving, so we have a negative current-account balance

Summary 1: Measures of Aggregate Saving

Saving measure	Definition and formula
Private saving	Private disposable income less consumption $S_{pvt} = (Y + NFP + TR + INT - T) - C$
Government saving	Net government income - government purchases $S_{govt} = (T - TR + INT) - G$
National saving	Private saving plus government saving; also GNP ($Y + NFP$) less consumption and government purchases $S = S_{pvt} - S_{govt}$ $= Y + NFP - C - G$

Real GDP, Price Indexes, and Inflation (1 of 12)

- Real GDP
  - Nominal variables are those in dollar terms
  - Problem: Do changes in nominal values reflect changes in prices or quantities?
  - Real variables: adjust for price changes; reflect only quantity changes

Real GDP, Price Indexes, and Inflation (2 of 12)

- Real GDP
  - Example of computers and bicycles
  - Nominal GDP is the dollar value of an economy's final output measured at current market prices
  - Real GDP is an estimate of the value of an economy's final output, adjusting for changes in the overall price level

Real GDP, Price Indexes, and Inflation (3 of 12)

- Real GDP
  - Quarterly annualized growth rates of GDP are calculated using the formula

$$\frac{\Delta Y}{Y} = \left(\frac{Y(t)}{Y(t-1)} \right)^4 - 1, \qquad (2.12)$$

  - U.S. data are also generally seasonally adjusted
  - Text Figure 2.3 shows quarterly annualized U.S. GDP growth rates

