

Chapter 1

Introduction

■ Overview

Chapter 1 describes the macroeconomic ideas and issues that are built up throughout the text. It begins with a description of macroeconomics as “the study of large collections of economic agents,” which is typically broken into two distinct issues: long-run growth and business cycles. Macroeconomic measurement is given in terms of Gross National Product (GNP), which is the quantity of goods and services produced by a country’s citizens (or *nationals*, hence the name) during some specified period of time. The rate of growth of GNP is shown to be approximately $(\log y_t - \log y_{t-1})$ where y_t represents GNP for time period t , and $t - 1$ represents GNP for the previous time period. This approximation is particularly useful as it represents the slope of logged GNP. In essence, the slope of the graph of the natural logarithm of a time series y_t is a good approximation to the growth rate of y_t when the growth rate is small.

A distinction is made between actual GNP growth and trend growth where trend refers to the level of GNP that occurs in the long run. The business cycle component of growth is defined to be the difference between actual GNP and trend GNP. After the introduction to macroeconomic measurement, current macroeconomic modeling is discussed with an emphasis on microeconomic foundations. The basic structure of macroeconomic models consists of: 1) Consumers and firms that interact in the economy; 2) The set of goods that consumers wish to consume; 3) Consumers’ preferences over goods; 4) The technology available to firms for producing goods and 5) The resources available. Under the assumption that firms and consumers optimize, an equilibrium can be derived from the model. The competitive equilibrium, which is the concept of equilibrium most used in this book, is characterized by markets in which there exists a price such that the quantity of goods supplied is equal to the quantity of goods demanded.

U.S. business cycles, the historic growth of the U.S. government, recent trends in U.S. inflation, interest rates, unemployment, and energy prices are discussed as examples of current macroeconomic events. In addition, the recent “twin deficit” phenomenon in which the U.S. federal budget and current account deficits had simultaneously arisen was discussed. Overall, Chapter 1 is designed to introduce the reader to macroeconomic measurement, modeling, and the questions pertaining to business cycles and long-run growth that modern macroeconomics addresses.

■ True and False

- _____ 1. Gross national product measures the quantity of goods and services produced within a country over a particular time period.
- _____ 2. A competitive equilibrium requires that both consumers and producers take prices as given.
- _____ 3. Rational expectations theory implies that the behavior of individuals may be very different from the behavior of the economy.
- _____ 4. Keynesian business cycle theory suggests that government intervention in markets may create disequilibria in supply and demand, thereby exacerbating business cycles.

- _____ 5. The money surprise theory states that the government should use its monetary tools to smooth out business cycles.
- _____ 6. The real business cycle theory indicates that the government should not attempt to smooth out business cycles.
- _____ 7. Macroeconomic analysis teaches that selfish behavior typically leads to socially efficient outcomes.
- _____ 8. Crowding out occurs when increases in government expenditures cause decreases in private consumption and investment.
- _____ 9. Government savings is the difference between government spending and taxation.
- _____ 10. Inflation is ultimately determined by the rate of growth in money demand.
- _____ 11. Short-run movements in prices are fully explained by changes in the money supply.
- _____ 12. The central bank determines the long-run inflation rate.
- _____ 13. The central bank helps to determine the short-run interest rate.
- _____ 14. U.S. exports and imports have remained constant as a percentage of GDP since the 1940s.
- _____ 15. The current account is a measure of a country's international trade.
- _____ 16. A current account surplus occurs when the quantity of foreign goods and services purchased by domestic residents is smaller than the quantity of domestic goods and services purchased by foreigners.
- _____ 17. The average unemployment rate has fallen since the 1970s.

■ Short Answer

1. In what sense do different sources of government deficits cause different effects on the economy?
2. How is it that the growth rate of money supply explains long-run inflation?
3. What happened to U.S. interest rates in the 1970s and how did it happen?
4. What two “net” factors comprise the current account surplus?
5. Name one condition under which a current account deficit can be good for a country.
6. What are sectoral shifts and how do they affect unemployment?

■ Answers

True/False

1. False. GNP measures the quantity of goods and services produced by residents (or *nationals*) of a country over a particular time period.
2. True.

3. False. Rational expectations implies that studying individual behavior is crucial to understanding the behavior of the economy.
4. False. Keynesians argue that disequilibria are inherent in markets and that government intervention may help to smooth out business cycles.
5. False. The money surprise theory states that government intervention makes matters worse.
6. True.
7. True.
8. True.
9. True. It is also called government surplus.
10. False. Inflation in the long run is determined by the rate of growth in money supply.
11. False. Long-run price movements are fully explained by money supply changes. The relationship between money supply changes and changes in inflation is not “a tight one” in the short run.
12. True. The central bank does so by controlling the money supply.
13. True.
14. False. Exports have grown from 6 percent to 12 percent and imports have grown from 3 percent to 16 percent over the period 1947 to 1999.
15. True.
16. True.
17. False. The average unemployment rate has risen.

Short Answer

1. If the deficit is caused by a decrease in taxes, the government debt will ultimately be paid off with higher taxes that benefits current citizens and harms future ones. If the deficit is caused by higher government spending, however, the economy will be affected in a different way.
2. Without money supply growth, prices cannot continue to increase. Higher money supply growth, *ceteris paribus*, implies more and more money chasing a given quantity of goods.
3. The real interest rate was negative because the nominal rate was less than the rate of inflation.
4. The net exports of goods and services and the net factor payments.
5. A current account deficit may help the country to smooth consumption and it might help finance additions to the nation's productive capacity.
6. Sectoral shifts are changes in the aggregate sectors, or economic composition, of the economy. Sectoral shifts displace workers from the declining sector as those workers attempt to acquire new skills and search to find new jobs.

Chapter 2

Measurement

■ Overview

Chapter 2 explores the different measures of macroeconomic data ranging from Gross National Product to unemployment. Beginning with the National Income and Product Accounts (NIPA), three approaches to measuring Gross Domestic Product measures are discussed. The first, the *product approach* (also known as the value-added approach) uses the sum of value-added to goods and services produced across all productive units in the economy. This technique requires summing the value of all goods and services produced in the economy and then subtracting the value of all intermediate goods used. The second approach, the *expenditure approach*, calculates GDP as the total spending on all final goods and services produced in the economy. The *income approach* is the third and final method of measuring GDP. In this approach, all income received by economic agents contributing to production is added up. This income includes compensation of employees (wages, salaries, and benefits), proprietors' income (self-employed firm owners), rental income, corporate profits, net interest, indirect business taxes (sales and excise taxes paid by business), and depreciation (consumption of fixed capital). The last two GDP measures are represented by the income expenditure identity given as $C + I + G + NX$. C represents aggregate consumption and includes durables, nondurables, and services. Durables are the largest expenditure component of GDP and include items that last longer than the current period such as automobiles and furniture. Nondurables are goods that are consumed or "used up" within the period such as food. Services are non-tangible items such as haircuts and massages. Investment consists of fixed investment, residential investment, and inventory investment. Fixed investment includes the production of capital, such as plant and equipment known as nonresidential investment. Residential investment is housing. Inventory investment consists of stored goods; in essence, goods that are produced but not sold in the period. NX represents net exports, which is total exports minus total imports over the time period. G is government expenditures and includes expenditures by federal, state, and local governments on final goods and services. This measure excludes government transfers, which are payments such as social security and unemployment insurance. These are money transfers from one group to another.

Measures of GDP leave out all non-market activity, such as the value-added from cooking home meals and do-it-yourself repairs of cars and homes. Moreover, there are some exchanges that are not reported to the government and therefore occur in the so-called underground economy. These unreported transactions include cash payments for baby-sitting, trade in illegal drugs, and barter, or trade-in-kind such as fixing a neighbor's sink in return for him mowing your lawn. Evidence indicates that these exchanges are a significant percentage of reported GDP.

Differences in prices in the economy lead to a distinction between real GDP and nominal GDP. Real GDP excludes the effects of inflation in the economy while nominal GDP does not. Two common measures of the price level are 1) the implicit price deflator, and 2) the consumer price index (CPI). The first measure simply divides nominal GDP by real GDP and multiplies the result by 100 while the second includes only goods and services purchased by consumers and compares a bundle of goods and services one year with the cost of that same bundle in another year. Thus the CPI is a fixed-weight price index and is given by total current expenditures over total expenditures at base year prices and multiplies the result by 100. Both measures of inflation have problems that are addressed in the chapter.

The income identity shown above can be used to derive measures of aggregate savings, wealth and capital. National savings, S can be shown to equal total private investment, I plus the current account surplus, CA . Thus, $S = I + CA$. The current account surplus is equal to net exports, NX plus net factor payments from abroad, NFP . Thus, $CA = NX + NFP$. This is important as the nation's wealth (a stock variable) increases each year by the addition of national savings (a flow variable). The last aggregate measures characterize the labor market, including employment, unemployment, the size of labor force, and the labor-participation rate. The labor force consists of people currently employed or searching for work during the last four weeks. Employment is measured as the people in the labor force who worked part-time or full-time during the past week. The unemployment rate is the number of unemployed workers divided by the labor force while the participation rate is the labor force divided by the total working-age population.

■ True and False

- _____ 1. The difference between measuring GDP with the income approach and the expenditure approach is the aggregate value of savings.
- _____ 2. An intermediate good is used as an input to produce a final good.
- _____ 3. Greater self-sufficiency (repairing their own cars, preparing their own food) among residents of a country will tend to increase GDP.
- _____ 4. The product approach to measuring GDP sums the value added to all the goods and services produced in an economy over a particular time.
- _____ 5. The standard practice for valuing government-produced goods is to use the cost of the inputs used in production.
- _____ 6. The expenditure approach measures GDP as total spending on all final goods and services produced in the economy.
- _____ 7. The housing stock is counted as consumption in the National Income and Product Accounts.
- _____ 8. The production of wills, trusts, and other estate planning documents is counted as durables in the National Income and Product Accounts as they are written to last for many years.
- _____ 9. Calculating GDP using the income approach consists of adding up all income received by economic agents contributing to production of final goods.
- _____ 10. The income-expenditure identity for a closed economy is given by $Y = C + I + G$.
- _____ 11. Payments for medical checkups are counted as services in GDP.
- _____ 12. Residential Fixed Investment includes appliances *as long as they are used and kept in the residence*.
- _____ 13. *Transfers* are cash payments made by one individual to another and are not recorded in GDP.
- _____ 14. If the unemployment rate is 20 percent and there are 400,000 employed workers, the labor force equals 500,000.
- _____ 15. Inventories are subtracted from profits in the income approach because the inventories are not sold.
- _____ 16. Whereas GDP excludes foreign production within the domestic country, GNP excludes foreign earnings of domestic residents.

- _____ 17. Inventory expenditures include fixed investment and inventory investment.
- _____ 18. The implicit GDP price deflator is given by 100 times real GDP divided by nominal GDP.
- _____ 19. The Consumer Price Index is given by total expenditures in the current year times 100 divided by total expenditures in the current year at base year prices.
- _____ 20. One implicit assumption in the CPI is that consumers do not change their purchases when relative prices change.
- _____ 21. The CPI measure of inflation is biased upward because goods that become relatively more expensive receive a lower weight than they should in the CPI measurements.
- _____ 22. An upward bias in inflation causes an upward bias in real GDP.
- _____ 23. A stock refers to a total quantity in existence at one moment in time while a flow refers to a rate over a period of time.
- _____ 24. The government debt is a stock variable and the government deficit is a flow variable.
- _____ 25. National savings equals investment plus total imports plus net factor payments from abroad.
- _____ 26. The current account surplus is equal to $NX + NFP$.
- _____ 27. National savings is a stock because it increases the nation's wealth, which is itself a stock.
- _____ 28. The CA surplus is a stock because it represents the total claims of foreigners.
- _____ 29. Discouraged workers are citizens who do not wish to be employed.
- _____ 30. The search theory of unemployment suggests that a high unemployment rate is associated with labor market tightness and a low unemployment rate is associated with labor market laxity.

■ Short Answer

1. How are intermediate goods valued when using the value-added approach to measure GDP?
2. Under what conditions would baby-sitting services be counted in GDP?
3. Under what conditions is the sale of a used car counted in GDP?
4. Under what conditions would having more potholes in the road increase GDP?
5. Why is depreciation added to GDP using the income approach?
6. Under what conditions would having more potholes in the road decrease GDP?
7. Explain how the timing of the use of a good determines whether it is recorded as consumption or investment.
8. How can upward biases in CPI cause government expenditures and government deficits to increase?
9. What is the labor-participation rate given a labor force of three and a half million and a total work age population of five million?
10. How does the measure of the national savings rate differ between open and closed economies?

11. Why might unemployment fall in a recession?
12. In what way is the implicit price deflator a broader measure of inflation than the CPI?
13. How are prices and quantities treated in calculations of the CPI and implicit price deflator?
14. Place each of the following Ford Motors transactions in one of the four components of expenditure: Consumption, investment, government purchases, and net exports.
 - (a) Ford sells a truck to the Army.
 - (b) Ford sells a truck to United Parcel Service.
 - (c) Ford sells a truck to Tregi, an Italian transport company.
 - (d) Ford sells a truck to you.
 - (e) Ford builds a truck to be sold next year.

■ Graphic/Numeric

1. Consider an economy with a widget producer, consumers, and a government. The widget producer produces 100 million widgets, which sell at a market price of \$5 per widget. Consumers purchase 70 million widgets, 10 million are sold to the government, and the remainder are stored as inventory. The widget producer pays \$150 million in wages and \$40 million in taxes. Consumers pay \$30 million in taxes. The government spends all tax revenues to hire workers and purchase widgets as an intermediate good into the production of public infrastructure. The widgets total \$50 million and wages total \$20 million. Calculate GDP using the product approach, expenditure approach and income approach.
2. Imagine an economy with two goods, coconuts and fish. Last year, 40 coconuts were sold for \$5 each and 200 units of fish at \$2 each. This year, 60 coconuts were sold for \$7 each and 300 units of fish at \$4 each.
 - (a) Fill in the following table.

	Year 1	% increase
Year 1 Nominal GDP		
Year 2 Nominal GDP		

- (b) Calculate the relative price of coconuts to fish for both years.
- (c) Fill in the following table.

Real GDP	Year 1	Year 2	% increase
Year 1 = base year			
Year 2 = base year			

■ Answers

True and False

1. False. GDP is the same using the *income approach* or the *expenditure approach*.
2. True.
3. False. GDP rises with increases in productivity, which often result from greater specialization and exploitation of comparative advantage.

4. True.
5. True.
6. True.
7. False. The housing stock is counted as (residential) investment.
8. False. The production of legal documents is counted as services.
9. False. It consists of adding up all income received by economic agents contributing to production of all goods.
10. True.
11. True.
12. False. Appliances are recorded as durables.
13. False. Transfers are payments from one group of individuals to the government to another group of individuals.
14. True.
15. False. Inventories are added to profits in the income approach because inventories represent additions to assets of firms.
16. False. GDP excludes foreign earnings of domestic residents and GNP excludes foreign production within the domestic country.
17. True.
18. False. It is 100 times nominal GDP divided by real GDP.
19. True.
20. True.
21. False. The CPI is biased upward because goods that become relatively more expensive receive a *higher* weight than they should.
22. False. An upward bias in inflation causes an upward bias in *nominal* GDP.
23. True.
24. True.
25. False. National savings equals investment plus net exports plus net factor payments from abroad.
26. True.

27. False. Although the nation's wealth is a stock, national savings is a flow because it is measured over a given time period rather than at a single point in time.
28. False. The CA is a flow that represents the claims over a particular period of time.
29. False. Those who do not wish to be employed (and presumably are not looking for work) are not part of the labor force.
30. True.

Short Answer

1. The value of intermediate goods is subtracted from the total value of goods in the economy to avoid double counting.
2. These services are counted if they are reported to the IRS.
3. The sale of a used car is counted if there is specific value added to the transaction.
4. More potholes might lead to more car repairs and that, in and of itself, can increase GDP.
5. Because depreciation is taken out when profits are calculated and it represents a real "expenditure" or cost to the economy over that time period.
6. More potholes imply fewer deliveries are made on average and that lowers productivity and therefore output.
7. Expenditure on a good produced but not consumed in the period is investment while expenditure on a good produced and consumed in the period is consumption.
8. Some federal transfer payments are indexed to the CPI, which means an upward bias in CPI leads to an increase transfer payments. An increase in government expenditures, *ceteris paribus*, leads to an increase in the government deficit (or a reduction in the government surplus).
9. Participation rate = labor force/total working-age population = $3.5/5 = 0.7$ or 70 percent.
10. The national savings rate for a closed economy excludes NX and net factor payments.
11. Finding work during a recession may be difficult and many former workers may decide to drop out of the labor force.
12. The implicit price deflator compares GDP while the CPI only uses goods and services purchased by consumers.
13. The CPI holds the quantity of goods fixed and allows the prices to vary. The implicit price deflator holds the prices of goods fixed and allows the quantities to vary.
14. The answers are:
 - (a) Government Expenditures
 - (b) Investment
 - (c) Net Exports
 - (d) Consumption
 - (e) Investment (in particular, inventory)

Graphic/Numeric

1. Consider an economy with a widget producer, consumers, and a government. The widget producer, produces 100 millions widgets, which sell at a market price of \$5 per widget. Consumers purchase 70 million widgets, 10 million are sold to the government, and the remainder are stored as inventory. The widget producer pays \$150 million in wages and \$40 million in taxes. Consumers pay \$30 million in taxes. The government spends all tax revenues to hire workers and purchase widgets as an intermediate good into the production of public infrastructure. The widgets total \$50 million and wages total \$20 million. Calculate GDP using the product approach, expenditure approach and income approach.

