



National Income Accounting

Chapter #2

Introduction

- Why do we study the national income accounts?
 1. National income accounting provides formal structure for macrotheory models
 2. Introduces statistics that characterize the economy
- Output defined in two ways
 1. Production side: output = payments to workers (wages), capital (interest and dividends)
 2. Demand side: output = purchases by different sectors of the economy
- Output typically measured as GDP = value of all final goods and services produced within a country over a particular period of time

Production Side of the Economy

- The production side of the economy transforms inputs (labor, capital) into output (GDP)
 - Inputs = factors of production
 - Payments to these factors = factor payments
- The relationship between inputs and outputs defined by the production function $\rightarrow Y = f(N, K)$ where Y = output, N = labor, K = capital
 - “Output is a function of labor and capital,” where the functional form can be defined in various ways
 - For example: corn = f (land, labor, seed, machines)

From GDP to Factor Payments

- We use the terms *output* and *income* interchangeably in macroeconomics → are they really equivalent?
 - There are a few crucial distinctions between them:
 1. Capital wears down over time while it is being used in the production process → Net domestic product = GDP – depreciation
 - » NDP is the total value of production minus the value of the amount of capital used up in producing that output
 - » NDP is usually 87-89% of GDP

From GDP to Factor Payments

- We use the terms *output* and *income* interchangeably in macroeconomics → are they really equivalent?
 - There are a few crucial distinctions between them:
 2. Businesses pay indirect taxes (i.e. taxes on sales, property, and production) that must be subtracted from NDP before making factor payments → Factor payments = NDP – indirect business taxes
 - » Indirect business taxes account for more than 10% of NDP
 - » Factor payments are roughly 80% of U.S. GDP
 - » $\frac{3}{4}$ of factor payments go to labor

Components of Demand

- Total demand for domestic output is made up of four components:

1. Consumption spending by households (C)
2. Investment spending by firms (I)
3. Government spending (G)
4. Foreign demand for our net exports (NX)

→ The fundamental national income accounting identity is

$$Y = C + I + G + NX \quad (3)$$

Consumption

- Consumption refers to the purchases of goods and services by the household sector
 - Includes spending on durable (ex. Cars), non-durable (ex. Food), and services (ex. Medical services)
 - Consumption is the primary component of demand
- Consumption as a share of GDP varies by country
 - Figure 2-2 compares consumption as a share of GDP for the U.S. to Japan

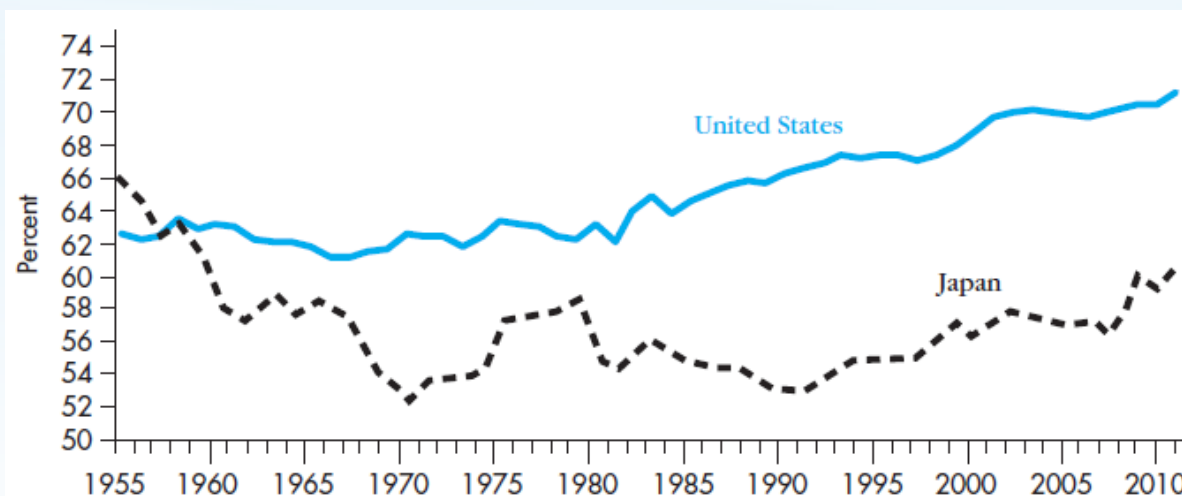


FIGURE 2-2 CONSUMPTION AS A SHARE OF GDP: UNITED STATES AND JAPAN, 1955–2011.