Figure 2.3: The annualized quarterly growth rate of U.S. real GDP, 1960Q1–2018Q1

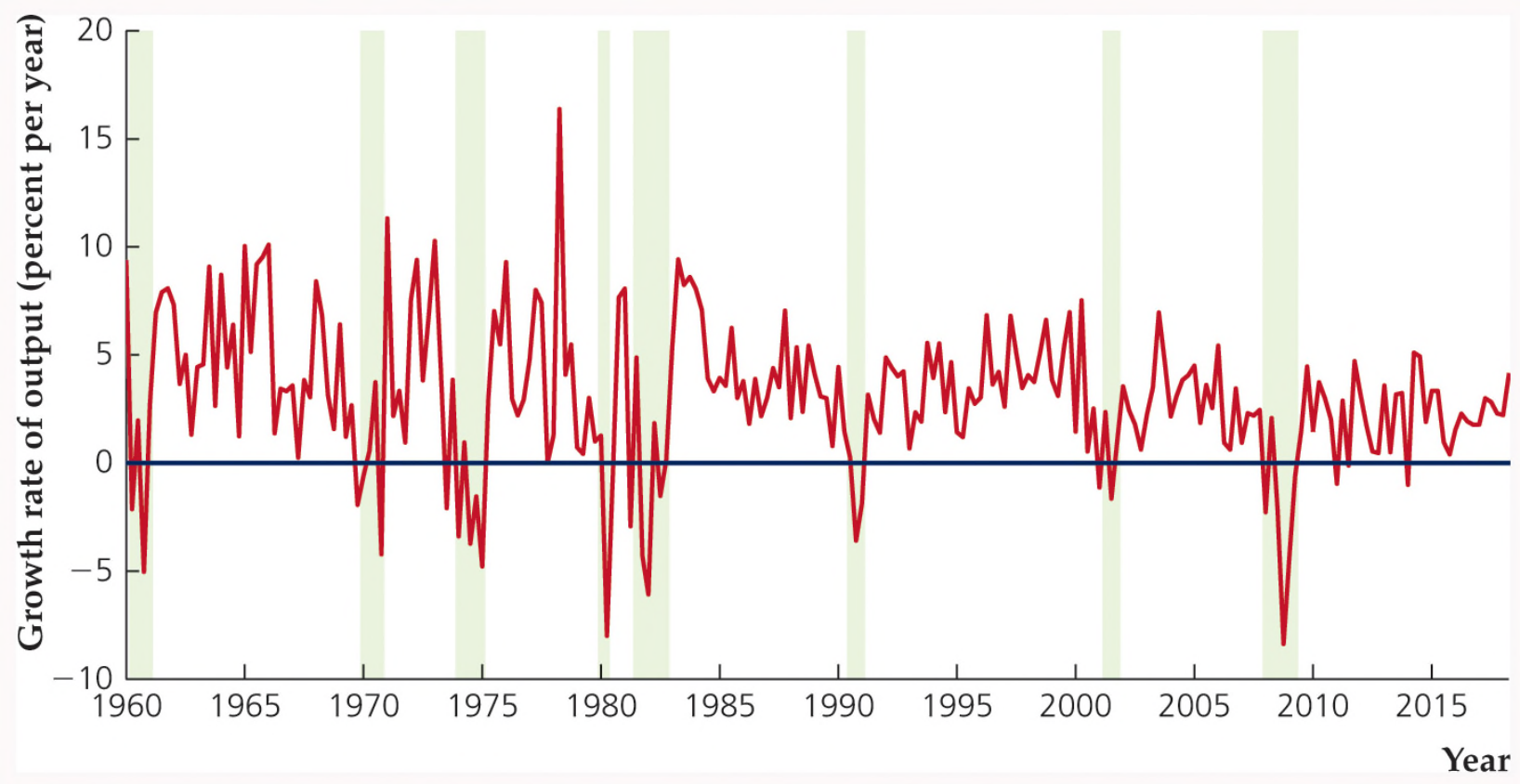


Table 2.3: Production and Price Data

	Year 1	Year 2	Percent change from year 1 to year 2
Product (quantity)			
Computers	5	10	+100%
Bicycles	200	250	+25%
Price			
Computers	$1200/computer	$600/computer	−50%
Bicycles	$200/bicycle	$240/bicycle	+20%
Value			
Computers	$6000	$6000	0
Bicycles	$40,000	$60,000	+50%
Total	**$46,000**	**$66,000**	**+43.5%**

Table 2.4: Calculation of Real Output with Alternative Base Years

Calculation of real output with base year = Year 1					
	Current quantities		Base-year prices		
Year 1					
Computers	5	×	$1200	=	$6000
Bicycles	200	×	$200	=	$40,000
				Total =	**$46,000**
Year 2					
Computers	10	×	$1200	=	$12,000
Bicycles	250	×	$200	=	$50,000
				Total =	**$62,000**
Percentage growth of real GDP = ($62,000 − $46,000)/$46,000 = 34.8%					
Calculation of real output with base year = Year 2					
	Current quantities		Base-year prices		
Year 1					
Computers	5	×	$600	=	$3000
Bicycles	200	×	$240	=	$48,000
				Total =	**$51,000**
Year 2					
Computers	10	×	$600	=	$6000
Bicycles	250	×	$240	=	$60,000
				Total =	**$66,000**
Percentage growth of real GDP = ($66,000 − $51,000)/$51,000 = 29.4%					

Real GDP, Price Indexes, and Inflation (4 of 12)

- Price Indexes
  - 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
  - GDP deflator = 100 x nominal GDP/real GDP
  - Note that base year $P = 100$

Real GDP, Price Indexes, and Inflation (5 of 12)

- Price Indexes
  - Consumer Price Index (CPI)
    - Monthly index of consumer prices; index averages 100 in reference base period (1982 to 1984)
    - Based on basket of goods in expenditure base period (updated periodically)

Real GDP, Price Indexes, and Inflation (6 of 12)

- Price Indexes
  - The computer revolution and chain-weighted GDP
    - Choice of expenditure base period matters for GDP when prices and quantities of a good, such as computers, are changing rapidly
    - BEA compromised by developing chain-weighted GDP
    - Now, however, components of real GDP don't add up to real GDP, but discrepancy is usually small