GDP Using the Product Approach

Value added—producers	\$500
Value added—government	\$20
GDP	\$520

GDP Using the Expenditure Approach

Consumption	\$350
Investment	\$100
Government Expenditures	\$70
Net Exports	\$0
GDP	\$520

GDP Using the Income Approach

After-Tax Wage Income	\$140
After-Tax Profits	\$310
Interest Income	\$0
Taxes	\$70
GDP	\$520

2. Imagine an economy with two goods, coconuts and fish. Last year, 40 coconuts were sold for \$5 each and 200 units of fish at \$2 each. This year, 60 coconuts were sold for \$7 each and 300 units of fish at \$4 each.

- (a) Fill in the following table.

$$\text{Year 1 nominal GDP} = (\$5 * 40) + (\$2 * 200) = \$400$$

$$\text{Year 2 nominal GDP} = (\$7 * 60) + (\$4 * 300) = \$1620$$

$$\% \Delta = (100 * 1620) / (1400 - 1) = 305$$

	Year 1	% increase
Year 1 Nominal GDP	400	
Year 2 Nominal GDP	1620	305

- (b) Calculate the relative price of coconuts to fish for both years.

$$\text{Year 1: Price of coconuts/Price of fish} = 5/2 = 2.5$$

$$\text{Year 2: Price of coconuts/Price of fish} = 7/4 = 1.75$$

(c) Fill in the following table.

For the first row, Year 1 = 100 and Year 2 is calculated using Year 1 prices.

Price deflator index = $(P_2 * Q_2)/(P_1 * Q_2)$

$$= \frac{(\$7 \times 50) + (\$4 \times 300)}{(\$4 \times 50) + (\$2 \times 300)} \times 100 = 193.75$$

For the second row, Year 2 = 100 and Year 1 is calculated using Year 2 prices.

Price deflator index = $(P_1 * Q_1)/(P_2 * Q_1)$

$$= \frac{(\$4 \times 47) + (\$2 \times 200)}{(\$7 \times 47) + (\$4 \times 200)} \times 100 = 52.0815$$

Real GDP	Year 1	Year 2	% increase
Year 1 = base year	100	193.75	93.75
Year 2 = base year	52.0815	100	92.0

Chapter 3

Business Cycle Measurement

■ Overview

This chapter discusses the measurement of business cycles using macroeconomic data. Business cycles are aperiodic positive and negative deviations of macroeconomic variables from their trends, though co-movements of economic variables are fairly regular over the business cycle as this chapter discusses. Co-movements are measured by plotting the percentage deviations from trend of two variables over time, and by calculating the correlation coefficient between two variables' deviations from their trends during some time period. A positive correlation shows that variables move together. A negative correlation says they move in opposite directions, while a correlation near zero indicates that variables are unrelated. Variables that move (in deviations from trend) in the same direction with GDP are called *procyclical*; those that move in the opposite direction are called *countercyclical*; and those that do not move with GDP are called *acyclical*. Changes in variables may also lead, lag, or be coincident with changes in GDP. They can also be more variable (a greater amplitude) or less variable (a lower amplitude) than is GDP. A well-specified economic model should be able to predict co-movements and amplitudes of relevant economic variables vis-à-vis GDP.

Tables 3.1 and 3.2 summarize business cycle facts presented in this chapter. Six variables are of primary importance: *Consumption* is procyclical, coincident and less variable than GDP; *investment* is procyclical, coincident, and more variable than GDP; *money supply* and *employment* are also procyclical with less variation than GDP, though the former leads GDP while the latter lags it; the *price level* is countercyclical, coincident, and has low variability; the *real wage* is procyclical but it is not clear whether it leads or lags GDP. One implication of these facts is that there is a reverse Phillips curve (a negative relationship between prices and unemployment) over the business cycle, counter to early research on this topic.

■ True and False

- _____ 1. Business cycle activity is represented graphically as deviations of real GDP from trend in GDP.
- _____ 2. The trend in GDP is a smooth curve that represents the part of GDP that can be explained by long-run growth factors.
- _____ 3. The persistence of deviations in GDP from trend implies that the duration of recessions and expansions tends to be consistent.
- _____ 4. The GDP data indicate that if GDP is below trend in one quarter, it is just as likely to go above or stay below trend the next quarter.
- _____ 5. A correlation coefficient of -1 indicates that the variables under study are unrelated.
- _____ 6. If a plot of real imports lies directly on top of a plot of real investment, the two are considered coincident variables.

- _____ 7. The index of leading economic indicators is coincident with deviations from trend in real GDP.
- _____ 8. Deviations from trend in real aggregate consumption are coincident with deviation from trend in real GDP.
- _____ 9. Deviations from trend in real aggregate consumption are useful in predicting deviations from trend in real GDP.
- _____ 10. Deviations from trend in real aggregate investment are coincident with deviations from trend in real GDP.
- _____ 11. Though deviations from trend in real aggregate investment are not useful in predicting deviation from trend in real GDP, components of aggregate investment such as residential and inventory investment are useful in predicting deviations from trend in real GDP.
- _____ 12. Data before 1980 show nominal money supply deviations to be procyclical.
- _____ 13. The nominal money supply deviation appears to be a lagging variable.
- _____ 14. Deviations from trend in employment appear to be procyclical and lagging.
- _____ 15. Deviations from trend in real wages appear to be procyclical.
- _____ 16. A correlation coefficient of 0.5 indicates acyclicity in a variable.
- _____ 17. Leading variables must have correlations between 0 and 1.

■ Short Answer

1. In what ways are business cycles irregular, and in what ways are they regular?
2. Why is short-term forecasting easier than long-term forecasting?
3. What evidence is there that the U.S. price-level deviation from trend is procyclical and what evidence is there that the U.S. price-level deviation from trend is countercyclical?

■ Answers

True/False

1. True.
2. True.
3. False. The duration is not consistent but is highly variable.
4. False. Deviations are *persistent* in that if GDP is below (above) trend in one quarter it is most likely to stay below (above) trend the next quarter.
5. False. It means that they are perfectly negatively related.
6. False. Deviations from trend, rather than the absolute quantities, are studied and used to determine the relationship among economic variables in business cycle behavior.
7. False. It is leading and therefore not coincident.

8. True.
9. False. The consumption variable does not lead the GDP variable.
10. False. Deviations in aggregate investment are not coincident but have a standard deviation of 464.4 percent of that for GDP.
11. True.
12. True.
13. False. The nominal money supply deviation appears to be a leading variable.
14. True.
15. True.
16. False. Correlation coefficients do not indicate cyclicalities.
17. False. Leading and lagging variable can have either positive or negative correlations.

Short Answer

1. They are irregular in that economists have difficulty predicting upturns and downturns. They are regular in the sense that many macroeconomic variables move together over the business cycle in predictable ways.
2. The persistence in GDP implies that if GDP is below trend in one quarter, it is most likely to stay below trend the next quarter. The irregularities listed in the book (choppy behavior of GDP, varying amplitude, and frequency of fluctuations) indicate why long-term forecasting is difficult.
3. The price level deviations appear procyclical over the 1947–1999 period in the United States and countercyclical over smaller periods such as between the world wars.

Chapter 4

Consumer and Firm Behavior: The Work-Leisure Decision and Profit Maximization

■ Overview

This chapter presents consumer and firm choices in a one-period static environment. Such an environment is not very realistic, but it allows one to understand the mode of analysis in a less complicated way before examining other environments. A representative consumer is used to characterize how a typical person makes choices to maximize the utility from consuming goods and leisure given a budget constraint. Standard consumer preferences produce higher utility when leisure and consumption rise, and when a varied bundle of goods is consumed. Each additional unit of goods or leisure consumed provides consumers with more utility, though less than the previous unit (positive but diminishing marginal utility). Economic agents are assumed to be atomistic and therefore price-takers, i.e. the market structure is competitive with no consumer having market power. Consumers are shown to maximize graphically when the marginal rate of substitution between leisure and consumption is equal to the real wage. Any deviation from this condition would produce lower utility for the representative agent. The analysis shows that as consumers' incomes rise, consumption rises while hours worked fall (that is, leisure increases). If wages increase, consumption rises, but hours worked may rise or fall depending on the strength of the income and substitution effects.

A representative firm is also modeled in this chapter to understand how a typical firm makes decisions to maximize profits in a competitive environment. In this static model, a firm's capital is fixed, but it chooses how much labor to employ. A firm's labor demand depends on its production function (the engineering relationship between production inputs and final output). This relationship has two important properties that are suggested by the data: constant returns to scale (a fixed percentage increase in all inputs produces the same percentage output), and positive but diminishing marginal product (an increase each input in isolation increases output, but at a less than the rate of the input increase). When a firm chooses labor employed to maximize profits, the marginal product of labor equals the real wage. In addition, a firm's labor demand increases when capital rises, and also when total factor productivity rises since both of these raise labor productivity.

■ True and False

- _____ 1. The *more is preferred to less* criterion violates the diminishing returns concept because consumers would want less of a good that they have in great abundance.
- _____ 2. An inferior good is one that brings negative utility to consumers.
- _____ 3. Given that consumption and leisure are normal goods, consumption must decrease but leisure may increase or decrease in response to an increase in the real wage.
- _____ 4. The marginal rate of substitution of x for y at point Z (some arbitrary point on the indifference curve) equals the negative of the slope of the indifference curve passing through point Z .

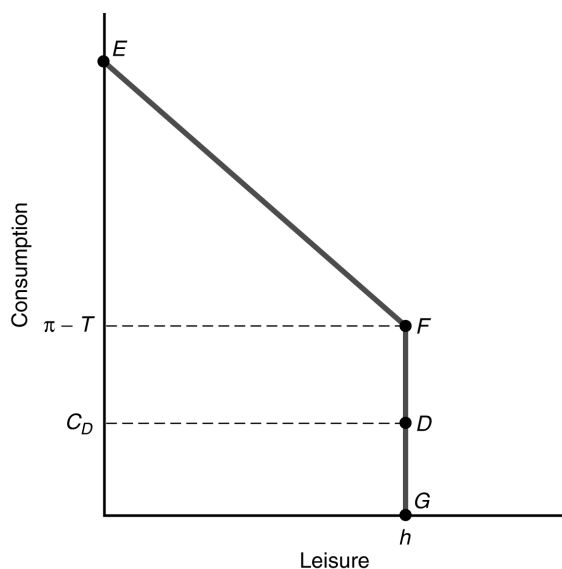
- _____ 5. If x is a numeraire good, the prices and quantities of all other goods will be denominated in terms of x .
- _____ 6. Assuming x and y are goods that satisfy the properties of preferences, $U(C_1, l_1) > U(C_2, l_1)$ implies $C_2 < C_1$.
- _____ 7. The following budget constraint, $C + wl = wN^s + \pi - T$ holds with equality assuming $l + N^s = h$.
- _____ 8. Rationality allows a consumer to rank different consumption bundles and requires that the utility-maximizing one be chosen.
- _____ 9. The relative price of good x in terms of good y is the number of units of y that trade for a unit of x .
- _____ 10. The marginal rate of substitution of consumption for leisure equals the relative price of leisure in terms of consumption goods.
- _____ 11. The assumption that leisure is a normal good implies that a decrease in non-wage disposable income increases labor supply.
- _____ 12. A good whose income effect is positively (negatively) related to increases (decreases) in income is, by definition, an income normal good.
- _____ 13. An increase in income causes an increase in consumption of an income normal good.
- _____ 14. If the substitution effect is smaller than the income effect of a change in the real wage, labor supply will decrease with increases in real wages.
- _____ 15. If an economy's aggregate production function is given by $Y = zK^{1/2}(N^d)^{1/2}$, the capital and labor shares of national income will be equal assuming profit-maximizing price-taking behavior.
- _____ 16. Profit-maximizing behavior requires that firms hire additional labor when $MP_N < w$.

■ Short Answer

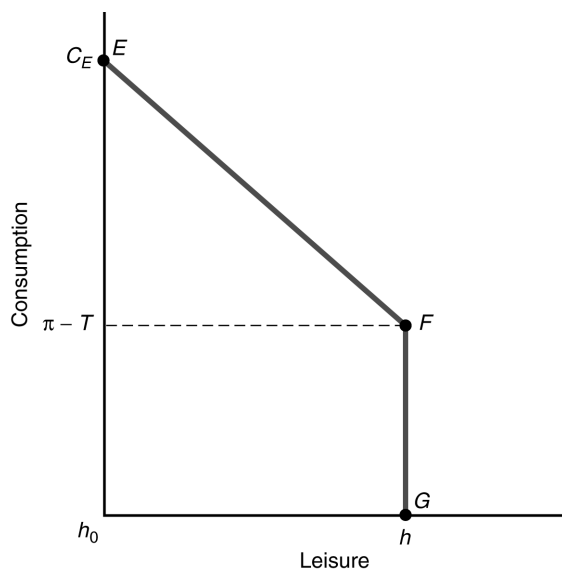
- 1. In what sense does wl in the one-period model represent the amount spent on leisure?
- 2. Demand for a good represents both the *willingness* and *ability* to pay for a good at various prices. How are these two concepts illustrated at the consumer optimum?
- 3. In what ways do perfect complements preferences violate the properties of utility assumed in this chapter?
- 4. Is there empirical support for the income effect outweighing the substitution effect of a change in U.S. real wages?
- 5. Prove mathematically that labor's share of national income will equal a for an aggregate production function given by $Y = zK^{1-a}(N^d)^a$ assuming profit-maximizing, price-taking behavior.

■ Graphic/Numeric

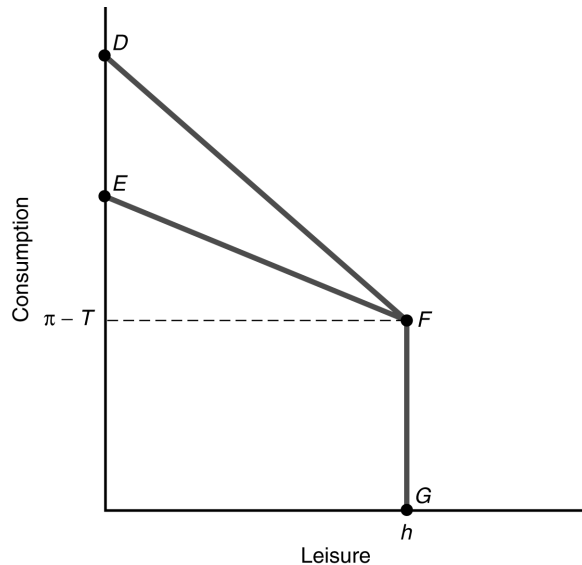
1. Consider point D at (C_D, h) in the graph below.
 - (a) Is point D a possible consumer optimum given the budget line EFG ? Why or why not?
 - (b) Is point D a feasible point for consumption in a representative agent model? Why or why not?



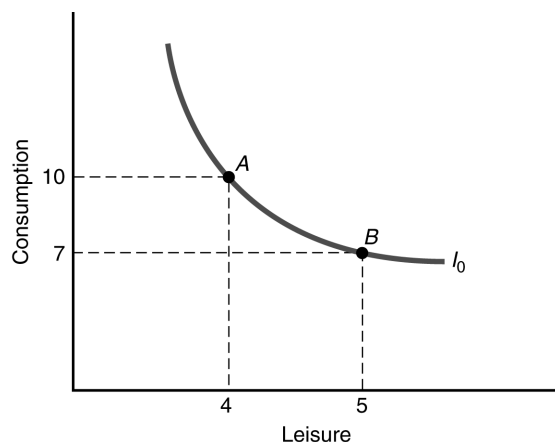
2. Consider point E at (C_E, h_0) in the graph below.
 - (a) Assuming that time is required to obtain and consume the consumption good C , is point E a feasible point for consumption in a representative agent model? Why or why not?



3. What are the two possible causes for the pivot in the budget constraint from EFG to DFG in the graph below?



4. Suppose that consumers in Las Vegas pay twice as much for apples as for pears, whereas consumers in Los Angeles pay 50 percent more for apples than for pears. If consumers in both cities maximize utility, will the marginal rate of substitution of pears for apples be the same in Las Vegas as in Los Angeles? If not, in which city will it be higher?
5. The McDonald farm is hiring labor to harvest its corn. It receives \$25 per bushel and pays its workers \$100 per day to pick corn. The marginal product of 10 workers is 10 bushels per day for the first 10 workers and decreases by 1 bushel for each additional 10 workers.
- What is the real wage in terms of bushels of corn?
 - How many workers should be hired?
6. What is the marginal rate of substitution of leisure for consumption from A to B in the graph below?



7. Consider the simple one period model presented in the chapter. Assume that leisure and consumption are normal goods. How will GDP be affected by a decrease in T ? Use indifference curve and budget constraints to illustrate your answers.
8. Consider the simple one period model presented in the chapter. Assume that leisure and consumption are normal goods. How will GDP be affected by a decrease in productivity, z ? Use indifference curve and budget constraints to illustrate your answers.

■ Answers

True and False

1. False. Diminishing returns do not imply negative marginal value.
2. False. An inferior good is characterized by a negative income effect.
3. False. Consumption must *increase* with an increase in the real wage.
4. True.
5. True.
6. True.
7. False. The constraint holds if $C + wl = wh + \pi - T$.
8. True.
9. True.
10. False. The marginal rate of substitution of *leisure* for *consumption* equals the relative price of leisure in terms of consumption goods.
11. True.
12. True.
13. False. Wage income increases can lead to a decrease in consumption of leisure.
14. True.
15. True.
16. False. Profit-maximizing behavior requires that firms reduce labor input when $MP_N < w$.