Government

- Government purchases of goods and services include national defense expenditures and salaries of government employees
- Government also makes transfer payments = payments made to people without their providing a current service in exchange
 - Ex. Social security, unemployment benefits
 - Transfer payments are NOT included in GDP since not a part of current production
 - Government expenditure = transfers + purchases

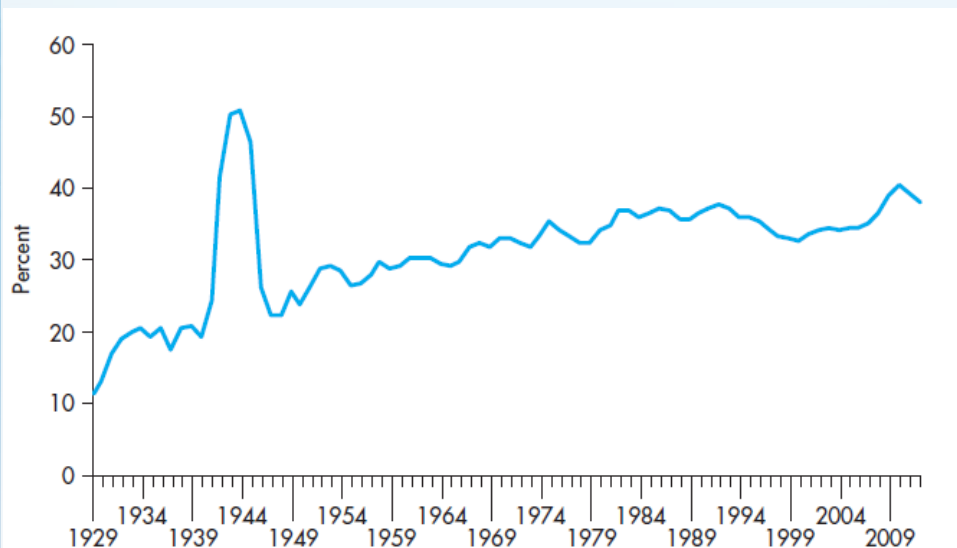


FIGURE 2-3 GOVERNMENT PURCHASES AND TRANSFER PAYMENTS AS A SHARE OF GDP, 1929–2012.

Investment

- Investment = additions to the physical stock of capital (i.e. building machinery, construction of factories, additions to firms inventories)
- In the national income accounts, investment associated with *business sector's* adding to the physical stock of capital, including inventories
 - Household's building up of inventories is considered consumption, although new home constructions considered part of I, not C
- Gross investment included in GDP measure, which is net investment plus depreciation

Net Exports

- Accounts for domestic purchases of foreign goods (imports) and foreign purchases of domestic goods (exports) → $NX = \text{Exports} - \text{Imports}$
 - Subtract imports from GDP since accounting for total demand for domestic production
- NX can be $>$, $<$, or $= 0$
 - U.S. NX has been negative since the 1980's → trade deficit