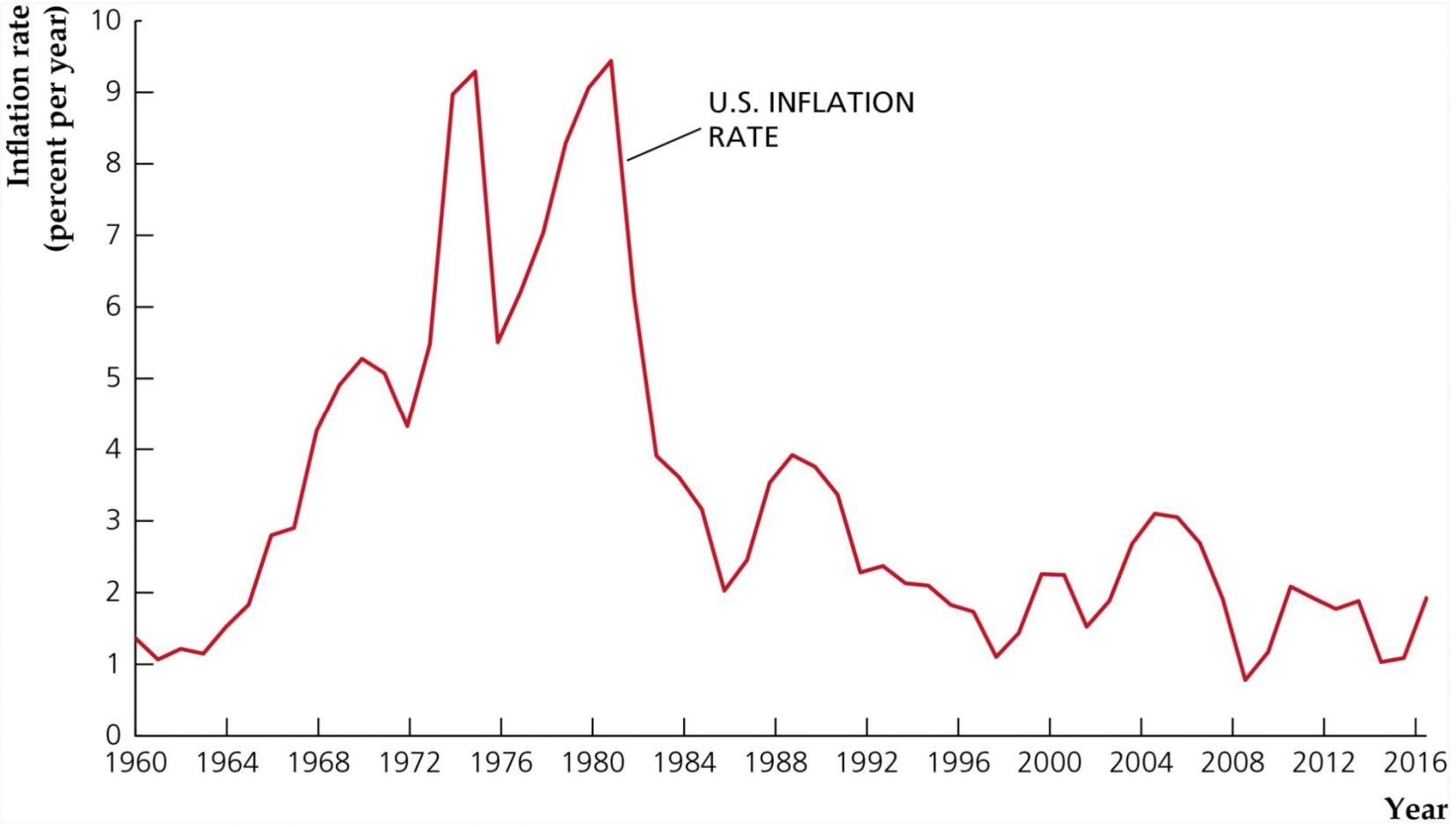
Real GDP, Price Indexes, and Inflation (7 of 12)

- Price Indexes
  - Inflation
    - Calculate inflation rate:

$$\pi_{t+1} = (P_{t+1} - P_t) / P_t = \Delta P_{t+1} / P_t$$

    - Text Fig. 2.4 shows the U.S. inflation rate since 1960 for the GDP deflator

Figure 2.4: The inflation rate in the United States, 1960–2017



Real GDP, Price Indexes, and Inflation (8 of 12)

- Price Indexes
  - Does CPI inflation overstate increases in the cost of living?
    - The Boskin Commission reported that the CPI was biased upward by as much as one to two percentage points per year
    - One problem is that adjusting the price measures for changes in the quality of goods is very difficult

Real GDP, Price Indexes, and Inflation (9 of 12)

- Price Indexes
  - Does CPI inflation overstate increases in the cost of living?
    - Price indexes with fixed sets of goods don't reflect substitution by consumers when one good becomes relatively cheaper than another
      - This problem is known as substitution bias

Real GDP, Price Indexes, and Inflation (10 of 12)

- Price Indexes
  - Does CPI inflation overstate increases in the cost of living?
    - If inflation is overstated, then real incomes are higher than we thought and we have overindexed payments like Social Security
    - Latest research suggests bias is still 1% per year or higher