Short Answer

1. w is the market price of leisure time since each unit of leisure is forgone labor paid at the real wage w .
2. At the optimum, the willingness to pay just equals the ability to pay at the margin. The willingness to pay for a good refers to preferences and is captured by the utility function mathematically and the indifference curve graphically. The ability to pay for a good is captured by the budget constraint mathematically and the budget line graphically.

3. More is not always preferred to less for perfect-complements preferences and their indifference curves are not downward sloping.
4. There is support for the income effect outweighing the substitution effect of real wage increases in the U.S. from 1980 to 2003. The real wage rose by 9% over the period and the average hours worked fell from 35.4 to 33.7 hours per week.
5. Labor's share of income is wN^d/Y . Under profit-maximizing, price-taking behavior, $MP_N = w$ allowing us to rewrite wN^d as $MP_N N^d$. $MP_N = azK^{1-a}(N^d)^{a-1}$ and thus $MP_N N^d = azK^{1-a}(N^d)^a$ and $wN^d/Y = azK^{1-a}(N^d)^a / zK^{1-a}(N^d)^a = a$.

Graphic/Numeric

1. (a) At point D , the worker consumes C_D of the consumption good rather than the maximum amount possible, $\pi - T$, for h hours of leisure. This bundle violates the more is preferred to less criterion and therefore cannot be an optimum.
(b) Point D is not feasible in the representative agent model because no work ultimately implies no dividend income π and therefore no consumption.
2. (a) At point E , the worker consumes C_E of the consumption good and spends no time consuming leisure. This bundle cannot be feasible if time is required to actually consume the good.
3. An increase in the real wage or a decrease in the price of C are the possible causes of the pivot in the budget constraint.
4. The information on prices can be written as $P_A^{LV} = 2 P_P^{LV}$ and $P_A^{LV} = 1.5 P_P^{LV}$. Because utility is maximized when the equimarginal principle holds $MRS = \text{Price ratio}$, we can say that the $MRS_{P,A} = MU_A/MU_P = P_A/P_P$. Thus $MRS_{P,A}^{LV} = 2 P_P^{LV}/P_P^{LV} = 2$ and the $MRS_{P,A}^{LV} = 1.5 P_P^{LV}/P_P^{LV} = 1.5$. The answer is “no, the MRSs are not the same but higher in Las Vegas: $MRS^{LV} > MRS^{LA}$.”
5. (a) The real wage is $\$25/\$100 = 0.25$ bushels of corn per daily labor.
(b) Hire up to the point where the $MP_N = w = 0.25$. $MP_{N=100} = 1$ and $MP_{N=110} = 0$. So hire between 100 and 110.
6. $MRS = 3/1$ or 3. In other words, the slope of the indifference curve over that range equals -3 .
7. GDP will fall for a decrease in T . Lower T will raise incomes as represented by a shift up the budget line. Because both leisure and goods are normal, consumption of both will rise and labor will fall. The decrease in labor decreases aggregate output and hence GDP .
8. GDP may rise or fall for an increase in z . Higher z will raise incomes as represented by a shift up the budget line. Because both leisure and goods are normal, consumption of both will rise and labor will fall. Though the decrease in labor tends to decrease output, the increase in productivity tends to increase output. If the positive effect of z on output is greater than the negative effect on labor, GDP will increase. If the positive effect of z on output is less than the negative effect on labor, GDP will decrease.

Chapter 5

A Closed-Economy One-Period Macroeconomic Model

■ Overview

This chapter adds a government sector to the model discussed in Chapter 4 and uses this model to understand several important aspects of *equilibrium* economic behavior. In an equilibrium, the representative consumer and representative firm must all be optimizing, the goods and labor markets must clear (supply equals demand), and all choices, including those of the government, must be mutually consistent. Such an equilibrium is the presumed way that actual economic data are generated by market participants and therefore this model permits us to compare its predictions to the data. Market clearing occurs when prices in each market adjust until the amount supplied equals the amount demanded since all market participants respond to price signals when making optimal choices.

The model was used to show that an increase in government spending reduces consumers' incomes and consumption and raises employment. This is known as *crowding out* as the government displaces consumers' choices, although aggregate output increases. As total factor productivity rises (for example, from a technological advance), output, consumption, and real wages all increase, though employment may increase or decrease due to the income and substitution effects, which work in opposite directions.

This chapter also defines a *Pareto optimal* allocation (there is no other allocation that can be chosen that can make one individual better off without making one or more others worse off), and argues that the competitive equilibrium in this model is indeed Pareto optimal and that the converse is also true (the first and second welfare theorems hold). Importantly, this chapter also compared the model's predictions to the data to understand how the economy evolves over time.

■ True and False

- _____ 1. Economists generally agree that the government can play a useful role in providing public goods.
- _____ 2. Any market in which individuals purchase the amount of a good they desire is considered to be a market that clears.
- _____ 3. In the closed-economy, single-period macroeconomic model, $Y = \pi + wN^s$.
- _____ 4. The C -intercept of the PPF in the closed-economy, single-period macroeconomic model may be written as $\pi + wN^s - G$.
- _____ 5. The slope of the PPF in the closed-economy, single-period macroeconomic model indicates the rate at which leisure can be converted into C through work.
- _____ 6. π^* in the closed-economy, single-period macroeconomic model equals $C^* - w(h - l^*)$.
- _____ 7. An upward-sloping labor supply curve requires leisure be income normal.

- _____ 8. A negative correlation between energy price changes and productivity is supported by the real business cycle theory.
- _____ 9. In modern economies, inefficiencies such as externalities and monopoly power are rare.
- _____ 10. Pareto optimality is a useful concept only for analyzing economies that are efficient.
- _____ 11. The social planner chooses the technology, z , that gives the highest output given the total labor and capital in the economy.
- _____ 12. Greed and profit maximization lead to the social optimum when externalities, distorting taxes, and monopoly are insignificant.
- _____ 13. Adam Smith argued that social planners are important in guiding the economy to a Pareto optimal outcome.
- _____ 14. Consumer optimization under a tax on wage income results in $MP_N > MRS_{l,c}$.
- _____ 15. The optimal amount of production and consumption in the economy is determined by the interaction of technology and preferences and is represented by the production possibilities frontier and the representative agent's indifference curve, respectively.
- _____ 16. A decrease in government spending in the closed-economy, single-period macroeconomic model results in increased consumption, employment, and output.
- _____ 17. Because the demand for energy is inelastic, an increase in energy prices causes firms to cut back on hiring other inputs—capital and labor—and thereby decrease productivity.
- _____ 18. The Pareto optimum implies $MRS = MRT$ while the competitive equilibrium requires $MRT = w$.
- _____ 19. Government spending shocks in the closed-economy, single-period macroeconomic model explain business cycle behavior very well.
- _____ 20. The data on the effects of very large changes in government expenditures, such as during World War II, corroborate the predictions from the closed-economy, single-period macroeconomic model in terms of aggregate consumption and output.
- _____ 21. The short run is typically thought of as a year or less in macroeconomic models.
- _____ 22. A decrease in total factor productivity, z , must cause the real wage to fall regardless of what happens to employment.

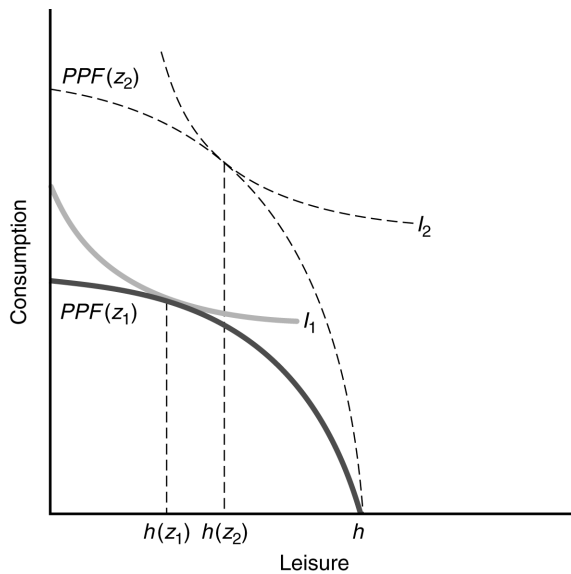
■ Short Answer

- 1. In what sense is a street light a public good?
- 2. How does the constraint facing the representative agent in the closed-economy, single-period macroeconomic model differ from the constraint facing the social planner?
- 3. In what sense does a tax on wage income create a wedge between consumer and firm optimization?
- 4. Explain how a decrease in government spending in the closed-economy, single-period macroeconomic model affects the real wage.

5. Use the income identity for the closed-economy, single-period macroeconomic model to prove that complete crowding out does not occur if leisure is a normal good.
6. Does the U.S. data support the prediction that increases in government expenditure lead to decreased wages and consumption?
7. How does the closed-economy, single-period macroeconomic model fail to explain unemployment?
8. For TFP to be the primary cause of business cycles, what must hold with respect to substitution and income effects for leisure?
9. How can increases in energy prices lower productivity?
10. What is meant by the term *efficiency*?
11. Under what conditions is the social optimum (as determined by the social planner) equal to the competitive equilibrium?
12. Under what conditions should government regulation be used to counter market inefficiencies?
13. How will an increase in total factor productivity affect real wages, employment and output in the bizarre case that leisure is *inferior*?

■ Graphic/Numeric

1. Under total crowding out, what must hold?
2. Explain using graphical terms (think slopes) why the real wage must be higher with the increase in z if labor is a normal good.
3. What can be said about the income and substitution effects of an increase in z from z_1 to z_2 as shown in the graph below?



4. Empirical data shows that hours worked has remained roughly constant in the post–World War II United States with increases in technology. Use the PPF to show how an increase technology can lead to an increase in Y , C , w but leave N constant. What is required for the income and substitution effects?
5. Using the PPF from Figure 5.10, prove that the wage must increase for the increase in total factor productivity, z , if leisure is an income-normal good.

■ Answers

True and False

1. True
2. False. Market clearing also requires that suppliers supply the amount they desire. That is, supply must equal demand.
3. True.
4. True.
5. True.
6. False. π^* equals $C^* + T - w(h - l^*)$.
7. True.
8. True.
9. False. Both externalities and monopoly power are common in modern economies.
10. False. Pareto optimality is also useful for analyzing economies with inefficiencies.
11. False. As with the competitive equilibrium, technology is taken as given in the social planner framework.
12. True.
13. False. Smith said unfettered markets often lead to a Pareto optimum as if guided by an “invisible hand.”
14. True.
15. True.
16. False. An decrease in government spending results in increased consumption, but a *decrease* in both employment and output.
17. False. Two problems exist. Energy is not modeled as being inelastic; when prices rise, less energy is used. Hiring fewer workers raises their marginal productivity but using less capital lowers it; the end effect is ambiguous.

18. True.
19. False. Consumption and real wages in the model move in the opposite direction, as the data would suggest.
20. True.
21. True.
22. True.

Short Answer

1. It would be difficult to get individuals to pay for a street light based on their usage and therefore would be difficult for the private sector to supply.
2. The constraint facing the representative agent is the budget constraint while the constraint facing the social planner is the production possibilities frontier.
3. Consumers optimize by setting $MRS = w(1 - t)$ while firms optimize by setting $MP_N = w$ causing $MRS_{l,C} < MP_N$.
4. A decrease in G raises real disposable income and therefore C and l . The increase in l implies employment falls causing MP_N and the real wage to increase.
5. $C = Y - G$ which implies $\Delta C = \Delta Y - \Delta G$. When G rises, $-\Delta G < 0$ and disposable income falls. Because leisure and consumption are normal goods, they must fall when G rises and employment and output must increase. Rewriting the income identity, $\Delta C + \Delta G = \Delta Y$, it is clear that $\Delta Y > 0$ implies that $\Delta G > \Delta C$ (because $\Delta C < 0$).
6. Yes and no. Yes, for the WWII data and no for the non-war data.
7. Unemployment requires that some people who wish to work cannot find jobs. The model assumes that the labor market clears, implying agents supply the optimal amount of labor. Those not working in this model choose not to work but to consume leisure.
8. Employment must increase (decrease) with TFP and wage increases (decreases) requiring that the substitution effect outweigh the income effect.
9. Causes a reduction in the energy input, which reduces MP_N .
10. Macroeconomists use *Pareto* optimality synonymously with efficiency. That is, an efficient outcome is one that is Pareto optimal.
11. The social optimum equals the competitive equilibrium when externalities, distorting taxes and monopoly power are not significant in the economy.
12. Government regulation should be used when the cost of doing so in terms of added waste is less than the benefit in terms of correcting the private market failure.
13. An increase in total factor productivity affects lowers real wages, employment and output when leisure is *inferior*. Consider Figure 5.10 from the chapter. An increase in z has a substitution effect shown by the movement from point A to D . Leisure inferiority implies a movement from D to a point on PPF_2 to the left of the amount of leisure consumed at point D . This point will have a lower $MRS_{l,C}$ than at point D . The real wage, which is equal to $MRS_{l,C}$, can therefore be lower in equilibrium when z is higher. Labor and output, given leisure inferiority, are higher.

Graphic/Numeric

1. $\Delta G = \Delta Y$ and is represented by a vertical drop in the PPF .
2. The income effect is larger than the substitution effect of the productivity increase from z_1 to z_2 .
3. Using the graph on page 153, the tangency of I_2 and PPF_2 must be to the right of point D on PPF_3 . Any point to the right of D must have a steeper slope than point D. Furthermore, because substitution effects are always negative, the slope at point D must be steeper than that at point A. It is impossible to graph a point whose slope is flatter (implying wage is lower) than at point A without violating the income normality assumptions.
4. The income and substitution effects must just balance out one another.
5. First, recall that a higher wage is illustrated by a higher $MRS_{l,c}$. Second, note that a higher $MRS_{l,c}$ is illustrated by a steeper slope. Third, show that PPF_2 is steeper within the range in which the new indifference can lie tangent to it.

Chapter 6

Economic Growth: Malthus and Solow

■ Overview

This chapter first examines growth under an early growth model based on the writings of Thomas Malthus. The model predicts that the standard of living, measured by output per capita, can increase only with population control. Otherwise, per capita economic growth will not occur and the populace will eventually be reduced to subsistence living. This model provides a fairly accurate depiction of economic growth before 1800, a time in which standards of living changed very little over time. Other important growth facts are as follows: 1) Per capita income growth has been sustained in the richest countries since the Industrial Revolution, with the U.S. averaging 2% per year since 1869; 2) the rate of investment and output per worker are positively correlated across countries; 3) the population growth rate and output per worker across countries is negatively correlated across countries; 4) between 1800 and 1950, differences in per capita incomes across the world increased dramatically; 5) levels of output per worker in 1960 and the average rate of growth in output per worker for the succeeding 35 years is uncorrelated; 6) a negative correlation exists between the level of output per worker in 1960 and the average rate of growth in output per worker for the succeeding 35 years among rich countries; 7) no correlation exists between the level of output per worker in 1960 and the average rate of growth in output per worker for the succeeding 35 years in the poorest countries.

After the Malthusian model is explored, the Solow growth model is presented in which consumers are posited to always save a fixed proportion of their income. This is called an *exogenous growth model* because exogenous growth in capital, labor, and total factor productivity produce output growth (i.e. there is no explanation of why these factors grow). This is a simplified descriptive model, which is akin to growth accounting. The model predicts that in the long run, all countries should converge to the same level of income per worker if none of the underlying factors (e.g. total factor productivity) changes. This prediction has some support in the data, at least among countries that are not very poor. The model also predicts that output falls when population growth rises, or the savings rate falls. These have strong support in the data.

The two primary implications of the Solow growth model are that i) poor countries should catch up to living standards in rich countries; and that ii) sustained long-run growth is not possible unless total factor productivity grows forever.

One way to test predictions of growth models involves *growth accounting*, a method to examine the factors that produce economic growth. These are the growth in capital, the growth in labor, and the growth in total factor productivity. Total factor productivity is measured as the residual impact on growth once changes in capital and labor are accounted for, a measure known as the *Solow residual*. The Solow residual reveals that productivity slowed in the United States from 1973 to the early 1980s. This slowdown appears to be the result of increasingly poor measurement of productivity due to the rise of the service sector, as well as the learning required to use computer technology as personal computers were first introduced in businesses during this period. The Solow residual also closely tracks business cycle variations in output. Growth accounting is also used to examine the causes of growth in Hong Kong, Singapore, South Korea and Taiwan, the so-called Asian growth miracles. Studies show that the majority of growth from these “miracle” countries came from large increases in labor and capital. Though total factor productivity played a role in their growth, it was relatively minor.

