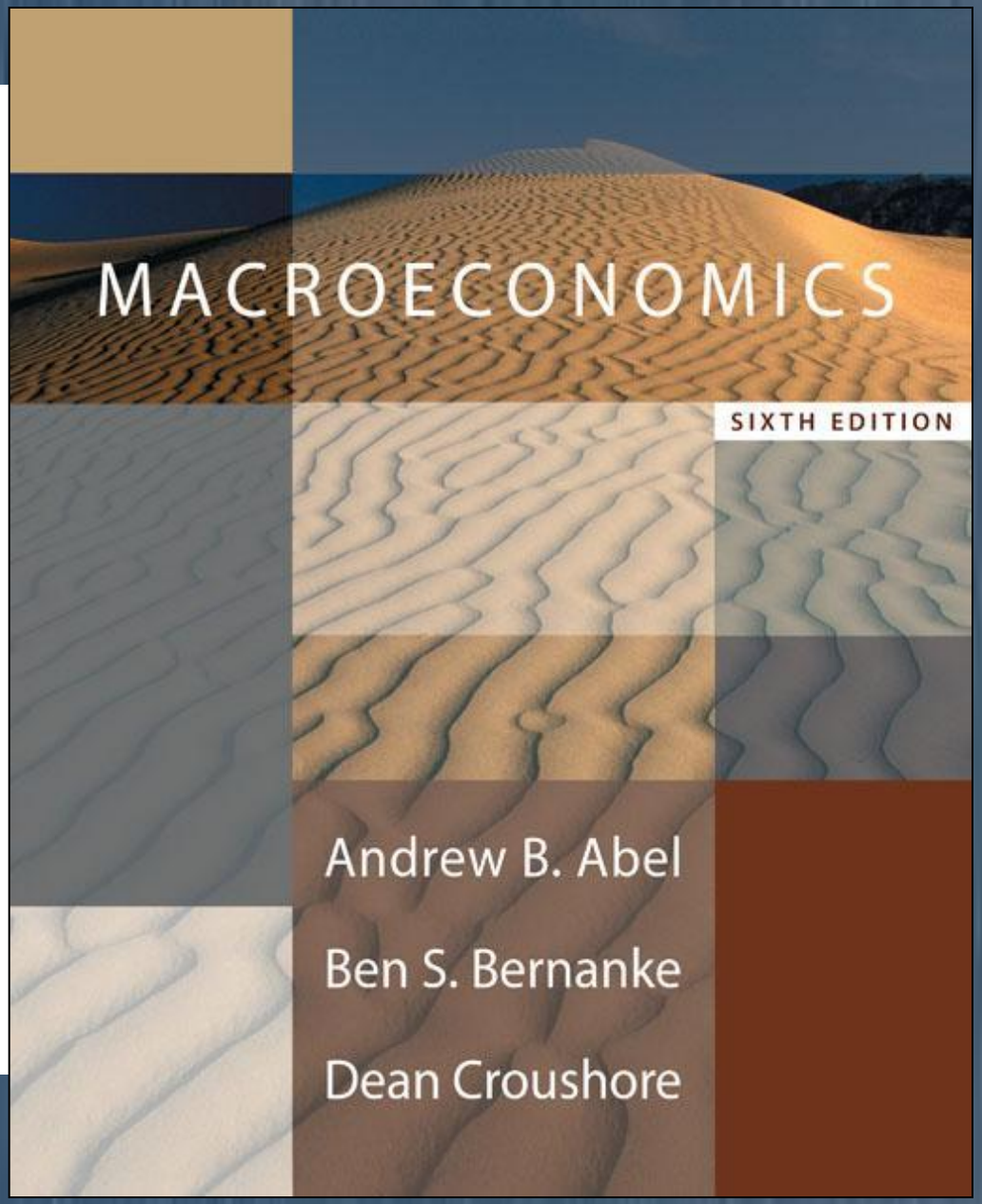
Chapter 2

The Measurement and Structure of the National Economy



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

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

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