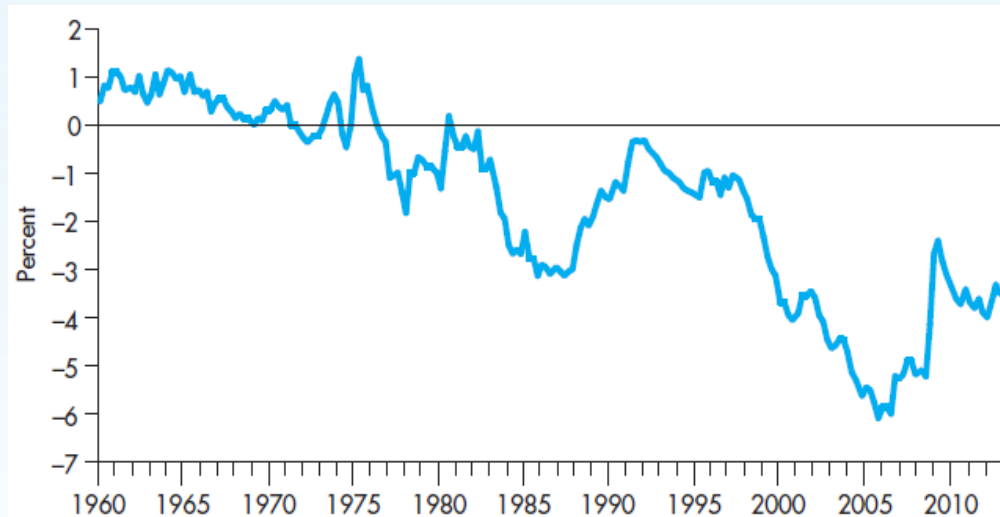


FIGURE 2-4 U.S. NET EXPORTS AS A SHARE OF GDP, 1960–2012.

Some Identities: A Simple Economy

- Assume national income equals GDP \rightarrow use terms income and output interchangeably (convenience)
- Begin with a simple economy: closed economy with no public sector \rightarrow output expressed as (4)
- Only two things can do with income: consume and save \rightarrow national income expressed as (5), where S is private savings
- Combine (4) and (5): (6)
- Rearrange (6) s.t. (7), or investment = savings in the simple economy

Some Identities: A Simple Economy

- Assume national income equals GDP → use terms income and output interchangeably (convenience)
- Begin with a simple economy: closed economy with no public sector → output expressed as
$$Y \equiv C + I \quad (4)$$
- Only two things can do with income: consume and save → national income expressed as $Y \equiv C + S$ (5), where S is private savings
- Combine (4) and (5):
$$C + I \equiv C + S \quad (6)$$
- Rearrange (6) s.t. $I \equiv S$ (7), or investment = savings in the simple economy

Some Identities: A Simple Economy

- Assume national income equals GDP → use terms income and output interchangeably (convenience)
- Begin with a simple economy: closed economy with no public sector → output expressed as
$$Y \equiv C + I \quad (4)$$
- Only two things can do with income: consume and save → national income expressed as $Y \equiv C + S$ (5), where S is private savings
- Combine (4) and (5):
$$C + I \equiv C + S \quad (6)$$
- Rearrange (6) s.t. $I \equiv S$ (7), or investment = savings in the simple economy

Some Identities: A Simple Economy

- Assume national income equals GDP → use terms income and output interchangeably (convenience)
- Begin with a simple economy: closed economy with no public sector → output expressed as $Y \equiv C + I$ (4)
- Only two things can do with income: consume and save → national income expressed as $Y \equiv C + S$ (5), where S is private savings
- Combine (4) and (5): $\underbrace{C + I}_{demand} \equiv Y \equiv \underbrace{C + S}_{income}$ (6)
- Rearrange (6) s.t. $I \equiv S$ (7), or investment = savings in the simple economy

Some Identities: A Simple Economy

- Assume national income equals GDP \rightarrow use terms income and output interchangeably (convenience)
- Begin with a simple economy: closed economy with no public sector \rightarrow output expressed as $Y \equiv C + I$ (4)
- Only two things can do with income: consume and save \rightarrow national income expressed as $Y \equiv C + S$ (5), where S is private savings
- Combine (4) and (5): $\underbrace{C + I}_{demand} \equiv Y \equiv \underbrace{C + S}_{income}$ (6)
- Rearrange (6) s.t. $I \equiv Y - C \equiv S$ (7), or investment = savings in the simple economy

