# Chapter 2

## The Measurement and Structure of the National Economy

MACROECONOMICS

SIXTH EDITION

Andrew B. Abel

Ben S. Bernanke

Dean Croushore
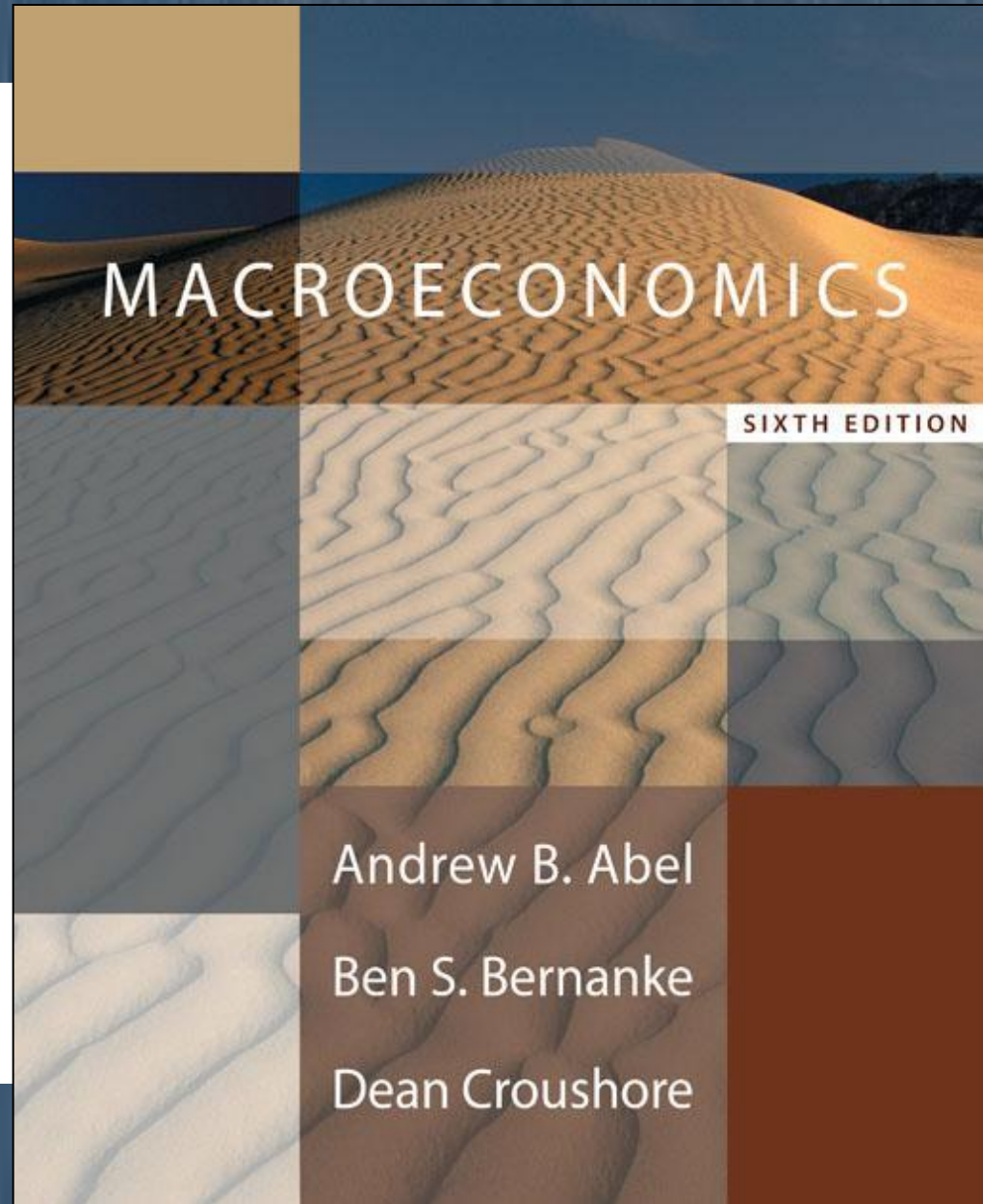
# Chapter Outline

- National Income Accounting: The Measurement of Production, Income, and Expenditure

- Gross Domestic Product

- Saving and Wealth

- Real GDP, Price Indexes, and Inflation

- Interest Rates

# National Income Accounting

- 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

- The national income accounts is an accounting framework used in measuring current economic activity.
- The product approach measures the amount of output produced, excluding output used up in intermediate stages of production.