■ True and False

- _____ 1. Although total factor productivity declined in the 1970s, U.S. GDP growth continued due to increases in the factors of production, specifically capital and labor.
- _____ 2. Though growth in the factors of production declined in the 1980s, U.S. GDP growth continued due to increases in total factor productivity.
- _____ 3. U.S. GDP growth in the 1980s is attributed to increases in the factors of production.
- _____ 4. The miraculous growth of the “East Asian Tigers” from the 1960 to the 1990s is mostly attributed to the technological advances.
- _____ 5. Assuming the population growth rate, savings growth rate, and total factor productivity are constant, the growth rate of aggregate economic variables equals the population growth rate.
- _____ 6. In the long run, per-capita consumption growth is unaffected by increases in the savings rate but will increase with increases in the labor force growth rate.
- _____ 7. In the short run, per-capita consumption growth can be affected by increases in the savings rate.
- _____ 8. In the long run, aggregate consumption growth can be affected by increases in the savings rate.
- _____ 9. The key implication of the Solow growth model is that a country’s standard of living cannot continue to improve in the long run in the absence of continuing increases in total factor productivity.
- _____ 10. A country that increases its savings rate will experience higher long-run growth in income.
- _____ 11. Increasing the savings rate will result in a higher per capita income for a country.
- _____ 12. There exists a negative correlation between the rate of growth in income per worker and the level of income per worker.
- _____ 13. There seems to be no evidence of convergence among all the countries in the world for the years 1960–1990.

- _____ 14. The data reveal that convergence is occurring among the poor countries of the world.
- _____ 15. The Solow growth model is used to describe economic growth but not actually explain it.
- _____ 16. The Malthusian growth model fits the data better after, rather than before, the industrial revolution.

■ Short Answer

1. What are the three broad factors that lead to GDP growth in modern economies?
2. How did the women's rights movements affect the U.S. economy in the 1960s and 1970s? What might have happened to GDP in the 1970s if that movement had not occurred?
3. What is *steady* about the *steady state*?
4. In what ways do the data support the predictions from the Solow model?
5. What happens to a model Solow economy when $n = -1$?
6. How do the modeling assumptions about labor and consumption differ between the Solow model and the two-period models presented in the previous chapters?
7. What prediction regarding growth rates between rich and poor countries comes from the Solow model and is it supported by the empirical evidence?
8. Name three possible causes of the *U.S. productivity slowdown*.
9. Why did living standards increase after the industrial revolution?
10. What happens to living standards in the Malthusian model if there is an increase in productivity?
11. What factors are used to produce output in the Malthusian model?
12. What is a "steady state"?
13. How does population control raise living standards in Malthus' model?
14. Explain what happens to living standards if there is immigration in the Malthus model.
15. Why is the Solow model called an "exogenous" growth model?
16. Does Figure 6.15 showing the cyclical fluctuations in the Solow residual and GDP prove that changes in productivity cause business cycles?
17. What factor(s) cause long-run growth in the Solow model?
18. Is Singapore a "growth miracle"?
19. Can the U.S. become a "growth miracle" like the East Asian "tiger" economies?
20. Absent growth in total factor productivity, why do living standards reach a steady state in the Solow model?
21. Absent growth in total factor productivity, does a permanent increase in the savings rate in the Solow model increase growth?

■ Graphic/Numeric

1. Solve for the golden rule aggregate and per-capita capital stock, consumption, and income given the production function of $Y = zK^\alpha N^{1-\alpha}$.
2. Re-solve the above model with the following parameters values, $Y = zK^{1/3}N^{2/3}$, $s = 1/4$, $n = 0.05$, $d = 0.10$, $\alpha = 1/3$, $N = 100$ and $z = 10$.
3. In the Malthusian model, graph consumption per worker c after an increase in the population size.
4. Using the Solow growth model, suppose the economy is in a steady state and total factor productivity $z = z^* > 0$. Now, let z take on two new values, z_1 and z_2 so that $z_1 < z^* < z_2$. Graph output and consumption over 10 periods (quarters) when total factor productivity $z = \{z_1, z_1, z_1, z_1, z_2, z_2, z_2, z_2, z_2, z_2\}$. Describe what is happening in this economy.

■ Answers

True/False

1. True.
2. True.
3. True.
4. False. The miraculous growth of the “East Asian Tigers” from the 1960s to the 1990s is mostly attributed to increases in inputs rather than technical innovation.
5. True.
6. False. In the long run, per-capita consumption growth is unaffected by increases in the savings rate but will increase with increases in the labor force growth rate.
7. True.
8. True.
9. True.
10. False.
11. True.
12. True.
13. True.
14. False.
15. True.
16. False. It fits data before the industrial revolution, not after.

Short Answer

1. Growth in TFP , L , and K .
2. The women's movement led to greater employment in the economy and thereby boosted GDP growth. Given the productivity slowdown in the 1970s, GDP growth would have been lower without the increase in N .
3. All economic variables grow at a constant (steady) rate. Hence the name.
4. High (low) i/y is positively correlated with high (low) income per worker and a negative correlation exists between n and y .
5. Population is completely eliminated implying employment = 0 and hence production = 0.
6. The Solow model assumes inelastic labor supply and that consumption is determined exogenously by a marginal propensity to consume.
7. The Solow model predicts that countries that are initially poor in terms of income per worker will grow at a faster rate than countries that are initially rich. This prediction is consistent with the evidence for developed countries but not for developing countries. Developing countries seem to be falling behind wealthy countries rather than catching up.
8. 1) Measurement problems due to sectoral shifts out of manufacturing into services may have created the appearance of a productivity slowdown as productivity in services is often hard to measure. 2) The increase in oil during the 1970s may have caused a decrease in the use of older, non-energy-efficient capital equipment. The older capital may have been mismeasured and caused the appearance of a slowdown. 3) The costs of adopting new technology, especially information technology requires time to learn. Productivity may be low during the learning period.
9. Because production began to be based on not just land and labor, but physical capital. The latter is accumulable and this is what caused per capita incomes to accelerate.
10. Incomes rise leading to a rise in the population, and an eventual return to the original living standard.
11. Land (L) and labor (N) (see equation 1). Output is also influenced by the level of total factor productivity (z), but this is not a production input.
12. It is a point in a growth model's trajectory where there is no further growth or contraction. When a model is at a steady state, it stays there.
13. As the level of population shrinks, this increases labor productivity and income per person and therefore consumption per person.
14. Immigration is equivalent to population growth, driving down per person productivity and living standards. Lower incomes reduce fertility until per capita consumption eventually returns to its original level.
15. Because the source of long-run growth, productivity increases, are exogenous to the economic aspects of the model.

16. The figure just shows that they move together, it does not identify the direction of causation (i.e. change in GDP could cause productivity changes; for a full answer, see Ch. 11).
17. Changes in total factor productivity cause long-run growth in this model.
18. Table 6.4 shows that the majority of Singapore's output growth from 1966–1990 was due to the accumulation of capital (including foreign capital inflows) rather than increases in total factor productivity. While this rate of investment does seem “miraculous”, it is unsustainable since it doesn't utilize total factor productivity gains (or some other factor that can produce sustained growth; see Ch. 7).
19. This is unlikely as the U.S. can only moderately increase labor and capital in production, and U.S. total factor productivity growth has been modest (Table 6.4).
20. This is due to diminishing marginal product of capital.
21. Starting from a steady state, a permanent increase in the savings rate s will temporarily cause positive growth to a new, higher steady state. There is no further growth once the new steady state is reached.

Graphic/Numeric

1. Recall that $I = K' - (1 - d)K$ and $S = sY$,

In equilibrium $I = S$ implying $K' - (1 - d)K = sY$ or $K' - (1 - d)K = szK^\alpha N^{1-\alpha}$

Divide each side by N to give $k'(1 + n) - (1 - d)k = szk^\alpha$

$$k' = szk^\alpha / (1 + n) + (1 - d)k / (1 + n)$$

The golden rule occurs at the steady state in which $k' = k$, so we rewrite the above equation as $k = szk^\alpha / (1 + n) + (1 - d)k / (1 + n)$ and solve for k . Divide each side by k to give $1 + n = szk^{-1-\alpha} + (1 - d)$
 $n + d = szk^{-1-\alpha}$

The golden rule per-capita capital stock is $k^* = [sz/(n + d)]^\alpha$

The golden rule aggregate capital stock is $K^* = N * k^* = N[sz/(n + d)]^\alpha$

$$C^* = (1 - s)Y^* = (1 - s)z(K^*)^\alpha N^{1-\alpha} = (1 - s)z([sz/(n + d)]^\alpha)^\alpha N$$

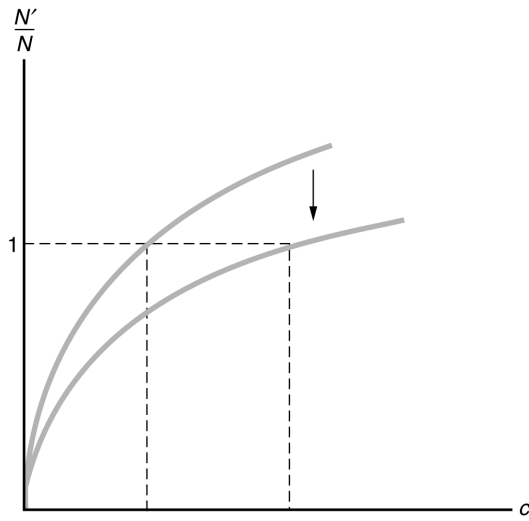
$$y = z(k^*)^\alpha = z([sz/(n + d)]^\alpha)^\alpha$$

2. $k^* = (2.5/.15)^{1/3} = 2.55436$, $K^* = 255.436$

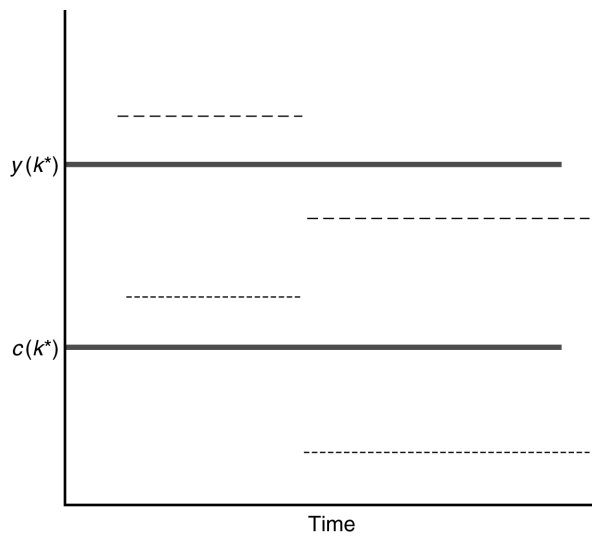
$$y = 10k^{1/3} = 13.6698, Y = 1366.98$$

$$C^* = (1 - s)Y^* = 1025.23, c^* = 10.25$$

3. Output per worker falls when population increases as shown in the following graph.



- 4.



Here $y(k^*)$ is the steady state level of output and $c(k^*)$ is steady state consumption (both with $z = z^*$). y and c are above the steady state levels when $z = z_1$ and below when $z = z_2$. This could correspond to expansions and contractions in the economy.

Chapter 7

Income Disparity Among Countries and Endogenous Growth

■ Overview

The Solow model from Chapter 6 predicted that countries with the same population growth rates and technology but different levels of physical capital would, over time, experience a convergence in incomes. Convergence, however, has only been seen among wealthy countries. Among the set of poor countries and all countries together, convergence does not appear in the data. Parente and Prescott suggest that barriers to technology adoption explain the lack of convergence to a considerable extent and provide insight into the growth of the Asian miracles countries. The next section moves beyond the Solow growth model to explore endogenous growth models. Unlike the Solow model, endogenous growth models predict persistent income disparities across countries. A variant of the Solow growth model that includes *human capital* (skills) is studied. In this version of the model, persistent long-run growth is achievable if human capital accumulation is sufficiently rapid without needing growth in total factor productivity. The model with human capital does not predict that per capita income levels will converge in the long run and therefore it provides a better fit to the data.

■ True and False

- _____ 1. The Lucas model predicts that countries with more efficient education systems should experience higher rates of growth in human capital.
- _____ 2. Unbounded growth requires increasing or constant returns to scale in the factor that accumulates (in the Lucas model, H).

■ Short Answer

- 1. How are labor unions related to economic growth?
- 2. How is international trade related to economic growth?
- 3. Why is physical capital a “rivalrous” good.
- 4. Why is total factor productivity different across countries?
- 5. Why is the growth model with human capital called “endogenous”?
- 6. Why doesn’t the production of human capital face diminishing marginal product?
- 7. What is it about the production function of human capital that results in long-run growth?
- 8. Using equation (7) as a guide, provide two methods that the government could to affect the growth rate of the economy by impacting b or $1 - u$.

9. If the government raised b or $1-u$ and increased the economy's growth rate, are people happier?
10. How does patience affect economic growth in the endogenous growth model?
11. How might one's expected length of life affect economic growth?
12. What characteristics do physical and human capital share?
13. Why might human capital investment not be subject to diminishing returns?
14. What is the fundamental difference between the Lucas and Solow model?
15. Is there empirical data support for the predictions from the human capital endogenous growth model?

■ Graphic/Numeric

1. Consider a variant of the endogenous growth model where human capital production is subject to diminishing marginal product and average human capital makes everyone more productive (e.g. fewer car accidents, fewer lost shipments, etc.). This model follows the one in the text except that equation (6) now becomes $h^a b(1-u)H^b$, where h is average human capital, and $a, b \in (0,1)$. In this equation for human capital growth, individuals only consider the effects on their own consumption when deciding how much time to spend acquiring human capital ($1-u$) and working (u), not the externality h^a . After this decision, we now let $h = H$ since there is a representative consumer (i.e. the total equals the average) so that in equilibrium human capital growth is $H' = b(1-u)H^{a+b}$. Graph the growth of human capital in this economy in $H'H$ space for $a+b < 1$, $a+b = 1$, and $a+b > 1$ and interpret what each graph means.
2. Continuing with question 1, explain why individuals will underinvest in human capital in this model relative to the social optimum. Use this answer to argue that this is a reason why many countries subsidize education.

■ Answers

True/False

1. True.
2. True.

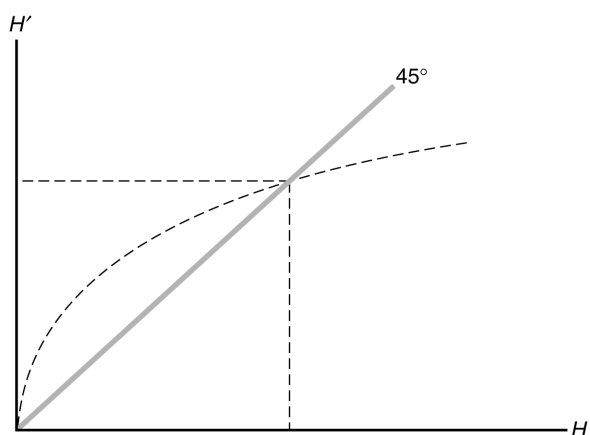
Short Answer

1. Parente and Prescott argue that unions seek to block the introduction of new technologies that are growth enhancing. Countries with strong unions generally have slower growth.
2. International trade exposes domestic firms to competition, raising productivity (either domestic firms increase efficiency to remain profitable or market share goes to more efficient foreign firms charging lower prices). International trade therefore spurs productivity increases and economic growth.
3. Because it can be only used by one person (or group of people working together) at a time.
4. Many reasons, including barriers to technology adoption and differences in human capital (human capital is needed to invent more efficient technologies).

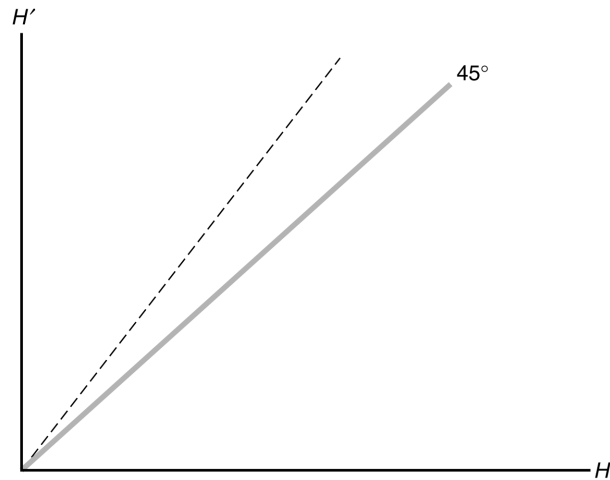
5. The source of long-run growth, human capital, grows within the context of the model. This is different than the Solow model with exogenous total factor productivity growth.
6. Because knowledge is nonrivalrous, it is easily spread and used by many people. For this reason, Robert Lucas and others have argued that human capital can increase linearly virtually forever (see equation 3).
7. The production function of human capital is linear (no diminishing marginal product) so that in the long run the growth rate will also be linear (see equation 7).
8. The government could affect i) b (the efficiency of human capital production) by making education more efficient, providing enriching daycare programs, or encouraging parents to spend more time with their children (e.g. subsidizing family vacations!); ii) $1 - u$ (the time spent acquiring human capital) by subsidizing education, or taxing/penalizing those who don't finish high school.
9. Economists measure happiness by the utility of consuming stuff, and consumption will initially fall as people spend more time acquiring human capital and less time consuming stuff. But, in the long run consumption and therefore utility will be higher. It is unclear whether people who acquire more human capital are happier from the model, but casual observation suggests many are (this is presumably why you are in school).
10. Patience is not shown in the model directly, but those with less patience will not want to defer consumption and acquire human capital. If enough people do this, economic growth will be slower than in a more patient society.
11. Those who expect to die young (for example, those growing up in crime-filled neighborhoods) generally do not want to defer consumption by spending time to acquire human capital. If enough people choose not to acquire human capital, the growth rate of the economy will be reduced ($1 - u$ will be lower).
12. Current costs are incurred for future benefits.
13. Nonrivalry in use.
14. The former is an endogenous growth model while the latter is an exogenous growth model.
15. Yes. Positive correlation between growth rate of y and average time in schooling and positive correlation for y level too.