$$= Y + NFP - C - G = \text{GNP} - C - G$$

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

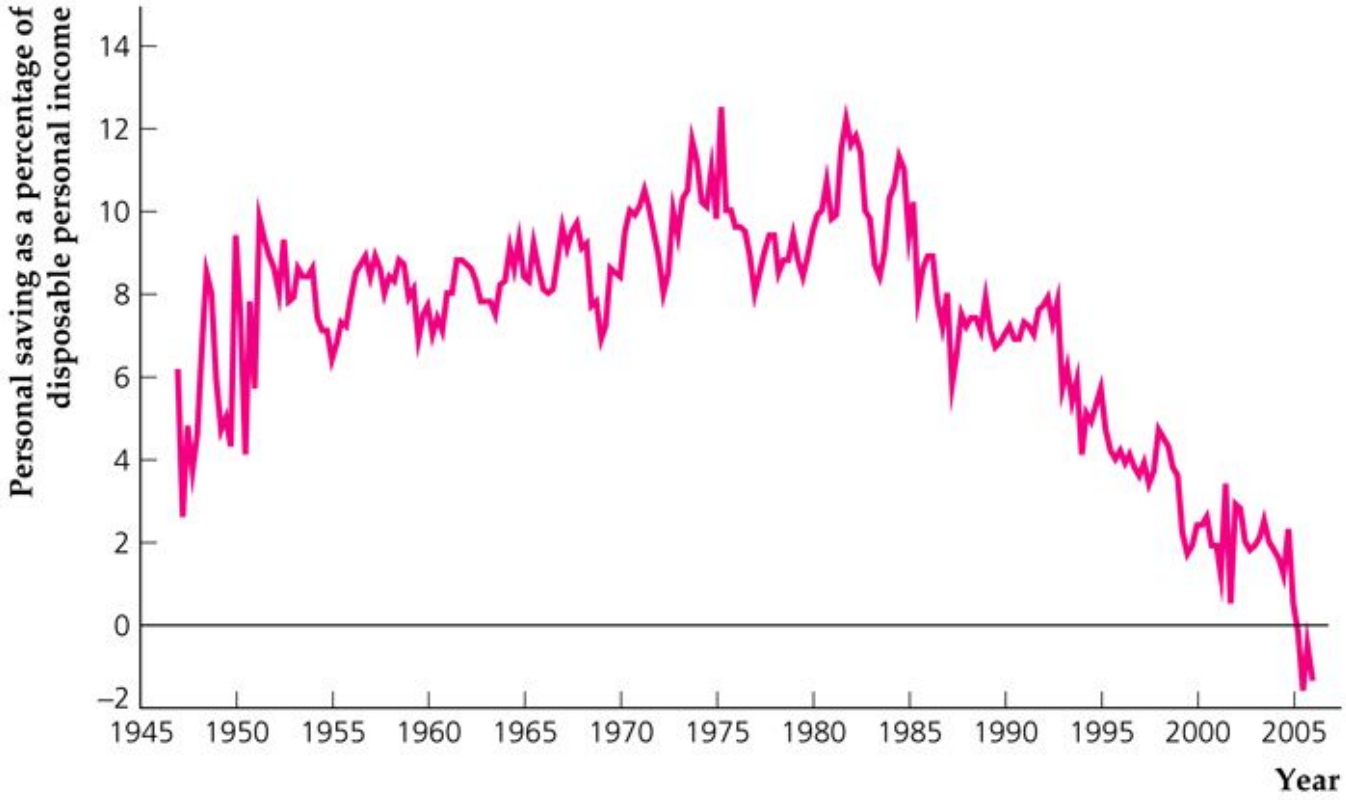
Measures of Aggregate Saving

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)