# National Income Accounting (continued)

- The income approach measures the incomes received by the producers of output.

- The expenditure approach measures the amount of spending by the ultimate purchasers of output.

# National Income Accounting

- 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

- 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:

total production = total income

    = total expenditure               (2.1)

# Gross Domestic Product

- 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

- 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

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

# Gross Domestic Product

- 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

- 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

- GNP vs. GDP
  - GNP (gross national product) = output produced by domestically owned factors of production
  - GDP = output produced within a nation
  - GDP = GNP – 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

- 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

- 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

- 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

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

# Gross Domestic Product

- The expenditure approach to measuring GDP
  - Government purchases of goods and services: spending by the government on goods or services
    - About 1/5 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

- 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, 2005

| | Billions of dollars | Percent of GDP |
|---|---|---|
| Personal consumption expenditures (C) | 8745.7 | 70.0 |
| Consumer durables | 1026.5 | 8.2 |
| Nondurable goods | 2564.4 | 20.5 |
| Services | 5154.9 | 41.3 |
| Gross private domestic investment (I) | 2105.0 | 16.9 |
| Business fixed investment | 1329.8 | 10.6 |
| Nonresidential structures | 335.1 | 2.7 |
| Equipment and software | 994.7 | 8.0 |
| Residential investment | 756.3 | 6.1 |
| Inventory investment | 18.9 | 0.2 |
| Government purchases of goods and services (G) | 2362.9 | 18.9 |
| Federal | 877.7 | 7.0 |
| National defense | 587.1 | 4.7 |
| Nondefense | 290.6 | 2.3 |
| State and local | 1485.2 | 11.9 |
| Net exports (NX) | −726.5 | −5.8 |
| Exports | 1301.2 | 10.4 |
| Imports | 2027.7 | 16.2 |
| Total (equals GDP) (Y) | 12487.1 | 100.0 |

*Note:* Numbers may not add to totals shown owing to rounding.
*Source:* Bureau of Economic Analysis Web site, *www.bea.gov*, Table 1.1.5, May 31, 2006.

# Gross Domestic Product

- 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

- 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 ($T$) = $Y + NFP + TR + INT – T$          (2.4)
    - Government's net income = taxes – transfers – interest payments = $T – TR – INT$                              (2.5)
    - Private disposable income + government's net income = GDP + $NFP$ = GNP

# **Table 2.2** Income Approach to Measuring GDP in the United States, 2005

| | Billions of dollars | Percent of GDP |
|---|---|---|
| Compensation of employees | 7113 | 57.0 |
| Proprietor's income | 939 | 7.5 |
| Rental income of persons | 73 | 0.6 |
| Corporate profits | 1352 | 10.8 |
| Net interest | 498 | 4.0 |
| Taxes on production and imports | 848 | 6.8 |
| Business current transfer payments | 80 | 0.6 |
| Current surplus of government enterprises | −11 | −0.1 |
| Total (equals **National Income**) | 10892 | 87.2 |
| *Plus* Statistical discrepancy | 55 | 0.4 |
| *Equals* **Net National Product (NNP)** | 10947 | 87.7 |
| *Plus* Consumption of fixed capital | 1574 | 12.6 |
| *Equals* **Gross National Product (GNP)** | 12521 | 100.3 |
| *Less* Factor income received from rest of world | 508 | 4.1 |
| *Plus* Payments of factor income to rest of world | 474 | 3.8 |
| *Equals* **Gross Domestic Product (GDP)** | 12487 | 100.0 |

*Note:* Numbers may not add to totals shown owing to rounding.
*Source:* Bureau of Economic Analysis Web site, *www.bea.gov*, Tables 1.7.5 and 1.12, May 31, 2006.