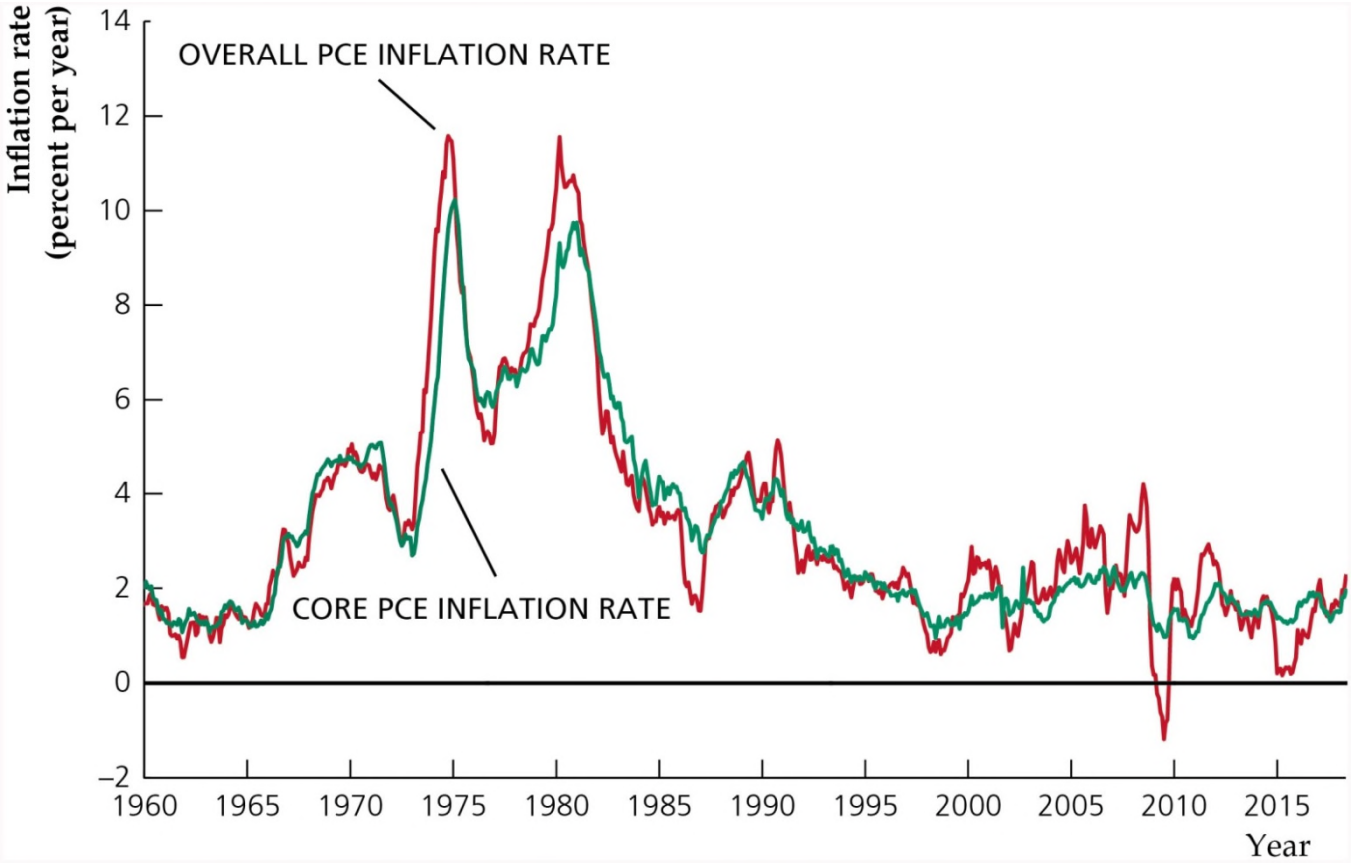
Real GDP, Price Indexes, and Inflation (11 of 12)

- Application: The Fed's preferred inflation measures
  - The Federal Reserve focuses its attention on the personal consumption expenditures (PCE) price index
    - The Fed forecasts both the overall PCE price index and the core PCE price index
  - The PCE price index is superior to the CPI because it avoids substitution bias and is revised when better data are available
  - Differences between the PCE price index and the CPI include formulas used in their calculation, coverage of different items, and weights given to different items

Real GDP, Price Indexes, and Inflation (12 of 12)

- Application: The Fed's preferred inflation measures
  - The Fed uses the core PCE price index to measure the underlying trend in inflation
  - But the Fed forecasts both the core and overall PCE price index because the Fed needs to keep its eye on both underlying trends but also the actual inflation rate faced by households
  - The inflation rate in the overall PCE price index tends to revert to the core measure after a period when the two measures deviate (Figure 2.5)

Figure 2.5: Overall PCE inflation rate and core PCE inflation rate, January 1960 to May 2018