Graphic/Numeric

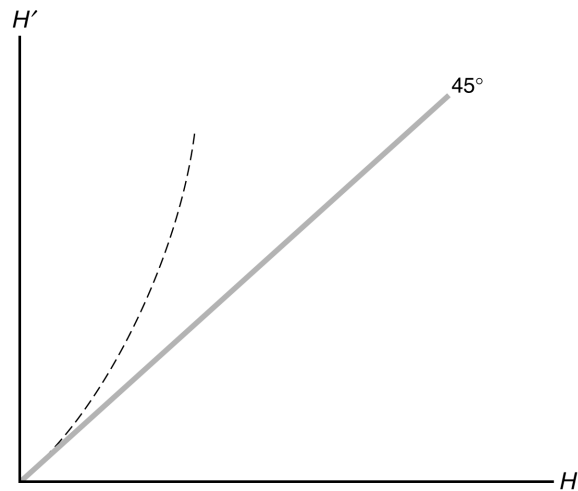
1. (i) $a + b < 1$ (weak externality). No long-run growth



(ii) $a + b = 1$ (moderate externality) Long-run growth (matches model in the book)



(iii) $a + b > 1$ (large externality). Very rapid growth.



2. Underinvestment in H occurs because individuals do not fully capture all the benefits from their personal, costly, investments. Some of the benefit from their human capital investments benefit society as a whole, and this is reflected in higher rates of economic growth when the externality (h^a) grows. Because most people (and much research) suggests that universal education benefits society (by raising productivity, but also by improving health and reducing crime), public education is highly subsidized in the U.S. and this may cause higher growth than without the subsidies (depending on how much the subsidies cost).

Chapter 8

A Two-Period Model: The Consumption-Savings Decision and Ricardian Equivalence

■ Overview

This chapter extends the static model of Chapter 4 to a dynamic setting by modeling the choices that consumers make for a two-period planning horizon. Consumers decide how much to consume today and tomorrow, and can transfer resources over time by saving or dissaving. Consumers face a budget constraint each period that includes a tax liability. The standard preference for diversity in consumption causes *consumption smoothing* (lifetime utility is higher when the amount of consumption today and the amount tomorrow are not too different from each other). Consumers still respond to price changes in the standard way given this preference though; e.g. an increase in present income raises present consumption, savings, and therefore future consumption. Similarly, an increase in future income causes future consumption to rise, but savings to fall (dissaving), raising present consumption. As a result, a permanent increase in income (an increase in both periods) has a larger effect on consumption than a one-period increase.

The Ricardian equivalence theorem was also examined. This theorem states that the timing of taxes is irrelevant vis-à-vis consumption decisions if the tax increase (or decrease) affects the same economic agents since government indebtedness must eventually be paid off. Though there is a reasonable amount of empirical support for Ricardian equivalence, there are many reasons to think that it will not hold in practice (e.g. early death, tax distortions, and market imperfections).

Applications of the two-period model include examining the effect of social security systems on economic welfare. Under a pay-as-you-go system, all consumers are shown to be better off if the growth rate of the population exceeds the real interest rate; worse off, otherwise. In this case, government taxes can solve a market failure problem that exists when intergenerational trade does not exist. Under a fully funded system, the welfare effects are, at best, neutral for consumers.

■ True and False

- _____ 1. A discount rate of $r = -0.1$ implies that future consumption is valued higher than present consumption.
- _____ 2. A discount rate of $r = 0$ implies that future consumption is valued higher than present consumption.
- _____ 3. Consumption smoothing implies that consumers consume the same amount each period.
- _____ 4. Consumption smoothing has empirical support because real GDP is less variable than aggregate consumption.

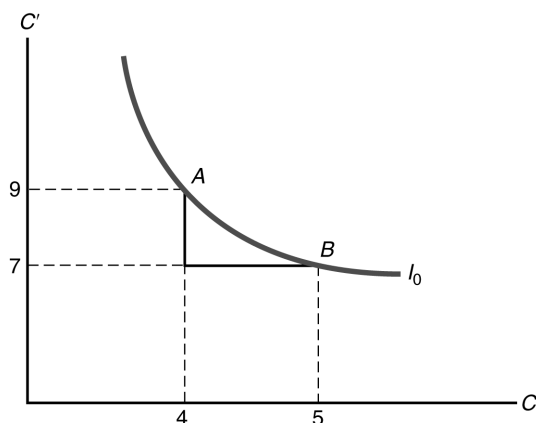
- _____ 5. Eliminating consumer durables from the measure of real aggregate consumption would lead to greater variability of consumption with respect to aggregate income.
- _____ 6. Deviations from trend in the stock price index are negatively correlated with deviations from trend in consumption.
- _____ 7. An increase in the real interest rate might cause a lender to increase current consumption if the substitution effect outweighs the income effect.
- _____ 8. A decrease in the real interest rate might cause a borrower to decrease current consumption if the substitution effect outweighs the income effect.
- _____ 9. The relative price of future consumption in terms of current consumption in the two-period model is $1 + r$.
- _____ 10. Temporary changes in income have a larger effect on permanent income than do permanent changes in income.
- _____ 11. A temporary increase in income leads to an increase in saving while a permanent increase in income need not result in more saving.
- _____ 12. In financial theory, changes in stock prices are assumed to be temporary.
- _____ 13. A decrease in the real interest rate causes current consumption to become cheaper relative to future consumption.
- _____ 14. An increase in the real interest rate results in current consumption falling and future consumption rising for borrowers.
- _____ 15. An increase in the real interest rate results in current consumption rising or falling for the lender and future consumption unambiguously falling.
- _____ 16. The Ricardian Equivalence theorem states that a change in timing of taxes does not affect real variables in the economy.
- _____ 17. A competitive equilibrium can be shown to exist when either identity, $S^p = B$ or $Y = C + G$, hold.
- _____ 18. Under Ricardian Equivalence, an increase in government debt while holding G constant does not change the consumption or saving decisions of consumers.
- _____ 19. Under Ricardian Equivalence, changes in national savings are caused by the changes in the real interest rate.
- _____ 20. Under Ricardian Equivalence, national saving is unaffected by changes in taxes.
- _____ 21. In the real world, if the government collects \$20 million in taxes, the welfare cost to the economy will equal \$20 million.
- _____ 22. Under Ricardian Equivalence, a change in current taxes (say a decrease of \$10 billion), exactly offset by an equal and opposite change in future taxes (an increase of \$10 billion), has no effect on the real interest rate or on the consumption of individual consumers in equilibrium.
- _____ 23. A pay-as-you-go social security system will make both young and old consumers better off as long as the real interest rate, r , exceeds the population growth rate, n .

■ Short Answer

1. What properties of indifference curves imply *consumption-smoothing behavior*?
2. What would happen to the discount rate if consumers valued future consumption more than present?
3. Why is there no B' in equation 18?
4. Provide two explanations for excess variability in the data on consumption.
5. Assume that consumers believe that changes in stock prices are temporary. What affect would this have on the correlation between stock price indices and consumption?
6. Describe the two possible explanations that may lead to the excess variability of consumption as seen in the data.
7. Compare and contrast the effects of an increase in the real interest on borrowers and lenders.
8. Under what condition would an increase in r increase lifetime wealth?
9. What conditions must hold for a competitive equilibrium in a two-period model with Ricardian Equivalence?
10. Under what conditions will the timing of taxes matter?
11. What will happen to aggregate current and future consumption (the sum of consumption for lenders and borrowers) when the real interest rate rises?

■ Graphic/Numeric

1. Assuming $r = 0.25$, $t = 10$, $t' = 20$, $y = 100$ and $y' = 100$, write the consumer's lifetime budget constraint and derive the consumer's lifetime wealth.
2. What is the $MRS_{cc'}$ between point A and B for indifference curve, I_0 ?



3. Show graphically the effect of a decrease in the real interest rate on current-period consumption for a lender whose income effect outweighs the substitution effect.
4. Assume Bill consumes his endowments and therefore neither lends nor borrows. Will an increase in the interest rate cause Bill to increase first and second period consumption? Prove it graphically.

5. Assume that $\Delta t = -2$ and $\Delta t' = 2$. Under what conditions will Ricardian Equivalence hold?
6. Assume an economy with 100 identical consumers. In the current period, each receives income of 8 units and pays taxes of 3 units, while in the future period, each receives income of 10 units and pays taxes of 4.75 units. The government purchases 400 units in the current period and 370 in the future period and borrows $B = 100$ in the current period. The real interest rate is 5 percent.
 - (a) What is the lifetime wealth for each consumer?
 - (b) Derive the government's present-value budget constraint and show that it holds.
 - (c) What is aggregate private saving, government saving, and aggregate consumption?
 - (d) How does aggregate private saving and government saving change if current period taxes are increased to 4 units in the current period and decreased to 3.7 units in the future?
7. Derive $T'^{**} = T'^{*} - m\Delta t(1+r)$ from the equations $G + \frac{G'}{(1+r)} = T'^{*} + \frac{T'^{**}}{(1+r)}$ and $G + \frac{G'}{(1+r)} = T'^{**} + \frac{T'^{**}}{(1+r)}$ given $T'^{**} = T'^{*} + m\Delta t$.
8. Consider a pay-as-you-go social security system to be implemented in a future period T . Consumers receive an endowment of y when young and y' when old. Assume that government expenditures are zero forever, $G = 0$, and the market interest rate, r will be unaffected by the social security system. The tax levied on the young, t , will be a function of the benefits received by the current old, b , and the population growth rate, n , given by $t = \frac{b}{1+n}$. Assume that the market interest rate is greater than the population growth rate, $r > n$.
 - (a) Consider the pre-social security periods where both taxes and government expenditures are zero. Derive the lifetime budget constraint for a young individual in the form $c' = f(r, y, y', c)$.
 - (b) Using the lifetime budget constraint derived above, what is the maximum amount of current consumption, c that a young individual could consume without a social security program? (Hint: Set $c' = 0$ in the budget constraint and solve for c .)
 - (c) Using the lifetime budget constraint derived above, what is the maximum amount of future consumption, c' that an individual could consume without a social security program? (Hint: Set $c = 0$ in the budget constraint and solve for c' .)
 - (d) Redo questions a, b and c for an economy with the pay-as-you-go social security program.
 - (e) Using the algebraic derivations above, prove algebraically that the lifetime budget line shifts in when the government institutes a pay-as-you-go social security program when $r > n$.
 - (f) Show graphically, that consumers must be worse off with the implementation of a pay-as-you-go social security system when $r > n$.

■ Answers

True/False

1. True.
2. False. A discount rate of $r = 0$ implies future and current consumption are valued equally.
3. False. Consumption smoothing implies consumers wish to avoid large deviations in consumption over time.
4. False. The data show that consumption is less variable than GDP, which supports consumption smoothing.

5. False. Eliminating consumer durables from the measure of real aggregate consumption would lead to less variability.
6. False. They are positively correlated with one another.
7. False. The lender with such preferences will always reduce current consumption.
8. False. Both effects are negative with respect to current consumption and thus current consumption must fall.
9. False. The relative price is $1/(1 + r)$.
10. False. Permanent changes in income have a larger effect on permanent income than do temporary changes in income.
11. True.
12. False. Changes in stock prices are assumed to be permanent.
13. True.
14. False. Future consumption may rise or fall for borrowers.
15. False. Future consumption unambiguously rises.
16. True.
17. True.
18. False. Under Ricardian equivalence, an increase in government debt while holding G constant changes consumer savings by an amount equal to minus the change in current taxes, $\Delta S^p = -m\Delta t$.
19. False. Under Ricardian equivalence, the real interest rate is constant.
20. True. Under Ricardian equivalence, government saving changes by an equal and opposite amount to aggregate private saving with changes in taxes implying national saving does not change.
21. False. In the real world, if the government collects \$20 million in taxes, the welfare cost to the economy will exceed \$20 million due to distortions attendant to the tax.
22. False. A change in current taxes offset by an equal and opposite change in the *present value* of future taxes, has no effect on the real interest rate or on the consumption of individual consumers in equilibrium. Note that this answer assumes $r \neq 0$.
23. False. A pay-as-you-go social security system will make both young and old consumers better off as long as $n > r$.

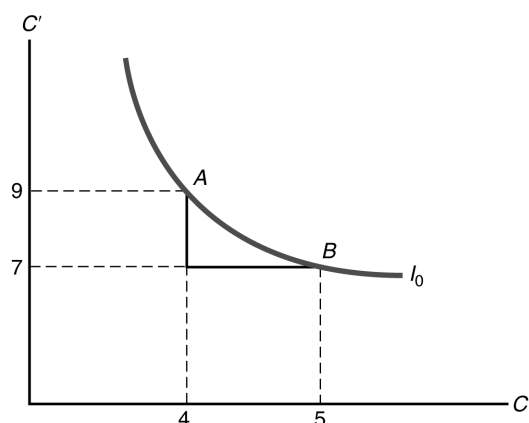
Short Answer

1. Consumption-smoothing behavior is implied by 1) the consumer preference for diversity in consumption bundles and 2) current and future consumption being normal goods. The former implies that the consumer dislikes having very unequal quantities of consumption between the current and future period while the latter implies that increased lifetime wealth results in more of both current and future consumption.
2. Discount rate would cease to discount but would be > 1 in value.

3. B' would represent bonds issued in the future period to be paid in the succeeding period. Because there is no period beyond the future period in the two-period model, B' does not appear in the model.
4. Imperfections in the credit market and aggregate consumption smoothing affects market prices.
5. There would be less variability in consumption if the shock was thought to be only temporary.
6. Imperfections in the credit market and aggregate consumption smoothing lead to changes in market prices.
7. Current consumption falls for the borrower but future consumption may rise or fall while current consumption may rise or fall for the lender and future consumption unambiguously rises due to the increase in the real interest rate.
8. If future income was less than future taxes, y' would be less than t' .
9. 1) Consumers optimize by choosing current and future consumption and thereby savings optimally; 2) the government's present-value budget constraint must hold; and 3) the credit market must clear.
10. Credit market imperfections, non-lump-sum taxes, varying tax rates for different groups, payments after death.
11. The answer is uncertain. Though an increase in the real interest rate decreases a borrowers' current consumption its effect on lenders' current consumption depends upon the relative strength of the income and substitution effects, which are unknown. Similarly, future consumption is uncertain. Though lenders' consumption will rise, the borrower's is uncertain, again dependent upon the income and substitution effects.

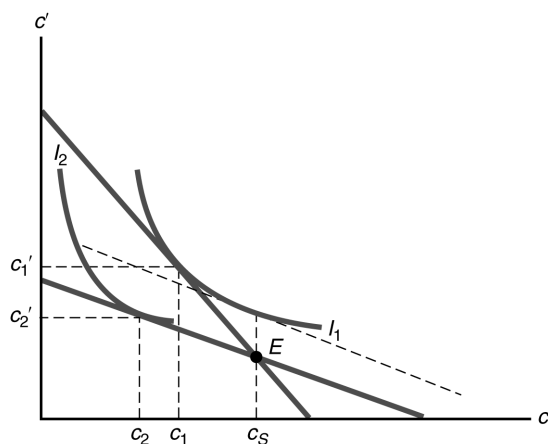
Graphic/Numeric

1. The consumer's lifetime budget constraint is $c + \frac{c'}{(1+r)} = y - t + \frac{(y' - t')}{(1+r)}$. Given the parameter values, the constraint can be rewritten as $c + \frac{c'}{1.25} = 90 + \frac{80}{1.25}$. The consumer's lifetime wealth is $90 + 80/1.25 = 154$.
2. What is the $MRS_{cc'}$ between point A and B for indifference curve, I_0 ?

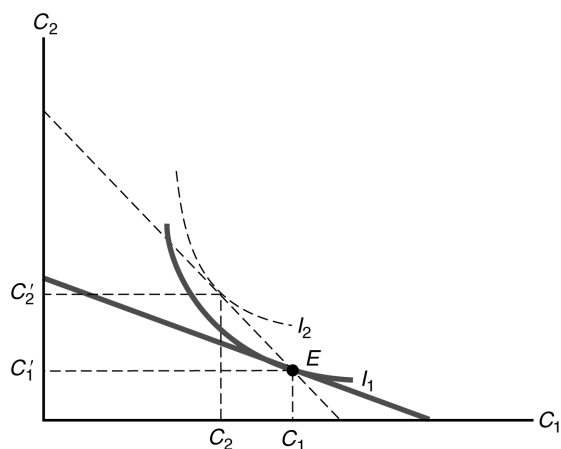


The indifference curve indicates that a consumer is just as happy (derives the same utility) from consuming 9 units next period and 4 units currently as from 7 units next period and 5 units this period. Thus, the person could give up 2 units of future consumption to obtain 1 more unit of current consumption and be just as happy. The marginal rate of substitution is $2/1$ or 2 . This also means that the slope of the indifference curve over that range equals -2 .

3. The effect of a decrease in the real interest rate on current-period consumption for a lender whose income effect outweighs the substitution effect is shown in the graph below. Note that current consumption falls from c_1 to c_2 . The substitution effect is given by $c_s - c_1$ while the income effect is given by $-(c_s - c_2)$. The total effect on current consumption is the sum of both effects $= c_s - c_1 + -(c_s - c_2) = c_2 - c_1 < 0$.



4. First assume $t' = 0$. With the endowment point E , note that there is no way of drawing a higher indifference curve that is to the right of C_1 nor below C_1' . This proves future consumption must increase and current consumption must decrease with the increase in r .