Some Identities: Adding G and NX

- When adding the government and the foreign sector, the fundamental identity becomes

$$Y \equiv (8) + I + G + NX$$

- Disposable income, YD , is what consumers split between C and S when have a public sector, or

$$(9), \text{ where } TR = \text{transfer payments and } TA = \text{taxes} \rightarrow (10)$$
- If rearrange (9) and substitute (8) for Y , then

$$(11)$$
- Substituting (10) into (11):

$$(12)$$
- Rearranging:

$$(13)$$

Some Identities: Adding G and NX

- When adding the government and the foreign sector, the fundamental identity becomes

$$Y \equiv (8) + I + G + NX$$

- Disposable income, YD, is what consumers split between C and S when have a public sector, or

$$YD = Y + TR - TA^{(9)}, \text{ where TR = transfer payments and } TA = \text{taxes} \rightarrow YD \equiv C + S^{(10)}$$

- If rearrange (9) and substitute (8) for Y, then

$$(11)$$

- Substituting (10) into (11): (12)

- Rearranging: (13)

Some Identities: Adding G and NX

- When adding the government and the foreign sector, the fundamental identity becomes

$$Y \equiv C + I + G + NX \quad (8)$$

- Disposable income, YD , is what consumers split between C and S when have a public sector, or

$$YD = Y + TR - TA \quad (9), \text{ where } TR = \text{transfer payments} \\ \text{and } TA = \text{taxes} \rightarrow YD \equiv C + S \quad (10)$$

- If rearrange (9) and substitute (8) for Y , then

$$YD - TR + TA \equiv C + I + G + NX \quad (11)$$

Some Identities: Adding G and NX

- When adding the government and the foreign sector, the fundamental identity becomes

$$Y \equiv C + I + G + NX \quad (8)$$

- Disposable income, YD , is what consumers split between C and S when have a public sector, or

$$YD = Y + TR - TA \quad (9), \text{ where } TR = \text{transfer payments} \\ \text{and } TA = \text{taxes} \rightarrow YD \equiv C + S \quad (10)$$

- If rearrange (9) and substitute (8) for Y , then

$$YD - TR + TA \equiv C + I + G + NX \quad (11)$$

- Substituting (10) into (11): $C + S - TR + TA \equiv C + I + G + NX \quad (12)$

Some Identities: Adding G and NX

- When adding the government and the foreign sector, the fundamental identity becomes

$$Y \equiv C + I + G + NX \quad (8)$$

- Disposable income, YD , is what consumers split between C and S when have a public sector, or $YD = Y + TR - TA$ (9), where TR = transfer payments

and TA = taxes $\rightarrow YD \equiv C + S$ (10)

- If rearrange (9) and substitute (8) for Y , then

$$YD - TR + TA \equiv C + I + G + NX \quad (11)$$

- Substituting (10) into (11): $C + S - TR + TA \equiv C + I + G + NX$ (12)

- Rearranging: $S - I \equiv (G + TR - TA) + NX$ (13)

S, I, Government Budget, and Trade

$$S - I \equiv \underbrace{(G + TR - TA)}_{\text{Budget Deficit}} + \underbrace{NX}_{\text{Trade Surplus}}$$

where $G + TR$ is total government expenditures and TA is government income → difference between expenditures and income is the government budget deficit

TABLE 2-2 The Budget Deficit, Trade, Saving, and Investment
(Billions of Dollars)

SAVING (S)	INVESTMENT (I)	BUDGET DEFICIT (BD)	NET EXPORTS (NX)
1,000	1,000	0	0
1,000	850	150	0
1,000	900	0	100
1,000	950	150	-100