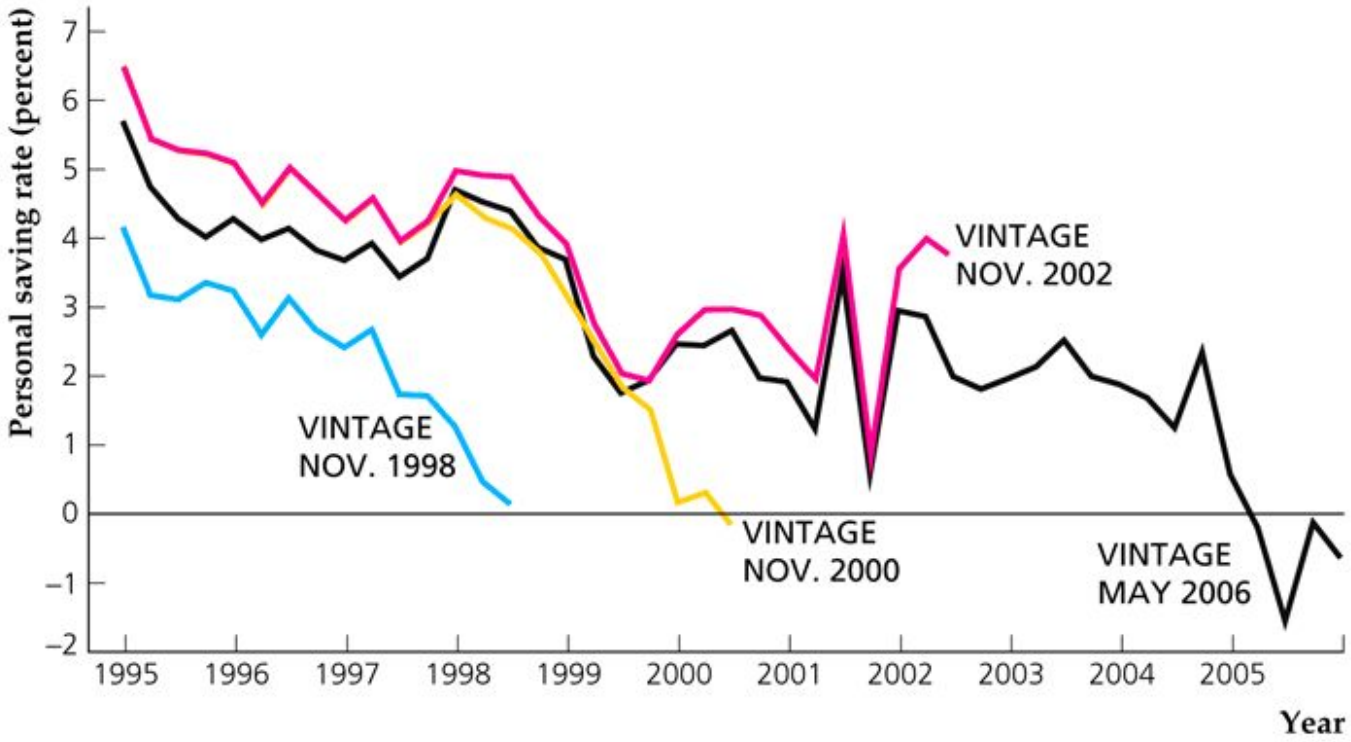
Figure 2.1 Personal Saving Rate, 1947-2006



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)

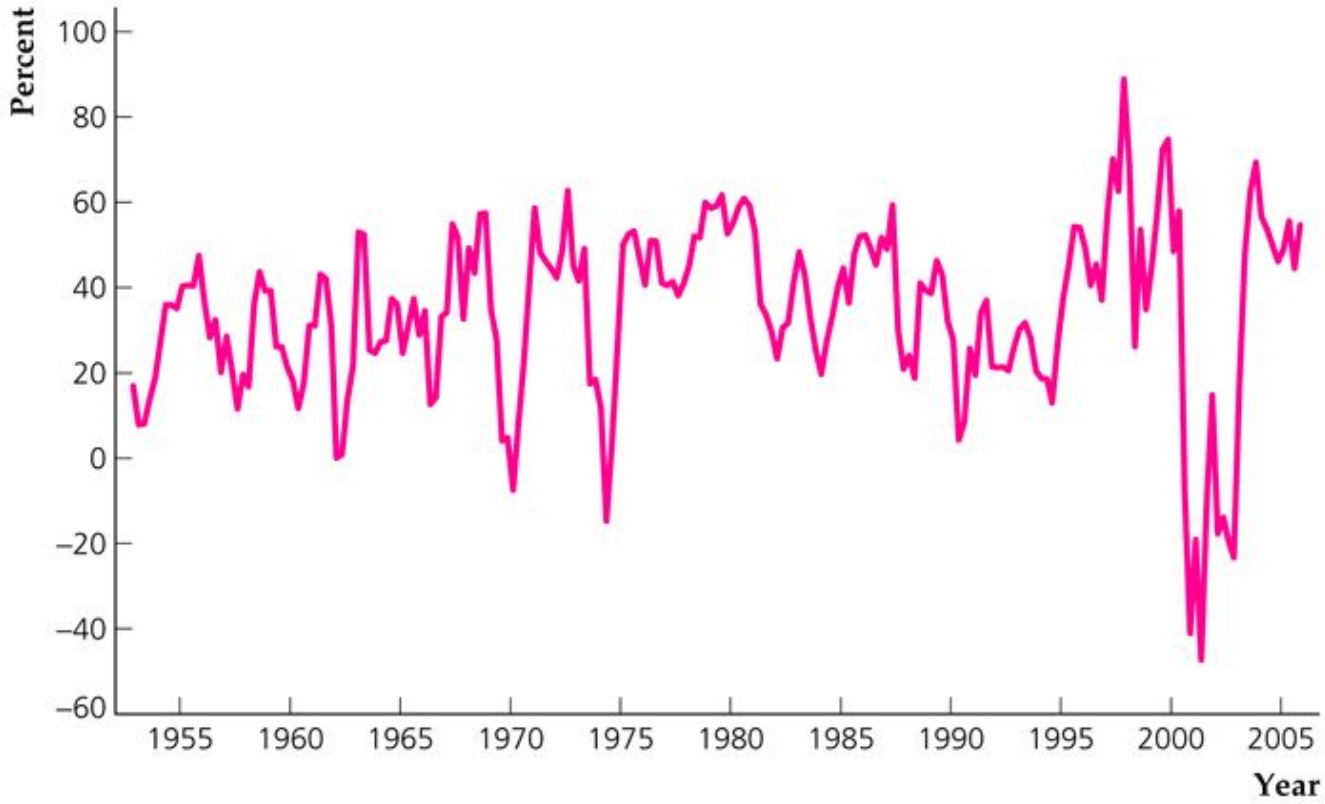
Figure 2.2 Personal Saving Rate Reported by the Government At Different Vintage Dates, 1995-2006