5. Because present values matter for Ricardian Equivalence, the theorem will hold for $\Delta t = -2$ and $\Delta t' = 2$, if, and only if, the real interest rate is zero.

6. Assume an economy with 100 identical consumers. In the current period, each receives income of 8 units and pays taxes of 3 units, while in the future period, each receives income of 10 units and pays taxes of 4.75 units. The government purchases 400 units in the current period and 370 in the future period and borrows $B = 100$ in the current period. The real interest rate is 5 percent.

(a) The lifetime wealth of each consumer is $8 - 3 + \frac{(10 - 4.75)}{1.05} = 10$.

(b) The government's present-value budget constraint is $G + \frac{G'}{(1+r)} = T + \frac{T'}{(1+r)}$ or $400 + \frac{370}{(1.05)} = 300 + \frac{475}{(1.05)}$, which holds.

(c) Aggregate private saving, $S^p = 100$ and government saving, $S^g = -100$. Thus aggregate current period consumption $= (y - t - s) * 100 = (8 - 3 - 1) * 100 = 400$.

(d) If current period taxes are increased to 4 units in the current period and decreased to 3.7 units in the future, lifetime wealth can be shown to remain constant and thus aggregate consumption remains constant. Aggregate private saving $= (y - t - c) * 100 = (8 - 4 - 4) * 100 = 0$ and government saving is just the negative of that, 0. Thus consumers do not save but consume all their income available in each period.

7. $G + \frac{G'}{(1+r^*)} = T^* + \frac{T'^*}{(1+r^*)}$ and $G + \frac{G'}{(1+r^*)} = T^{**} + \frac{T'^{**}}{(1+r^*)}$

$$T^* + \frac{T'^*}{(1+r^*)} = T^{**} + \frac{T'^{**}}{(1+r^*)}$$

$$T^* + \frac{T'^*}{(1+r^*)} = T^* + m\Delta t + \frac{T'^{**}}{(1+r^*)}$$

$$T'^* = m\Delta t(1+r^*) + T'^{**}$$

$$T'^{**} = T'^* - m\Delta t(1+r)$$

8. (a) $c' = y - s$

$$c' = y' + s(1+r)$$

$$c' = y' + (y - c)(1+r)$$

(b) $c' = 0$

$$0 = y' + (y - c)(1+r)$$

$$c_{MAX} = \frac{y'}{(1+r)} + y$$

(c) $c = 0$

$$c' = y' + (y - 0)(1+r)$$

$$c'_{MAX} = y' + y(1+r)$$

$$(d) \quad c^{ss} = y - \frac{b}{1+n} - s$$

$$c'^{ss} = y' + b + s(1+r)$$

$$c'^{ss} = y' + b + (y - c)(1+r)$$

$$c_{MAX}^{ss} = \frac{y' + b}{(1+r)} + y - \frac{b}{1+n}$$

$$c'^{ss}_{MAX} = y' + b + \left(y - \frac{b}{1+n} \right) (1+r)$$

(e) If the budget line shifts in, $c_{MAX} > c_{MAX}^{ss}$

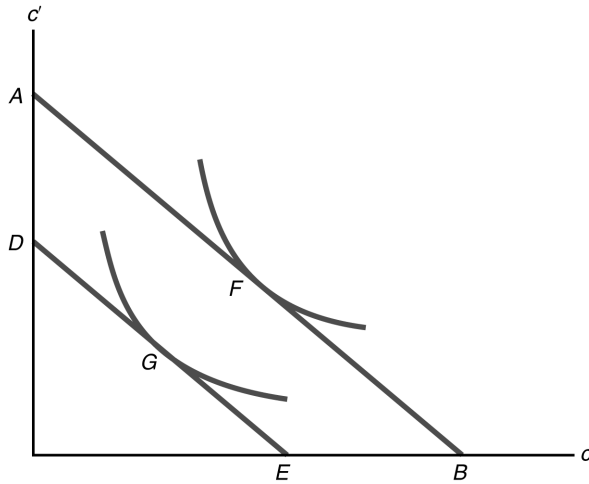
$$\text{or } \frac{y'}{(1+r)} + y > \frac{y' + b}{(1+r)} + y - \frac{b}{1+n}.$$

The inequality can be reduced through algebraic manipulation to

$$\frac{b}{1+n} > \frac{b}{(1+r)} \quad \text{or} \quad r > n.$$

The condition may also be proven using $c'_{MAX} > c'^{ss}_{MAX}$.

- (f) The pre-social security budget constraint is given by line AB in the graph below with an optimal consumption point of F . The line DE represents the budget line post-social security with an optimal consumption point of G . Because point F is associated with a higher indifference curve than G , the consumer is worse-off with the social security system when $r > n$.



Chapter 9

A Real Intertemporal Model with Investment

■ Overview

This chapter adds a firm problem to the intertemporal consumer problem of Chapter 8 to construct a complete dynamic competitive equilibrium model. The model is then used to explain a variety of issues observed in the data in Section I of the text. The representative firm now maximizes profits by choosing the amount of capital and labor to use in the production of the consumption good. At an optimum for the firm, the marginal product of capital equals the cost to rent capital (the real interest rate). Further, the firm demands less capital as the interest rate rises, while consumers generally save more when interest rates rise as they substitute away from more expensive present consumption and toward less-expensive future consumption.

In a competitive equilibrium, the real wage equates labor supply and labor demand; the real interest rate equates aggregate savings and investment; and the supply of the consumption good equals the demand for the consumption good. Importantly, this dynamic model now includes a market for capital: Consumers who want to save supply capital (net income less consumption), and firms demand capital for use in production. The chapter then ran five experiments using this model: i) an increase in present government purchases; ii) an increase in present and future government purchases; iii) a decrease in the capital stock; iv) a rise in current total factor productivity; and v) an increase in expected future total factor productivity. For each scenario, the effect on the economy is determined by examining the equilibrium in all markets (i.e. by characterizing how consumers' and firms' choices change). In each case, the model predicts the reaction of interest rates, wages, current and future consumption, savings, investment, and employment. Thus, this intertemporal model provides a rich set of predictions from which economic data can be understood.

■ True and False

- _____ 1. A firm will invest more the higher its expected future total factor productivity, the lower its current capital stock, and the lower the real interest rate.
- _____ 2. The price of current leisure relative to future leisure is represented by $\frac{w(1+r)}{w'}$.
- _____ 3. If w and w' are held constant, a decrease in the real interest rate results in an increase in the price of current leisure relative to future leisure.
- _____ 4. Assume the real interest rate increases. If the income effect dominates the substitution effect, current consumption for lenders will fall.
- _____ 5. Current leisure will increase when the real interest rate decreases if the income effect dominates the substitution effect.
- _____ 6. An increase in the present value of taxes results in an increase in current labor supply.

- _____ 7. The slope of the demand curve, $C^d(r)$, is the marginal propensity to save.
- _____ 8. The labor demand curve is downward sloping because hiring more labor increases total productivity.
- _____ 9. As N increases, both total and marginal productivity rise.
- _____ 10. Shifts in the labor demand curve are caused by changes in total factor productivity and the current capital stock.
- _____ 11. Movements along the labor demand curve are caused by changes in real wages.
- _____ 12. If capital fully depreciates every period (depreciation = 100%), the marginal benefit from investment will be $\frac{MP'_k}{(1+r)}$.
- _____ 13. An increase in wealth increases labor demand because laborers demand less money.
- _____ 14. The optimal investment schedule is the firm's net marginal product of capital.
- _____ 15. A decrease in productivity causes a change in N^s because workers must supply more labor to produce any given Y .
- _____ 16. A decrease in future government expenditures, G' , leads to a decrease in the labor supply and output.
- _____ 17. An increase in future income Y' shifts the Y^d curve to the left.
- _____ 18. An increase in total factor productivity, z' causes the Y^d curve to shift to the right.
- _____ 19. A decrease in the current capital stock K causes the Y^d curve to shift to the right.
- _____ 20. A permanent increase in government purchases has the same crowding-out effects on current macroeconomic activity as a temporary increase in government purchases.
- _____ 21. A permanent increase in G results in an increase in current consumption expenditure when the intertemporal substitution effect is positive on consumption and leisure.
- _____ 22. When r decreases, Y increases because savings increases, investment increases, and therefore current capital increases, K .
- _____ 23. Milton Friedman argued that the marginal propensity to consume out of temporary income is greater than the marginal propensity to consume out of permanent income.
- _____ 24. Milton Friedman argued that the marginal propensity to consume out of permanent income is equal to one.
- _____ 25. If the marginal propensity to consume out of permanent income is less than one, a permanent increase in G will result in an increase in output demand.
- _____ 26. The output demand effect is larger with a temporary increase in government purchases, while the output supply effect is larger with a permanent increase.

■ Short Answer

1. Name three factors that determine the representative consumer's current supply of labor and how each factor affects supply.
2. How do the three factors listed above affect the representative consumer's supply of labor?
3. Explain what is meant by *diminishing marginal productivity of labor*.
4. Explain the following true statement: *A change in preferences affects labor supply while a change in technology affects labor demand*.
5. An increase in the real interest rate, holding current and future wages constant, results in an increase in the price of current leisure relative to future leisure. Is this statement true or false? Explain.
6. What is the slope of the individual demands for investment goods and government purchases in the current goods market diagram?
7. How does the analysis of the government change if G is purely transfers and there are no bureaucratic costs?
8. What is the flaw in the following statement? "If the real interest rate rises, lifetime wealth declines, causing leisure to decline, labor supply to rise thereby causing a leftward shift in output supply."
9. How is output demand affected by a permanent increase in G ?
10. How do the effects of an increase in G differ between the single-period model and the intertemporal multi-period model?
11. How do the effects on investment expenditure differ between permanent increases in government spending and temporary increases in government spending?
12. If the nominal interest rate is 4.5 percent and inflation is 5 percent, what is the real interest rate?

■ Graphic/Numeric

1. Show changes in optimal investment schedule for decrease in z' and r .
2. Prove graphically that the interest rate must fall with increases in G when $MPC = 1$.

■ Answers

True and False

1. True.
2. True.
3. False. A decrease in the real interest rate results in a decrease in the price.
4. False. The increase in the real interest rate will increase current consumption if the income effect > substitution effect because the total effect on current consumption = substitution effect + income effect. Because income effect is positive and substitution effect is negative, total effect > 0.

5. False. Current leisure will decrease when the real interest rate decreases if income effects dominate the substitution effects.
6. True.
7. False. The slope is the marginal propensity to consume.
8. False. The labor demand curve is downward sloping because hiring more labor decreases marginal productivity.
9. False. Total productivity rises and marginal productivity falls with increases in N .
10. True.
11. True.
12. True.
13. False.
14. True.
15. False.
16. True.
17. False. It shifts to the right.
18. True.
19. True.
20. False.
21. True.
22. False. Future capital, K' increases.
23. False. Friedman argued that the marginal propensity to consume out of permanent income is greater than the marginal propensity to consume out of temporary income.
24. True.
25. True.
26. True.

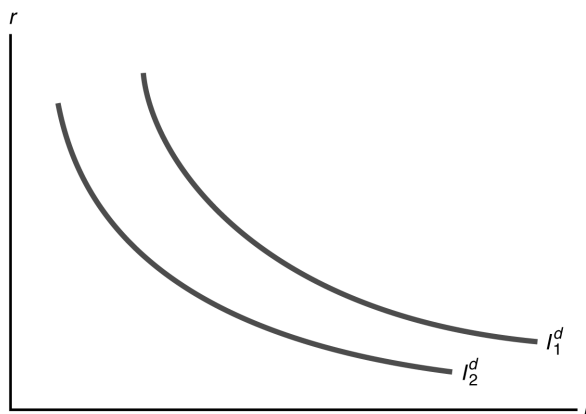
Short Answer

1. The real wage, the real interest rate, and lifetime wealth.
2. Assuming that substitution effects outweigh the income effects: 1) An increase (decrease) in the real wage increases (decreases) the opportunity cost of leisure and causes an increase labor supply; 2) an increase (decrease) in the real interest rate increases (decreases) labor supply; and 3) an increase (decrease) in lifetime wealth increases the quantity of leisure in the current and future periods and causes a decrease in labor supply.

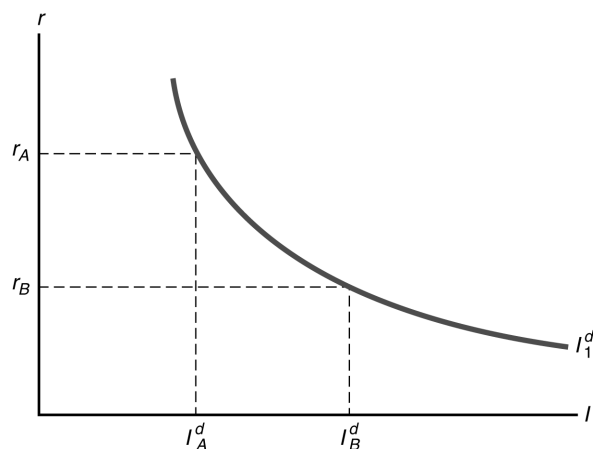
3. Marginal productivity of labor refers to the additional output brought forth by hiring one more laborer and holding all other inputs constant. It is assumed to diminish (after a point) as each additional laborer brings a smaller increase to firm output, as other inputs remain constant.
4. A change in preferences affects utility because leisure is a component of utility and changes in preferences for leisure affect the labor-leisure decision. This, in turn, affects the labor supply. Labor demand is the derived demand for labor by firms. This demand is a function of the marginal product of labor, which is determined by technology. Hence, technology affects labor demand.
5. The statement is true. An increase in r means that the return on income (or wages) earned in the current period will be higher than before the r increase. Consuming leisure implies forgoing this return. As the return rises, so does the cost of current leisure.
6. The slopes are both equal to zero as neither is a function of Y .
7. Government expenditures in this case are a wash and there is no affect from increased G .
8. The flaw is confusing a movement along a curve with a shift in a curve. The change in interest rates causes a movement along, not a shift in, output supply.
9. A permanent increase in G causes a negative effect on current consumption demand which is roughly offset by an increase in government purchases. Thus output demand remains unchanged.
10. An increase in G in the single-period model causes a reduction in only consumption expenditure. An increase in G in the intertemporal multi-period model causes an increase in r and a reduction in both consumption expenditure and private investment expenditure.
11. A temporary increase in government spending will lead to larger rightward shift in output demand than output supply. The real interest rate rises and investment falls. A permanent increase in government spending leads to a rightward shift in output supply but not output demand due to crowding out of ΔC^d equal to the ΔG . The real interest rate falls inducing an increase in investment expenditures.
12. The real interest rate = nominal interest rate – inflation. In this case, the real interest rate = $4.5\% - 5\% = -0.5\%$.

Graphic/Numeric

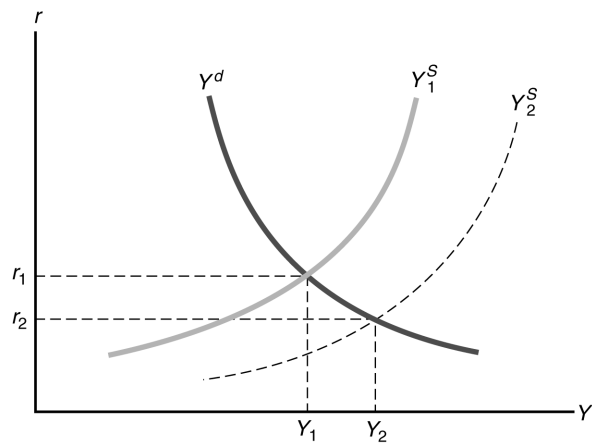
1. A decrease in z' will cause a decrease in investment shifting the optimal investment schedule to the left from I_1^d to I_2^d as shown in the graph below.



A decrease in r , say from r_A to r_B , will cause an increase in the quantity invested as represented by a movement southeast along the optimal investment schedule from I_A^d to I_B^d as shown in the graph below.



2. Because $MPC = 1$, the increase in G is exactly offset by the decrease in C^d caused by the decrease in lifetime wealth. Thus the Y^d curve does not move. The Y^s curve, on the other hand, shifts to the right from Y_1^s to Y_2^s as the decrease in lifetime wealth causes an increase in the current labor supply. Thus, the real interest rate must fall as it does below from r_1 to r_2 .



Chapter 10

A Monetary Intertemporal Model: The Neutrality of Money

■ Overview

Money has three roles: a store of value, a medium of exchange, and a unit of account. The most important role for money today is as a medium of exchange. This chapter discusses various measures of money in the economy and how the money supply is determined by the Federal Reserve. Then, the intertemporal model of Chapter 7 is modified to include money. This was done by adding a *cash-in-advance constraint* where some goods in the economy can only be purchased with cash held over from the previous period. Thus, this model takes into account the use of money as a medium of exchange. This model predicts that money is *neutral* in that a change in the stock of money in the economy has no effect on real variables, only changing prices.

■ True and False

- _____ 1. Assuming a positive interest rate, the demand for current money, in real terms, is identical to the demand for current goods.
- _____ 2. The demand for current money, in real terms, is identical to the demand for future goods.
- _____ 3. Money is held in the monetary intertemporal model because consumers do not like to put all their purchases on credit cards.
- _____ 4. Money is held in the monetary intertemporal model because it is needed to buy some goods that have to be purchased immediately.
- _____ 5. When R increases, the opportunity cost of holding money decreases, and the demand for future goods may either increase or decrease.
- _____ 6. An increase in $\bar{r}$ will shift the current labor supply curve to the left.
- _____ 7. A decrease in $\bar{i}$ will shift the current labor supply curve to the left.
- _____ 8. Seigniorage refers to the process when the government increases taxes on the elderly.