# Saving and Wealth

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

# Saving and Wealth

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

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

# Saving and Wealth

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

    $S_{govt} = (T - TR - INT) - G$ \qquad\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 = $- S_{govt}$
    - Simplification: count government investment as government purchases, not investment

# Saving and Wealth

- **Measures of aggregate saving**
  - National saving
    - National saving = private saving + government saving
    - $S = S_{pvt} + S_{govt}$ (2.8)

      $= [Y + NFP - T + TR + INT - C]$

      $\quad + [T - TR - INT - G]$

      $= Y + NFP - C - G = GNP - C - G$

# Saving and Wealth

- The uses of private saving

  $S = I + (NX + NFP)$        (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

# Saving and Wealth

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

# Saving and Wealth

- 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

- 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

- 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 the Aggregate Savings

## Measures of Aggregate Saving

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

# Saving and Wealth

- Application: Wealth Versus Saving
  - The personal saving rate has declined dramatically in recent years (Fig. 2.1)
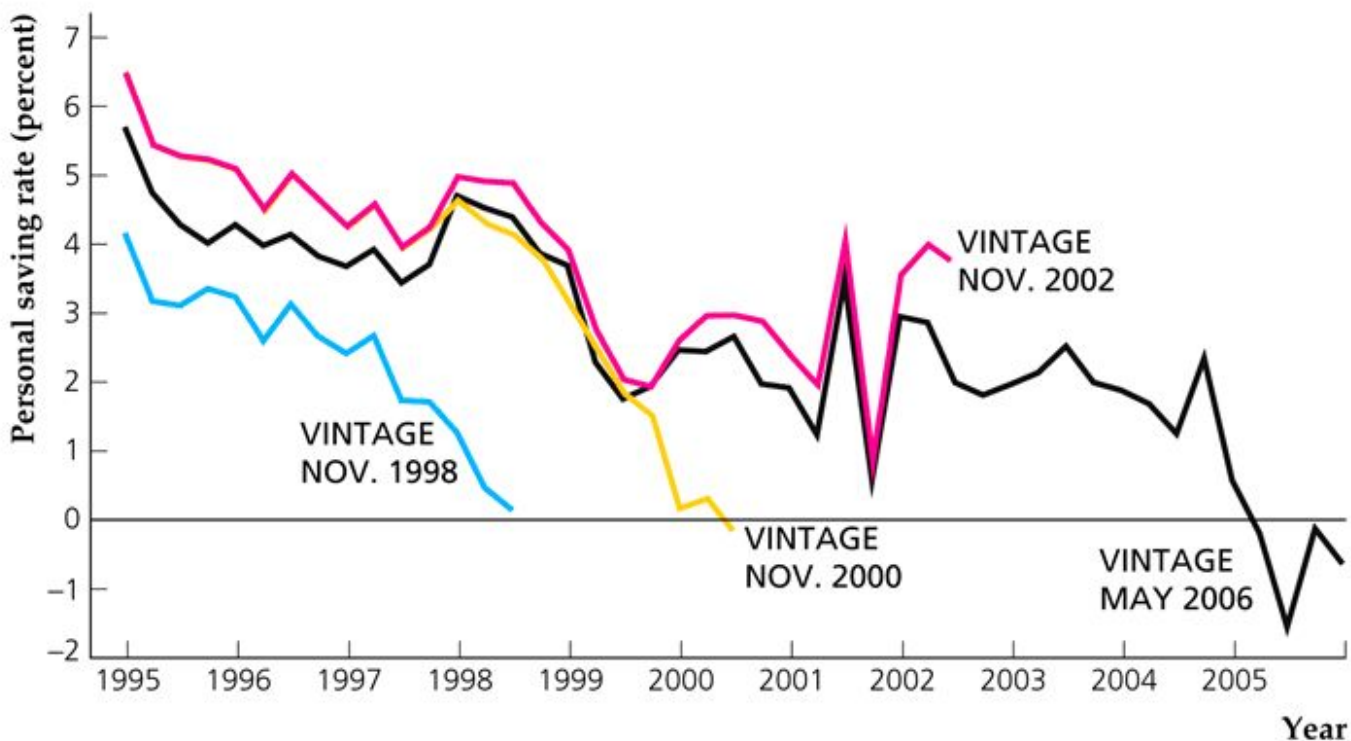
# **Figure 2.1** Personal Saving Rate, 1947-2006
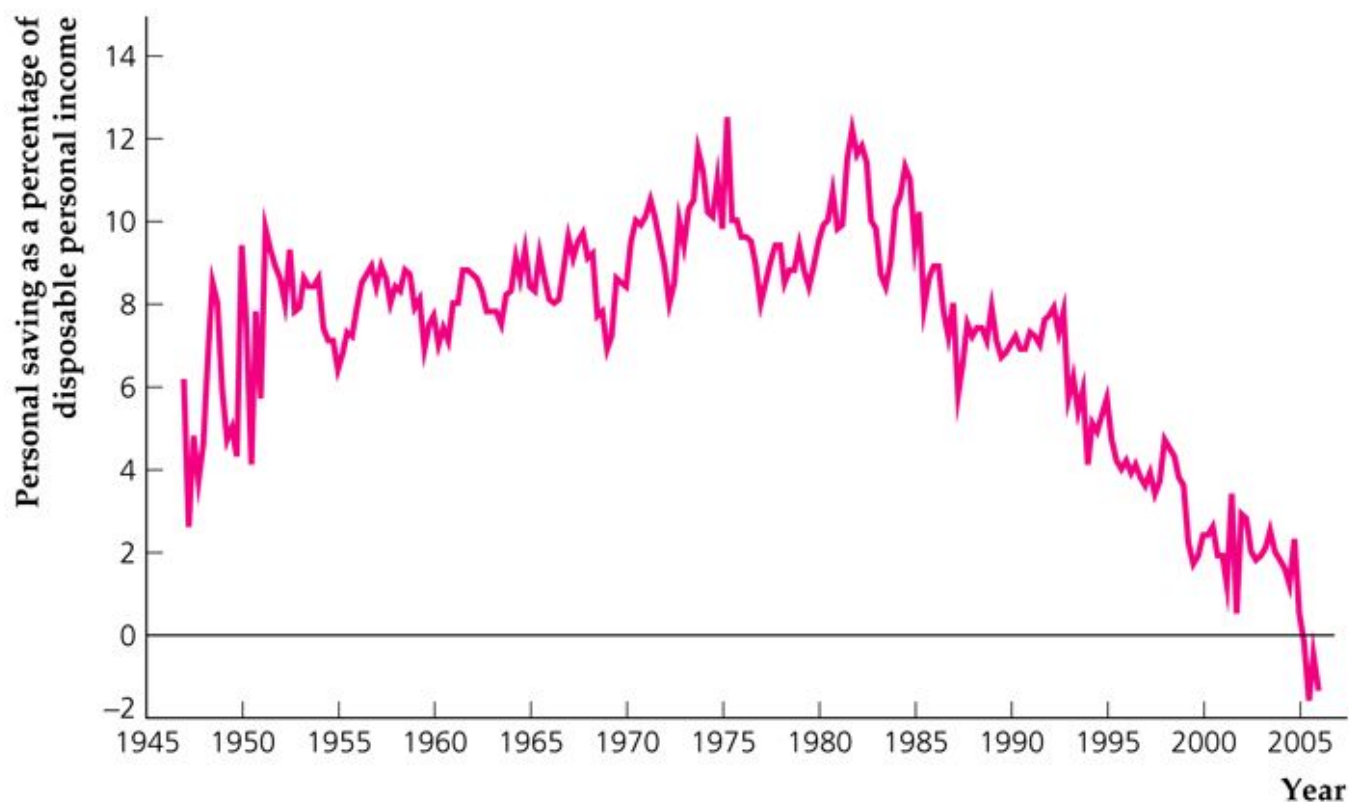
# Saving and Wealth