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

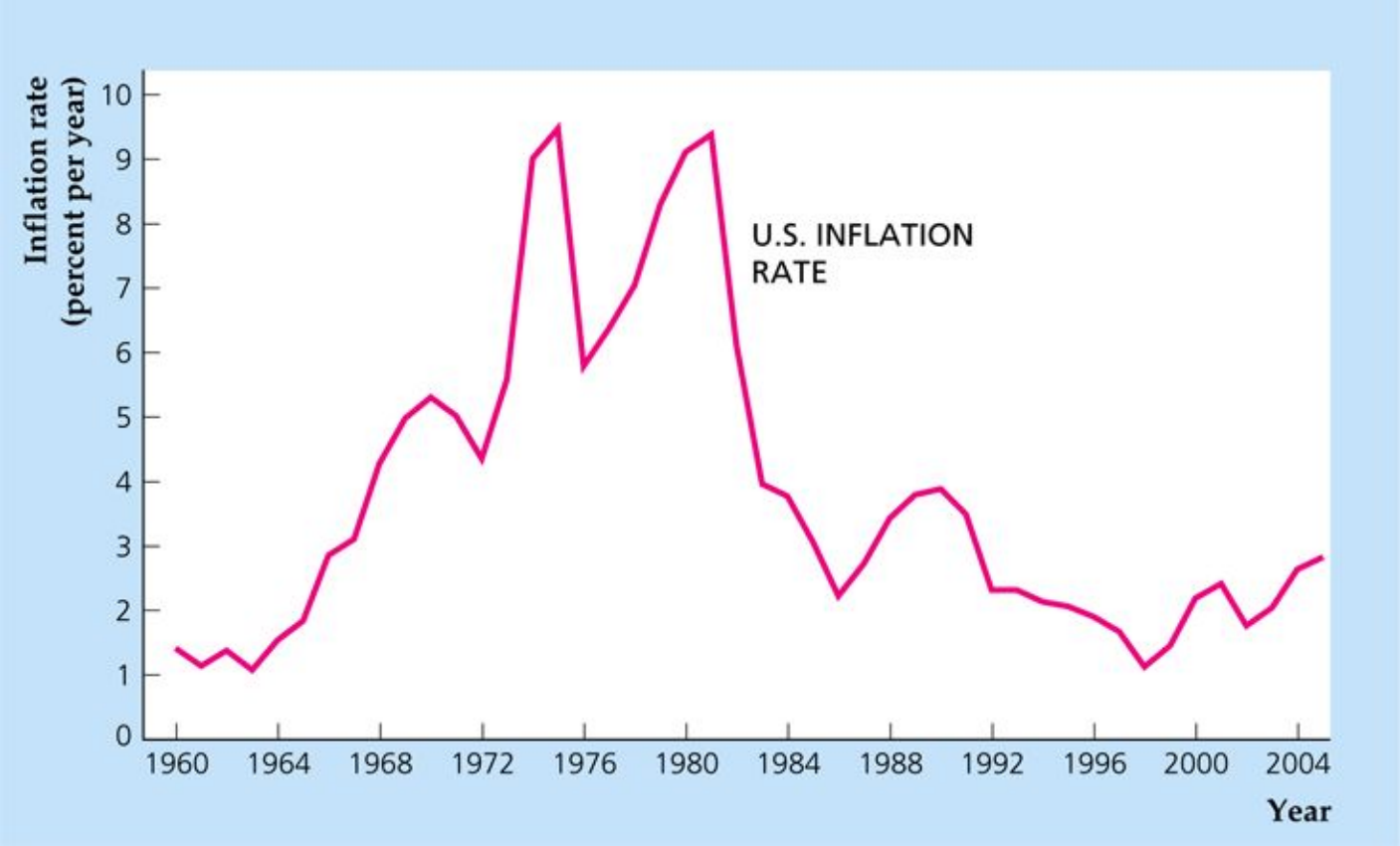
Real GDP, Price Indexes, and Inflation