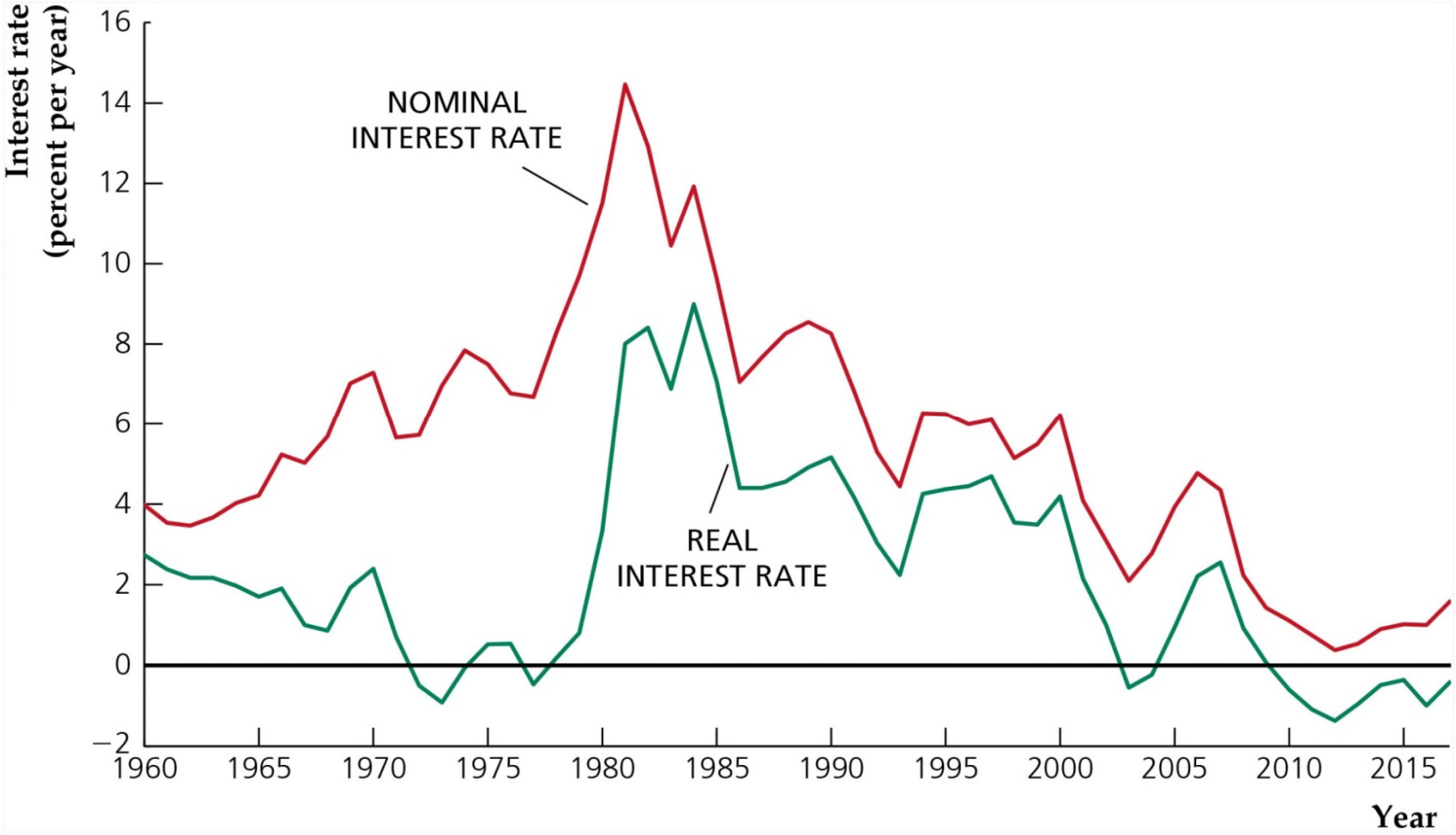
Interest Rates (1 of 3)

- Real vs. nominal interest rates
  - Interest rate: a rate of return promised by a borrower to a lender
  - Real interest rate: rate at which the real value of an asset increases over time
  - Nominal interest rate: rate at which the nominal value of an asset increases over time

Interest Rates (2 of 3)

- Real vs. nominal interest rates
  - $\text{Real interest rate} = i - \pi$ (2.13)
  - Text Fig. 2.6 plots nominal and real interest rates for the United States since 1960

Figure 2.6: Nominal and real interest rates in the United States, 1960–2017



Interest Rates (3 of 3)

- The expected real interest rate

$$r = i - \pi^e \qquad (2.14)$$

  - If $\pi = \pi^e$, real interest rate = expected real interest rate

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