- Application: Wealth Versus Saving
  - We might not need to worry about the decline in the personal saving rate because:
    - private saving is the relevant measure of saving
    - the personal saving rate may be revised upward in the future (Fig. 2.2)

# Figure 2.2 Personal Saving Rate Reported by the Government At Different Vintage Dates, 1995-2006

# Saving and Wealth

- Application: Wealth Versus Saving
  - We might not need to worry about the decline in the personal saving rate because:
    - the personal saving rate ignores capital gains; as people's wealth rises, their saving rate declines (Fig. 2.3)

# **Figure 2.3** Annual change in net worth divided by disposable personal income, 1953-2006
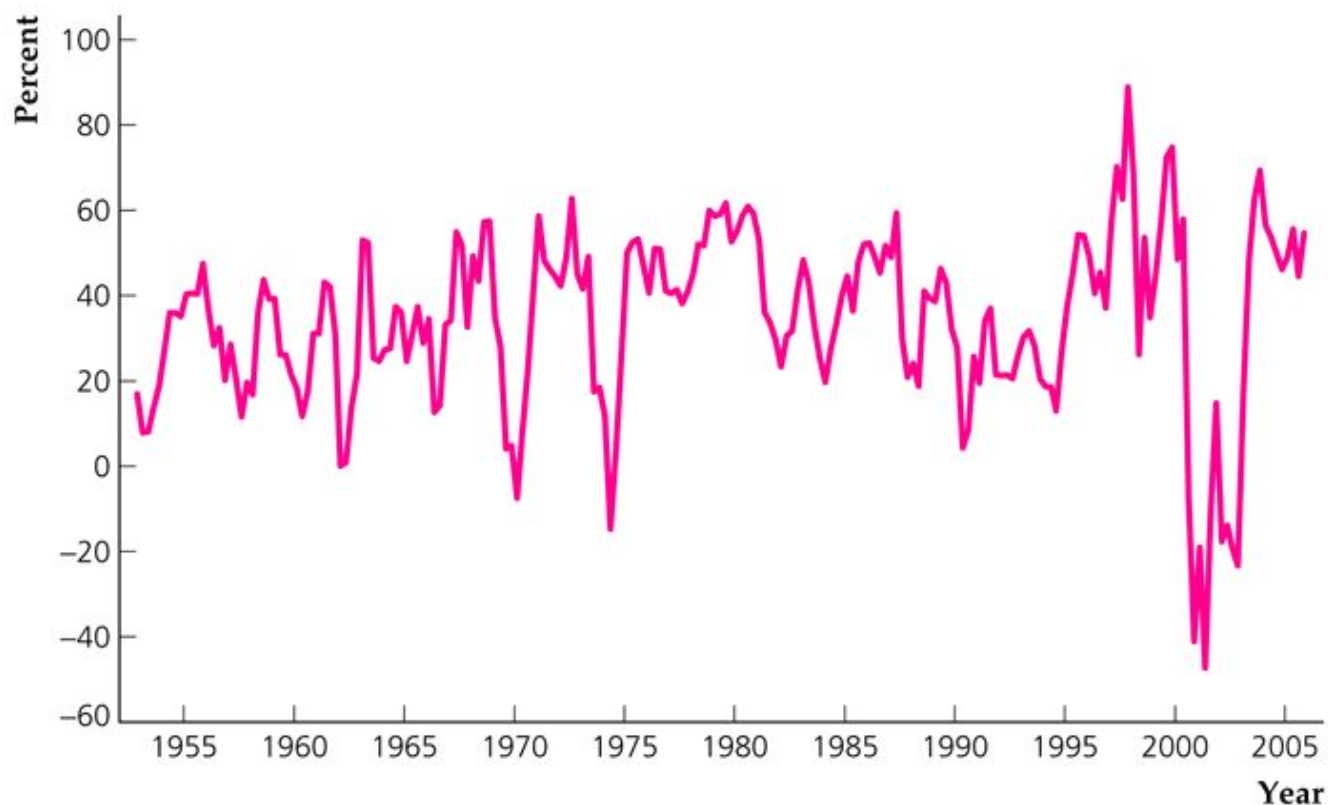
# Real GDP, Price Indexes, and Inflation

- 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

- 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

# 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 | $1,200/computer | $600/computer | −50% |
| Bicycles | $200/bicycle | $240/bicycle | +20% |
| **Value** | | | |
| Computers | $6,000 | $6,000 | 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 | × | $1,200 | | = | $6,000 |
| Bicycles | 200 | × | $200 | | = | $40,000 |
| | | | | Total | = | $46,000 |
| **Year 2** | | | | | | |
| Computers | 10 | × | $1,200 | | = | $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 | | = | $3,000 |
| Bicycles | 200 | × | $240 | | = | $48,000 |
| | | | | Total | = | $51,000 |
| **Year 2** | | | | | | |
| Computers | 10 | × | $600 | | = | $6,000 |
| 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

- 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 × nominal GDP/real GDP
  - Note that base year $P$ = 100

# Real GDP, Price Indexes, and Inflation

- 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 (2003 to 2004)