- 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

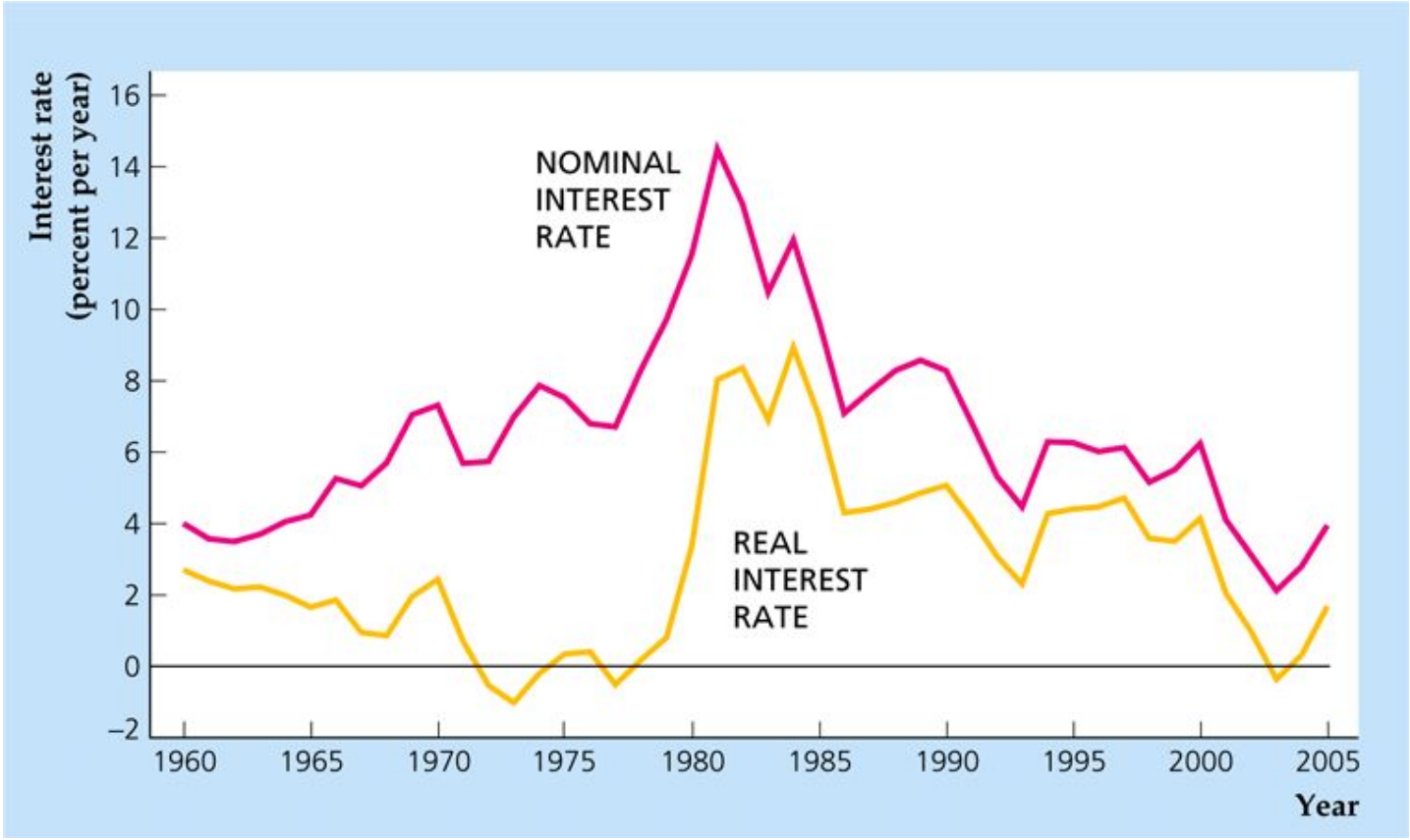
Interest Rates

- 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