- _____ 9. Money neutrality implies that a one-time increase in the money supply will lead only to a temporary increase in prices, which then quickly fall back to their previous levels.
- _____ 10. The demand for money is altered by factors that change the costs of making transactions and change what can be used as a medium of exchange.
- _____ 11. An increase in the demand for goods that are purchased with cash will shift the money demand curve to the right.
- _____ 12. A discovery of large, non-depleted gold mines throughout the country would cause the money demand curve to shift to the right.
- _____ 13. A government decree effectively banning all new exploration of gold would cause the money demand curve to shift to the right.
- _____ 14. If there were a temporary increase in z under perfect information, the real wage w would increase and the current price level P would fall.

■ Short Answer

1. What is meant by the “double coincidence of wants” and how does it explain the use of money?
2. Under what conditions is the real interest rate, $r = R - i$?
3. Optimality dictates that money not be held as a pure store of value. Why?
4. Describe the roles played by the government in the monetary intertemporal model.
5. Why would economists expect a significant decrease in the stock market to increase the demand for money?
6. Explain why a positive relationship is predicted between the velocity of M1 and the nominal interest rate.
7. Name two key elements of monetarism.
8. In what way does the supply of output depend on the real interest rate r ?
9. The economic recovery after the 2001 recession had both high productivity and concerns of deflation. Does this conform to the theoretical model presented in this chapter?
10. The economic recovery after the 2001 recession had both high productivity and low employment. Does this conform to the theoretical model presented in this chapter?

■ Graphic/Numeric

1. Prove $R > 0$ implies $r^m < r$ using $1 + r = \frac{(1 + R)}{(1 + i)}$ and $1 + r^m = \frac{1}{(1 + i)}$.

■ Answers

True/False

1. False. Current money demand is related to next-period purchases.
2. True.
3. False.
4. True.
5. False.
6. True.
7. False.
8. False.
9. False.
10. False.
11. True.
12. False. To the left.
13. True.
14. False. Gold becomes a less inflation-prone asset.
15. True.

Short Answer

1. The “double coincidence of wants” refers to the need to find two traders with the same wants in order to effect a trade in a barter system. The double coincidence can be avoided with the use of money as a medium of exchange.
2. When iR is sufficiently small.
3. The opportunity cost of money is not zero, so every dollar held is a dollar not invested for a positive return.
4. Provides monetary (determines supply of money) and fiscal policy (taxes and spends).
5. Holding stocks becomes less desirable as it ceases to be a good *store of value* relative to money.
6. $V = Y/L(Y, R)$ and L is negatively related to R .
7. Money supply is thought of as the key measure of the level of aggregate economic activity and the money supply is the key indicator of monetary policy.

8. The supply of output depends on the real interest rate r because r affects the household's labor supply function through an intertemporal substitution of leisure. If the current real interest rate increases, the current labor supply curve will shift to the right thereby increasing current output. If the previous period's real interest rate increases, the current labor supply shifts to the left because of substitution between current leisure and current cash goods.
9. High productivity and low prices (i.e., concerns of deflation) conform to the theoretical model. High productivity leads to high output and causes money demand to shift to the right. This causes the price level to fall.
10. High productivity and low employment do not conform to the model. Higher productivity should increase labor demand and hence, employment.

Graphic/Numeric

1. $1 + r^m i + r^m + i = 1$ and $1 + ri + r + i = 1 + R$ or $r^m(1 + i) + i = 0$ and $r(1 + i) + i = R$. If $R > 0$ then $r(1 + i) + i > r^m(1 + i) + i$ or $r > r^m$.

Chapter 11

Market-Clearing Models of the Business Cycle

■ Overview

Three equilibrium models of business cycles are presented in this chapter and their implications are compared to the data. These models are: i) the Friedman-Lucas money surprise model; ii) the real business cycle model; and iii) the Keynesian coordination failure model. In (i), due to a lack of information, consumers do not know if price changes are occurring because of a change in market conditions (a shift in supply or demand) or due to a change in the money supply. As a result, a money supply increase has real effects, e.g. raising real wages and inducing greater labor supply. Thus, money is not neutral in this model. The model's predictions do not fit the business cycle data in several important ways, and therefore this may not be the best model upon which to base policy.

In model (ii), variations in economic aggregates are directly and indirectly caused by variations in total factor productivity. The predictions from this model fit almost all the business cycle data (though problems with the measurement of the Solow residual call this into question) and indicate that there is no role for government policy to counteract business cycles (unlike in model (i)) since all choices by consumers and firms are optimal.

Model (iii) is based on the notion of *strategic complementarities* (doing what others do) in production that produce aggregate increasing returns to scale. In this model, the particular strategic complementarity is waves of optimism or pessimism about the economy that are mutually reinforcing (these are called these “animal spirits” or “sunspots” as they are totally unrelated to economic fundamentals). This model fits the business cycle data as well as model (ii), but produces multiple equilibria with the economy fluctuating between them. The government might be able to affect which equilibrium the economy reaches through monetary or fiscal policy that impacts consumers’ optimism about the economy.

■ True and False

- _____ 1. Keynesians believed that monetary policy was the optimal tool for fine-tuning the economy.
- _____ 2. Both monetarists and Keynesians believed in the non-neutrality of money.
- _____ 3. Even with markets clearing, the level of the money supply can have real effects on the economy in the Friedman-Lucas model.
- _____ 4. The optimal central bank policy in the Friedman-Lucas model is to shock the economy when necessary with changes in the money supply.
- _____ 5. Workers care about the nominal wage and not the real wage in the Friedman-Lucas model.
- _____ 6. If workers could observe all variables in the economy, a permanent increase in the level of the money supply would have no real effects in the economy.

- _____ 7. In the Friedman-Lucas model, an increase in the nominal money supply in the short run will cause real output and employment to rise and the real interest rate and real wage to fall.
- _____ 8. Because money is non-neutral in the Friedman-Lucas model, it is not a market clearing model.
- _____ 9. In an environment with imperfect information about economic variables, the optimal central bank policy is to let the money supply grow at a constant rate over time.
- _____ 10. Though policy implications are similar, the Keynesian sticky wage model and the Friedman-Lucas model differ in their short-run predictions.
- _____ 11. According to the Friedman-Lucas model, the price level is procyclical and real wages are countercyclical, which is inconsistent with empirical data.
- _____ 12. The key insight from the Friedman-Lucas model is that the economy functions less efficiently when the behavior of policy makers is not well understood, or when policy decisions are difficult to predict.
- _____ 13. A decrease in the interest rate will cause a rightward shift in output demand as firms increase investment and workers increase employment.
- _____ 14. The one feature of the empirical data that the real business cycle fails to replicate is the procyclicality of the money supply.
- _____ 15. In the real business cycle model, money surprises only cause a proportionate increase in the price level and have no effect on real variables.
- _____ 16. The real business cycle model implies that government should vary its expenditures in response to changes in total factor productivity.
- _____ 17. The real business cycle model implies that the long-run role of the government is to provide public goods.
- _____ 18. Labor hoarding refers to the practice of keeping workers during recessions but underutilizing them.
- _____ 19. Whereas the real business cycle and Friedman-Lucas model assume constant returns to scale technology in each firm and the overall economy, the Keynesian coordination failure model assumes increasing returns to scale for the overall economy.
- _____ 20. Increasing returns to scale technology results in convex aggregate production functions and an upward-sloping labor demand curve.
- _____ 21. The coordination failure theory requires that the labor supply curve have a greater slope than labor demand curve.
- _____ 22. A sunspot is an extraneous event that causes changes in real variables.
- _____ 23. The coordination failure model can explain why the money supply is procyclical with the money supply being neutral.
- _____ 24. Stating that the money supply is a sunspot variable implies a change in it causes a change in aggregate output.

- _____ 25. Though the real business cycle and coordination failure models are similar in their results, the coordination failure model implies an active role for government in controlling business cycles.
- _____ 26. The coordination failure model implies that the government can, in principle, bump the economy from a bad equilibrium to a good one and vice versa.
- _____ 27. The key insight from the coordination failure model is that optimism and pessimism about the economy can lead to business cycles.
- _____ 28. The coordination failure thesis can be used even if the models contain constant returns to scale production.

■ Short Answer

1. Milton Friedman, perhaps the most famous monetarist, in the 1960s claimed in the 1960s that macroeconomists “are all Keynesians now.” In what sense was that true?
2. Name two principles of monetarism.
3. Name two principles of Keynesianism.
4. Name two microeconomic principles on which rational expectations models are based.
5. Explain the mechanism by which increases in the money supply “fool” workers into increasing labor supply in the Friedman-Lucas model.
6. Explain why there is a *shift* rather than a *movement along* the labor supply curve when the money supply changes in the Friedman-Lucas model.
7. Why must the price level rise less than proportionally to an increase in the money supply in the Friedman-Lucas model?
8. In what sense is the Friedman-Lucas model not Pareto optimal?
9. What arguments can be made against the Friedman-Lucas model?
10. What evidence is there that productivity shocks have the potential to explain business cycles?
11. Name two factors that decrease total factor productivity, z .
12. Describe two ways in which endogenous money in the real business cycle model can explain the procyclicality of money supply.
13. Describe two ways in which endogenous money in the real business cycle model can explain how money supply is a leading indicator of business cycles.
14. How well does the Keynesian sticky-price model work in explaining the Great Depression?
15. How well does the real business cycle model work in explaining the Great Depression?
16. Under what conditions is it efficient for government to intervene on a cyclical basis in the real business cycle model? In what sense is the coordination failure model a model of self-fulfilling prophecies?
17. How can the coordination failure model explain why the money supply is procyclical?

18. Explain how money can be neutral yet appear to cause business cycles.
19. How does stock market behavior support the coordination failure hypothesis?
20. Name two potential weaknesses of the coordination failure model.

■ Graphic/Numeric

1. Explain and illustrate how a decrease in z and z' affects the economy using output supply and demand, labor supply and demand, and money supply and demand.
2. Derive the output supply curve, Y^s for the Keynesian coordination failure model when the labor demand curve is flatter than the labor supply.

■ Answers

True and False

1. False. Monetarists believed this.
2. True.
3. True.
4. False. Optimal policy is to make money supply predictable.
5. False. They only care about the real wage but don't have perfect information about it.
6. True.
7. True.
8. False.
9. True.
10. False. Their policy implications are different but their short-run predictions are similar.
11. True.
12. True.
13. False. It will cause a movement along the output demand curve.
14. True.
15. True.
16. False.
17. True.
18. True.
19. True.

20. True.
21. False. The coordination failure theory requires that labor demand have a greater slope than labor supply.
22. True.
23. True.
24. True.
25. True.
26. True.
27. True.
28. False.

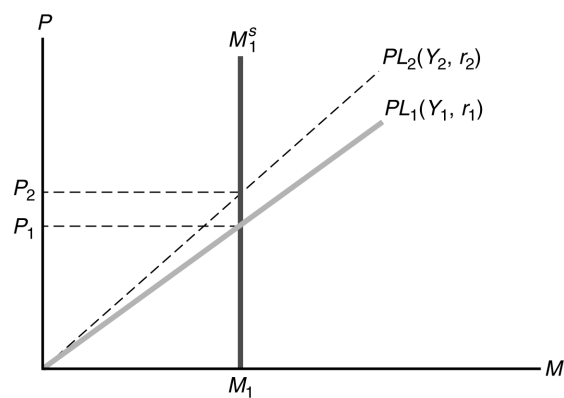
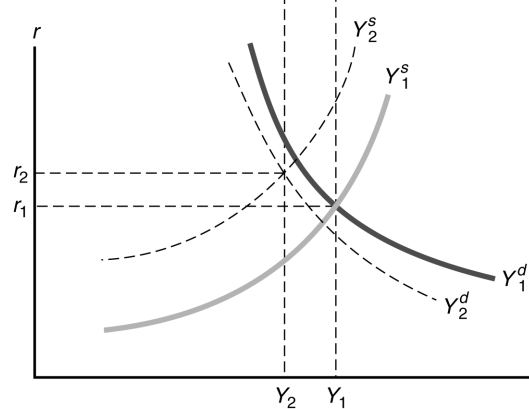
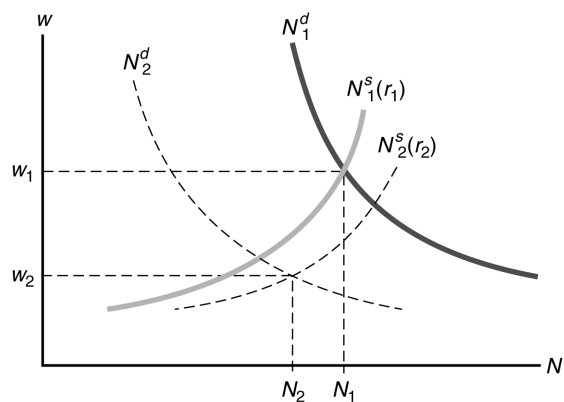
Short Answer

1. All macroeconomists used the Keynesian model.
2. Monetary policy is a more effective stabilization tool than fiscal policy; 2) skeptical of government policy for fine-tuning economy; 3) policy may only be effective in very short run.
3. Fiscal policy is a more effective stabilization tool than monetary policy; 2) government should use policy to fine-tuning economy; 3) policy may only be effective in very short run.
4. 1) Models grounded on descriptions of preferences, endowments and technology and consumer and firm optimization; 2) equilibrium models are most productive for studying macro phenomenon.
5. Workers are uninformed about the real wage and perceive nominal wage changes as real wage changes because they don't have perfect information about prices and the money supply.
6. Because the real wage w is on the vertical axis and the "fooling" of workers means they are willing to supply more labor than previously at any given real wage.
7. If it rose as much or more, real money demand M/P would fall, which cannot be the case when income rises and the interest rate falls—it would invalidate the Friedman-Lucas model.
8. Market prices are signals that carry important information to market participants about how to allocate scarce resources. The imperfect information in the Friedman-Lucas model leads to a misallocation of resources as workers supply a nonoptimal amount of labor, etc.
9. Countercyclical real wage, countercyclical average labor productivity and procyclical price. Information is available on prices and money supply and Federal Reserve is very open about its activities (i.e. no money surprise).
10. Detrended Solow residual closely tracks detrended real GDP.
11. Bad weather, increased government regulation, and increases in the relative price of energy.
12. 1) When Y increases, loans increase with deposits. Loans result in an increase in the money supply.
2) Central bankers who wish to hold prices constant must change the money supply to accomplish price stability.

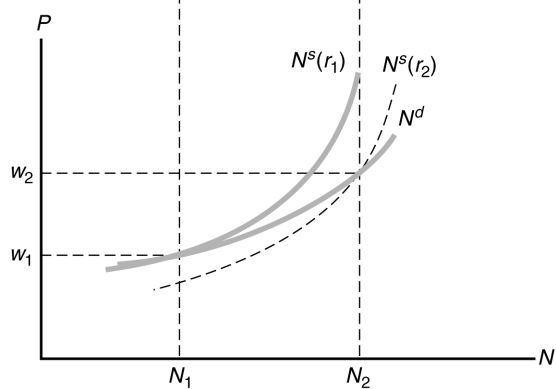
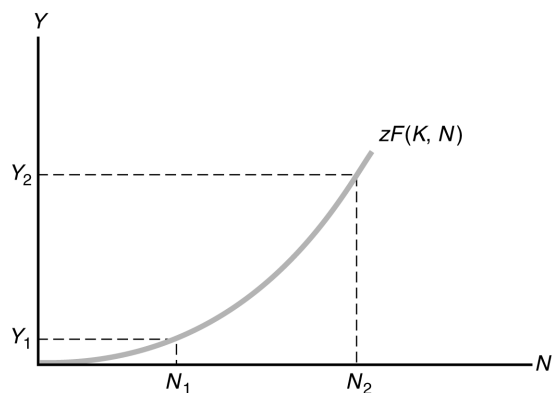
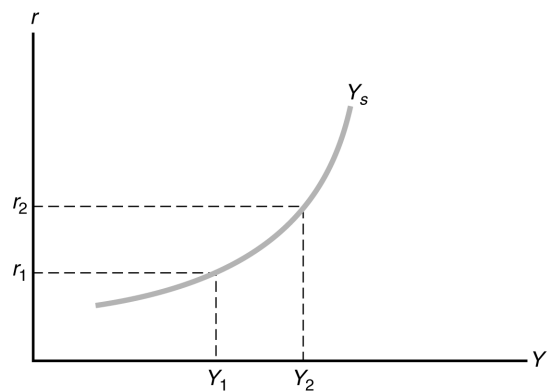
13. 1) Banking sector has been shown to be a leading indicator and banks provide loans for real activity that occurs at a later date. 2) Monetary policy has a lag and central bankers who wish to hold prices constant must change the money supply to accommodate it before the change in output.
14. The Keynesian model fails in that the real wage fell, except for in manufacturing, during the depression. The theory predicted nominal wages would remain sticky while the price level fell, thereby causing the real wage to rise.
15. The real business cycle explains the period from 1929 to 1933 fairly well but not thereafter. The theory predicts a faster recovery than actually occurred.
16. To smooth tax distortions in the face of distorting taxes and possibly market failures.
17. Optimism leads to good coordinated result; pessimism leads to bad coordinated result.
18. The coordination failure model explains nominal procyclical money supply behavior by appealing to self-fulfilling expectations. When people observe a high money supply, they are optimistic and when they observe a low money supply, they are pessimistic. Optimism leads to the good economic equilibrium and pessimism leads to the bad economic equilibrium.
19. The coordination failure model explains how the nominal money supply can appear to be procyclical but actually be neutral. Self-fulfilling expectations lead to this result as explained in the previous question.
20. The coordination failure hypothesis explains how economies can go from good to bad equilibria by expecting the results. The stock market has wide swings that seem to follow the predictions of the coordination failure hypothesis.
21. Aggregate production may be constant returns to scale. Expectations are essentially unobservable.