# Real GDP, Price Indexes, and Inflation

- Price Indexes
  - Box 2.2 on 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
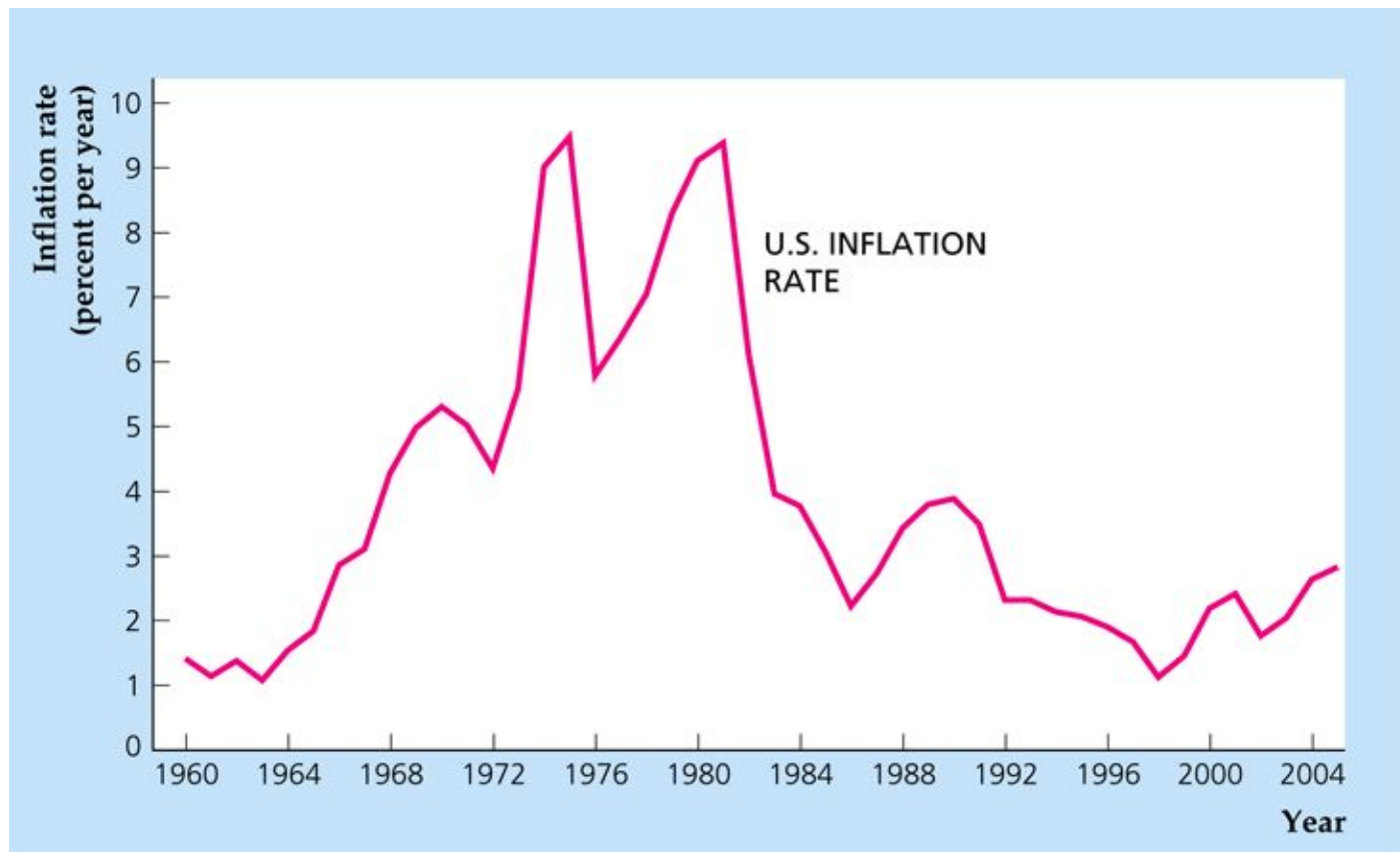
- Price Indexes
  - Inflation
    - Calculate inflation rate:

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

    - 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, 1960-2005

# Real GDP, Price Indexes, and Inflation

- Price Indexes
  - Box 2.3: Does CPI inflation overstate increases in the cost of living?
    - The Boskin Commission reported that the CPI was biased upwards 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

- Price Indexes
  - Box 2.3: 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