S, I, Government Budget, and Trade

- Excess of savings over investment ($S > I$) in the private sector is equal to the government budget deficit plus the trade surplus
- Any sector that spends more than it receives in income has to borrow to pay for the excess spending
 - Private sector can dispose of savings in three ways:
 1. Make loans to the government
 2. Private sector can lend to foreigners
 3. Private sector can lend to firms who use the funds for I

Measuring Gross Domestic Product

- GDP = value of final goods and services currently produced within a country over a period of time
 - Final goods and services → NO DOUBLE COUNTING
 - Ex. Would not include the full price of a car AND the tires bought by the manufacturer for the car → tires = *intermediate goods*

Measuring Gross Domestic Product

- GDP = value of final goods and services currently produced within a country over a period of time
 - Goods and services currently (in the time period being considered) produced & excludes transactions involving used goods
 - Ex. Include the construction of new homes in current GDP, but not the sale of existing homes

Measuring Gross Domestic Product

- GDP = value of final goods and services currently produced within a country over a period of time
 - Goods and services produced within a country, regardless of the ownership/nationality of the producing firm
 - Ex. Include the sale of a car produced by a Japanese car manufacturer located in the U.S. in U.S. GDP

Problems of GDP Measurement

- There are three major criticisms of the GDP measure:
 1. Omits non-market goods and services
 - Ex. Work of stay-at-home mothers and fathers not included in GDP
 2. No accounting for “bads” such as crime and pollution
 - Ex. Crime is a detriment to society, but there is no subtraction from GDP to account for it
 3. No correction for quality improvements
 - Ex. Technological improvements are beneficial to the economy, but nothing is added to GDP to account for them
- Despite these drawbacks, GDP is still considered one of the best economic indicators for estimating growth in an economy

Nominal vs. Real GDP

- NGDP is the value of output in a given period measured in current dollars
 - NGDP in 2007 is the sum of the value of all outputs measured in 2007 dollars:

$$NGDP_{2007} = \sum_{i=1}^N P_i^{2007} * Q_i^{2007}$$

- Changes in NGDP could be purely due to changes in prices → if GDP is to be used as a measure of output, need to control for prices

Nominal vs. Real GDP

- RGDP is the value of output in constant dollars → scaled by a based year price, so that any change in GDP is due to change in production, not prices
 - If P^B is the price in the base year for good i , RGDP in 2007 is:

$$RGDP_{2007} = \sum_{i=1}^N P_i^B * Q_i^{2007}$$

vs.

$$NGDP_{2007} = \sum_{i=1}^N P_i^{2007} * Q_i^{2007}$$

Nominal vs. Real GDP

TABLE 2-3 Real and Nominal GDP, an Illustration

	2005 NOMINAL GDP	2012 NOMINAL GDP	2012 REAL GDP*
Beer	1 at \$1.00 \$1.00	2 at \$2.00 \$4.00	2 at \$1.00 \$2.00
Skittles	1 at \$0.50 0.50	3 at \$0.75 2.25	3 at \$0.50 1.50
	\$1.50	\$6.25	\$3.50

*Measured in 2005 prices.

Inflation and Prices

- Inflation, Π , is the rate of change of prices:

$$\Pi_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

where P_t is today's price and P_{t-1} is last period's price

- Additionally, $P_t = P_{t-1} + (P_{t-1} * \Pi)$, or today's price equals last year's price, adjusted for inflation
 - If $\Pi > 0$, prices are increasing over time → inflation
 - If $\Pi < 0$, prices are decreasing over time → deflation
- How do we measure prices?
 - For the macroeconomy, need a measure of overall prices (price index)
 - Most common indexes are CPI, PPI, and the GDP deflator

Price Indexes: GDP Deflator

- GDP deflator is the ratio of NGDP in a given year to RGDP of that year
 - Since GDP deflator is based on a calculation involving all goods produced in the economy, it is a widely based price index that is frequently used to measure inflation
 - Measures the change in prices between the base year and the current year
- Ex. If NGDP in 2012 is \$6.25 and RGDP in 2012 is \$3.50, then the GDP deflator for 2012 is $\$6.25 / \$3.50 = 1.79 \rightarrow$ prices have increased by 79% since the base year