- **Price Indexes**
  - Box 2.3: Does CPI inflation overstate increases in the cost of living?
    - If inflation is overstated, then real incomes are higher than we thought and we've overindexed payments like Social Security
    - Latest research (July 2006) suggests bias is still 1% per year or higher
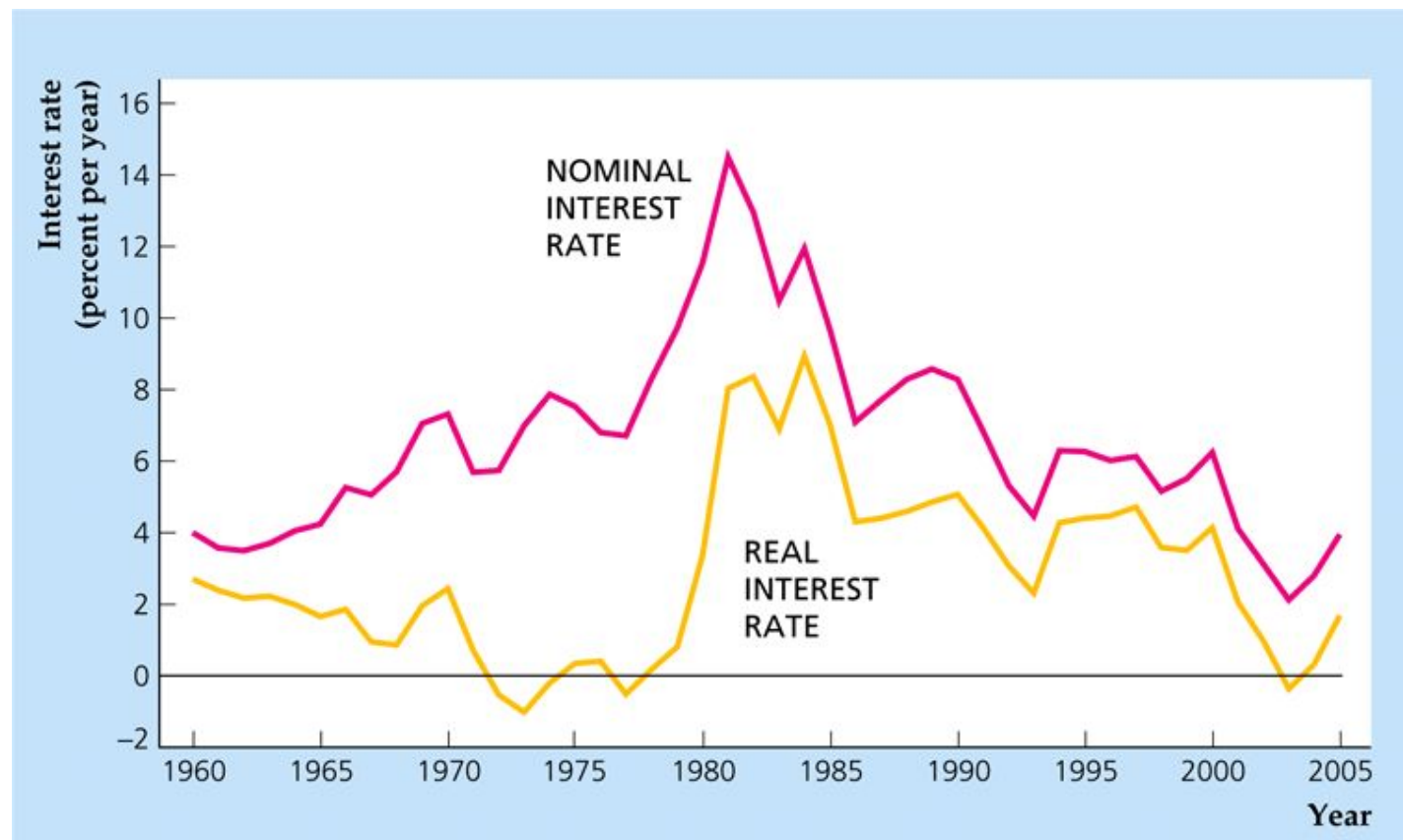
# Interest Rates

- 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

- **Real vs. nominal interest rates**
  - Real interest rate = $i - \pi$           (2.12)
  - Text Fig. 2.5 plots nominal and real interest rates for the United States since 1960

# **Figure 2.5** Nominal and real interest rates in the United States, 1960-2005"

# Interest Rates

- The expected real interest rate

  $r = i - \pi^e$                                (2.13)

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