Price Indexes: CPI

- CPI measures the cost of buying a fixed basket of goods and services representative of the purchases of urban consumers
 - Measure of the cost of living for the average household
- Differs from GDP deflator in three ways:
 1. CPI measures prices of a more limited basket of goods and services (only household goods and services)
 2. The bundle of goods in the consumer basket is fixed, while that of the deflator is allowed to vary
 3. CPI includes prices of imports, while GDP deflator only considers those goods produced within the U.S.

Price Indexes: PPI

- PPI measures the cost of buying a fixed basket of goods and services representative of a firm
 - Captures the cost of production for a typical firm
 - Market basket includes raw materials and semi-finished goods
- PPI is constructed from prices at an earlier stage of the distribution process than the CPI
- PPI signals changes to come in the CPI and is thus closely watched by policymakers
 - *Over long periods of time, the two measures yield similar values and trends for inflation*

Unemployment

- The unemployment rate measures the fraction of the workforce that is out of work and looking for a job or expecting a recall from a layoff
 - Important indicator of well-being of an economy/households
 - Optimal unemployment rates differ from country to country
 - Optimal unemployment rate linked to the potential level of output for a given economy (see Figure 2-8)

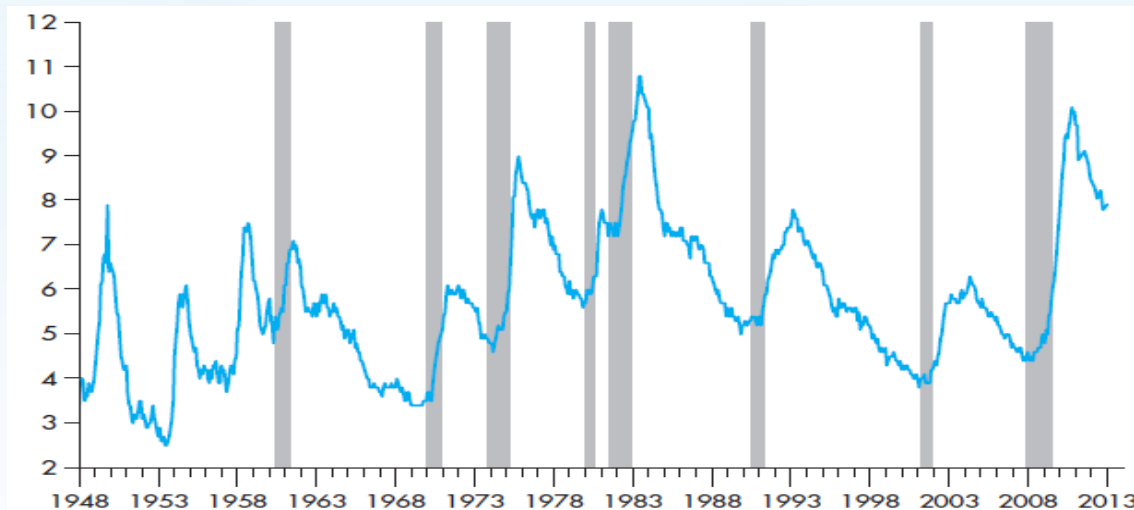


FIGURE 2-8 UNEMPLOYMENT RATES, 1948–2012.

Interest Rates and Real Interest Rates

- Interest rate = rate of payment on a loan or other investment over and above the principle repayment in terms of an annual percentage
 - Cost of borrowing money OR benefit of lending money
- Nominal interest rate = return on an investment in current dollars
- Real interest rate = return on an investment, adjusted for inflation
- If R is the nominal rate, and r is the real rate, then we can define the nominal rate as: $R = r + \Pi$

Interest Rates, 3-Month Treasury Bill

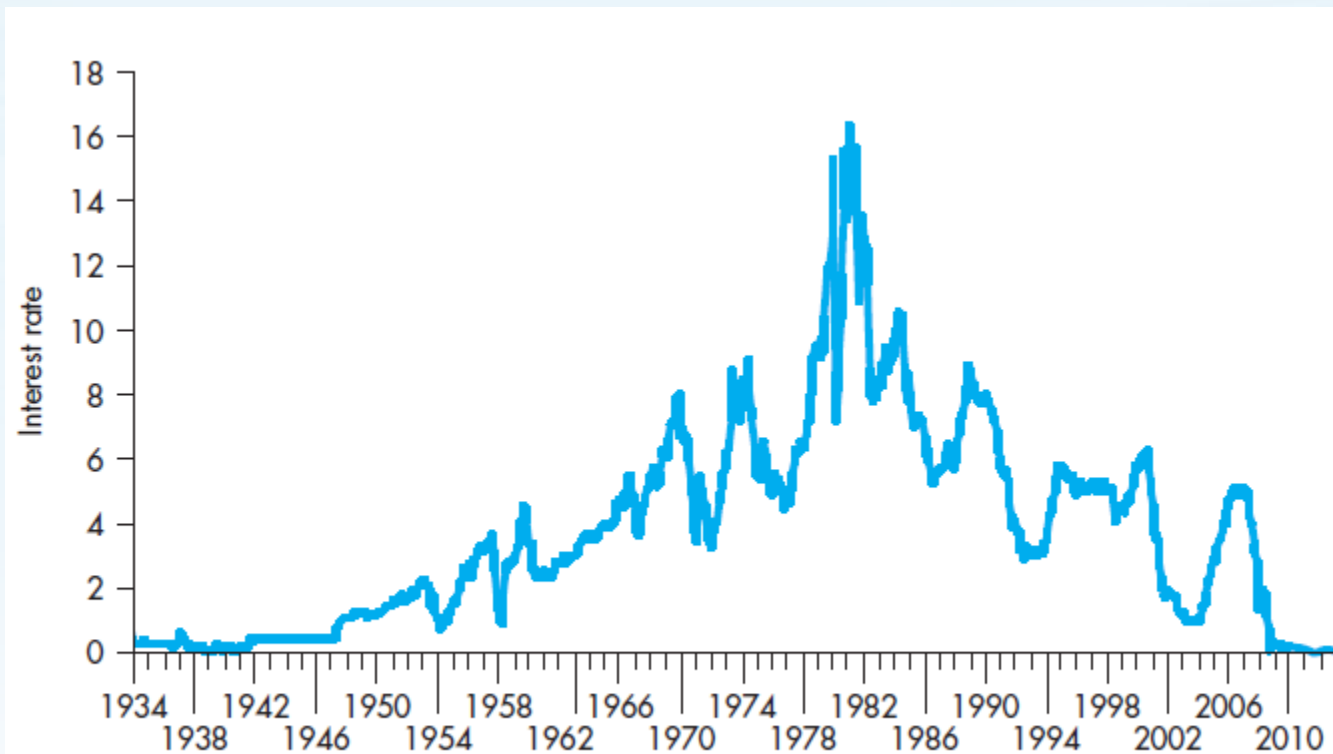


FIGURE 2-10 THREE-MONTH TREASURY BILL, SECONDARY MARKET, 1934–2013.

Exchange Rate

- Each country has its own currency in which prices are quoted
 - In the U.S. prices are quoted in U.S. dollars, while in Canada prices are quoted in Canadian dollars and most of Europe uses the euro
- Exchange rate = the price of a foreign currency
 - Ex. The British pound is worth U.S. \$1.53 (Feb. 2013)
- Floating exchange rate → price of a currency is determined by supply and demand
- Fixed exchange rate → price of a currency is fixed
 - Ex. A Bermuda dollar is always worth one U.S. dollar