Graphic/Numeric

1. The decrease in z and z' decreases MP_N causing N^d to shift leftward from N_1^d to N_2^d and shifts the output supply curve leftward from Y_1^s to Y_2^s . Both effects are shown below. Firms will decrease their demand for investment goods due to the decrease in MP_K . Consumers anticipate lower future income, so that lifetime wealth decreases along with the demand for consumption goods. These last two factors imply that the output demand curve, Y^d will shift leftward from Y_1^d to Y_2^d . Assuming that the direct effect of the decrease in current total factor productivity, TFP on the supply of goods is larger than the effects of anticipated decrease in future TFP on the demand for goods, output supply will shift by more than output demand. As a result, the real interest rate will rise from r_1 to r_2 . At r_2 laborers substitute toward more work and N^s shifts rightward, partially offsetting the move in N^d . In the money market, money demand falls due to the increase in the real interest rate and the decrease in output. Nominal money demand shifts leftward from $PL_1(Y_1, r_1)$ to $PL_2(Y_2, r_2)$ and the price level rises from P_1 to P_2 .



2. The output supply curve, Y^s for the Keynesian coordination failure model when the labor demand curve is flatter than the labor supply, is upward sloping. When r increases the labor supply shifts rightward and because N^d is flatter than N^s employment increases along with the real wage. The increase in employment leads to an increase in aggregate output. Thus the output supply relation is upward sloping as increases in r lead to increases in Y .



Chapter 12

Keynesian Business Cycle Theory: The Sticky Wage Model

■ Overview

This chapter presents a Keynesian business cycle model that assumes that wages are *sticky* (they do not respond to changes in the supply and demand for labor in the short run). Because wages do not adjust to labor market conditions, unemployment occurs. The analysis of this model uses the IS-LM diagram, where the IS curve plots output demand, and the LM curve plots the money-market equilibrium. Taxes, future income, the capital stock, and total factor productivity shift the IS curve, while money supply, money demand, and prices shift the LM curve.

Money is not neutral in this model. An increase in money supply growth causes real interest rates to fall and output to rise. This prediction is inconsistent with the data and therefore the model's usefulness is questionable. The model also lacks the microeconomic foundations of consumer and firm decision making. Further, it does not explain why prices are sticky, but simply claims this is the case. Nevertheless, many policy makers still use this model as a guide to policy.

■ True and False

- _____ 1. The main difference between the Keynesian sticky wage model and the classical model is that the nominal wage rate is assumed fixed in the long run.
- _____ 2. The *classical dichotomy* exists in models in which the price level and real variables can be determined separately.
- _____ 3. *Indexation* is less valuable, and therefore less likely, in times of low inflation.
- _____ 4. Though employment is affected by changes in the real interest rate in the Keynesian sticky wage model, unemployment is not.
- _____ 5. A decrease in W will cause the aggregate supply curve to shift to the left.
- _____ 6. An increase in total factor productivity leads to an increase in the aggregate supply curve.
- _____ 7. A decrease in the real interest rate causes the *IS* curve to shift to the right.
- _____ 8. A decrease in the real interest rate causes the investment to increase, which causes the *IS* curve to shift to the right.

- _____ 9. The nominal money supply in the United States is determined entirely by the Federal Reserve.
- _____ 10. If the Federal Reserve adopts a “tight” monetary policy in which the money supply is decreased, the *LM* curve will shift to the left.
- _____ 11. If consumers think their stock market investments have become riskier than previously thought, the *LM* curve will shift to the left.
- _____ 12. The aggregate demand curve is equivalent to the output demand curve and factors that shift the aggregate demand curve shift the output demand curve.
- _____ 13. The Keynesian sticky wage model predicts that employment, consumption, and investment are procyclical while prices and real wages are countercyclical.

■ Short Answer

1. Explain how a model can provide a theory of employment but not unemployment.
2. Contrast how employment is determined in the Keynesian sticky wage model with the classical model.
3. Why does employment and output depend on the price level in the Keynesian sticky wage model?
4. Why does the supply of output not depend on the real interest rate r in the Keynesian sticky wage model?
5. Explain why the money demand curve is downward sloping in the Keynesian sticky wage model in terms of opportunity costs.
6. Due to the rise in computer use in schools, firms believe that workers will be more productive in the near future. Show the effects on the economy.
7. Explain the Keynesian transmission mechanism for a decrease in the money supply.
8. In what ways does the Keynesian sticky wage theory fit the data better in the pre–WWII era than post–WWII era?
9. Given what you’ve learned about stabilization policy, explain the economics behind Keynes’s famous response to classical economists, “In the long run we’re all dead.”
10. Under what conditions is stabilization policy the best approach to downturns in aggregate output?
11. How effective will be stabilization policy if significant delays on data and the effects of Keynesian monetary mechanism exist?

■ Graphic/Numeric

1. Discuss the implications of a decrease in current government spending and a commensurate decrease in lump-sum taxes and graph the results using all relevant plots. Assume $MPC < 1$.
2. Discuss the implications of a decrease in current government spending and a commensurate decrease in lump-sum taxes and graph the results using all relevant plots. Assume $MPC = 1$.
3. How are employment, unemployment, output, real interest rates, and real wages affected if investors believe the stock market is highly undervalued and therefore significantly increase their stock holdings? Assume that the current wage is initially above the market wage. Show the results graphically and explain.
4. Continuing with the question above, assume that the central bank believes investors are “irrationally exuberant.” Demonstrate how Keynesian stabilization policy would be carried out using *monetary* policy to offset the increase in aggregate real output caused by the increase in investor confidence. Show the results graphically and explain.
5. Repeat the stabilization exercise above assuming that the federal government believes investors are “irrationally exuberant.” Demonstrate how Keynesian stabilization policy would be carried out using *fiscal* policy to offset the increase in aggregate real output caused by the increase in investor confidence. Show the results graphically and explain.

■ Answers

True and False

1. False. It is fixed only in the long run.
2. True.
3. True.
4. False. Unemployment is affected by changes in the real interest rate in the Keynesian sticky wage model, employment is not.
5. False.
6. True.
7. False. A decrease in the real interest rate causes a movement to the right *along the curve*.
8. False. A decrease in the real interest rate causes a movement to the right *along the curve*.
9. True.
10. True.

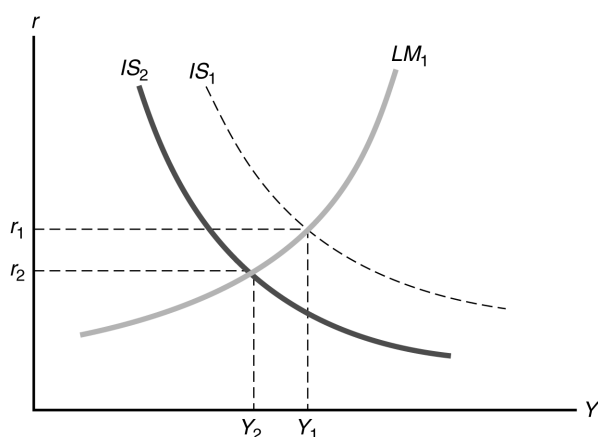
11. True. Money demand will rise as people substitute out of their investments and into cash. The real interest rate must rise to equate the new money demand and money supply and a decrease in LM results.
12. False.
13. True.

Short Answer

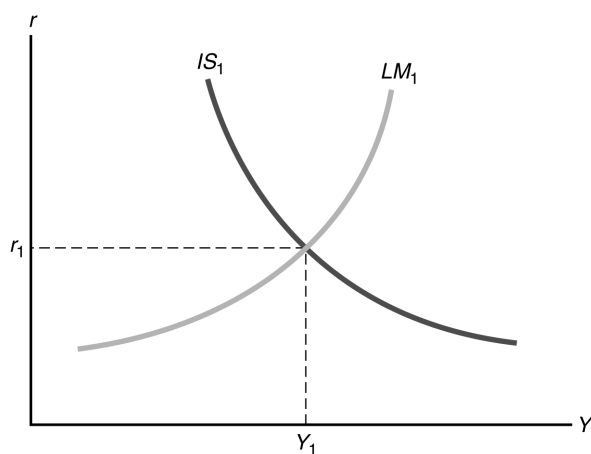
1. A theory that explains unemployment must account for laborers who wish to work at the going wage but cannot find such work. A theory that explains employment explains the quantity of work chosen by those who have jobs. The monetary equilibrium model explains the quantity of employment by assuming the labor market clears and people who wish to work are able to find work at the going wage. Thus, this model explains the quantity of work laborers choose at the going wage. In the Keynesian sticky wage model, on the other hand, it is possible for people who wish to work at the going wage to not find work. The Keynesian sticky wage model therefore explains the amount of employment and the amount of unemployment.
2. In the Keynesian sticky wage model, employment is determined by labor demanded—that is how much the firms wish to hire—at the market real wage. In the classical model, employment is determined by the equilibrium of labor demand and labor supply—that is, how much the firms wish to hire and how much the laborers wish to work.
3. Employment and output depend on the price level in the Keynesian sticky wage model because they both depend upon the real wage, W/P . Because the nominal wage, W , is assumed constant in the short run, changes in the price level change employment and hence output.
4. The supply of output does not depend on the real interest rate r in the Keynesian sticky wage model because only the labor supply curve is affected by r and the labor supply curve is irrelevant for determining N^* and therefore Y^* .
5. Because a decrease in r induces people to demand more money, the opportunity cost of holding money falls.
6. *Ceteris paribus*, firms will wish to increase investment to exploit the increase in worker productivity.
7. First the real interest rate rises to equate money demand with the decreased money supply. The rise in the real interest rate causes a decrease in demand for consumption and investment goods. The decrease in demand for goods lowers the price level, which raises the real wage and decreases employment.
8. Prices appear to have been procyclical.
9. This was a response to classical economists' desire to let the market correct itself.
10. Stabilization policy is the best approach to downturns in aggregate output when private markets fail to clear, information on the economy is available, and policymakers can move quickly in implementing policy.
11. Stabilization policy will not be very effective and may be counter-effective if significant delays exist on both economic data and effects of Keynesian monetary mechanism.

Graphic/Numeric

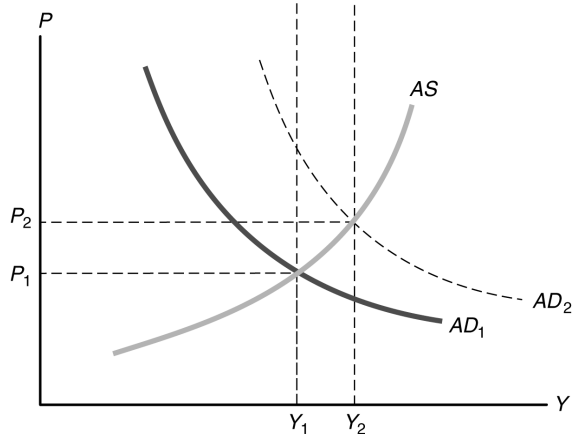
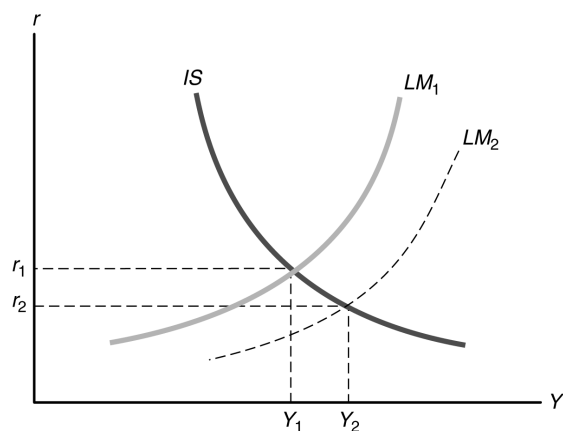
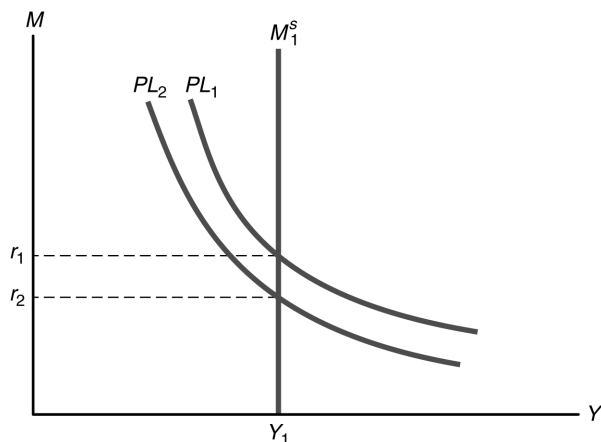
1. The decrease in taxes would increase consumption but by less than one-for-one given the $MPC < 1$. This effect causes the IS curve to shift to the right. Offsetting this effect, however, is the decrease in the demand for government expenditures, which will cause a one-for-one decrease in the demand for current goods. The net effect is for a decrease in the current demand for goods as represented by a leftward shift in the IS curve. This is shown below as a shift from IS_1 to IS_2 causing a decrease in output from Y_1 to Y_2 and a decrease in the real interest rate from r_1 to r_2 .

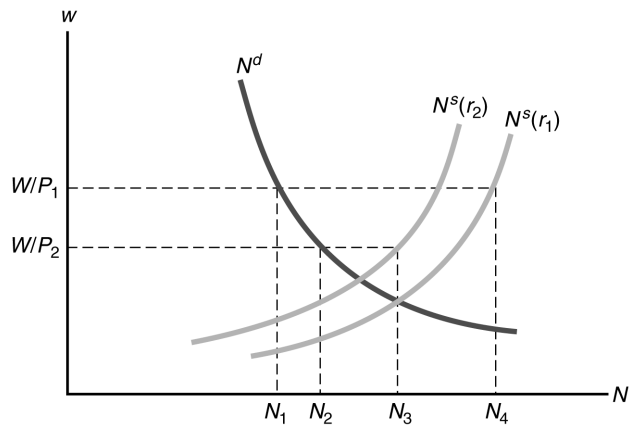


2. Given the $MPC < 1$, the decrease in taxes would increase consumption one-for-one. This effect causes the IS curve to shift to the right. This effect is exactly offset by the decrease in the demand for government expenditures, which causes a one-for-one decrease in the demand for current goods. The net effect is zero meaning the IS curve does not shift. Thus the IS curve remains at IS_1 and output and the real interest rate remain at Y_1 and r_1 .

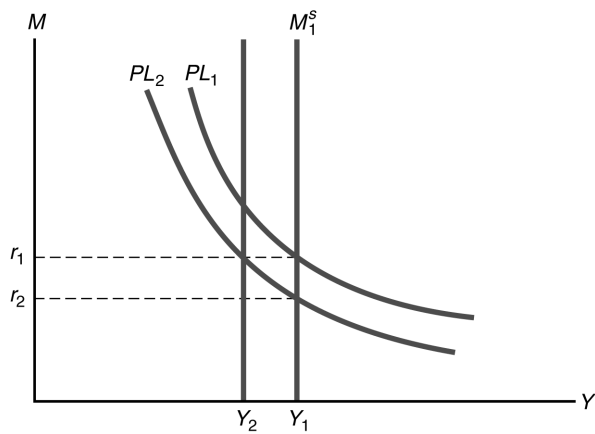


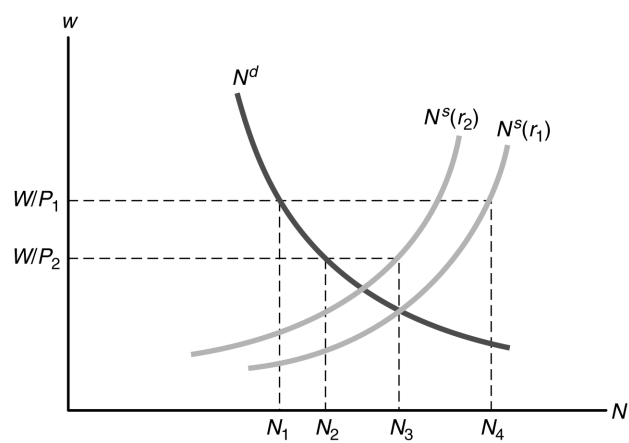
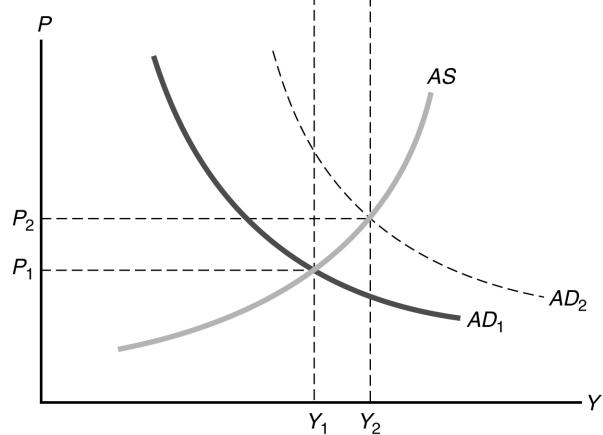
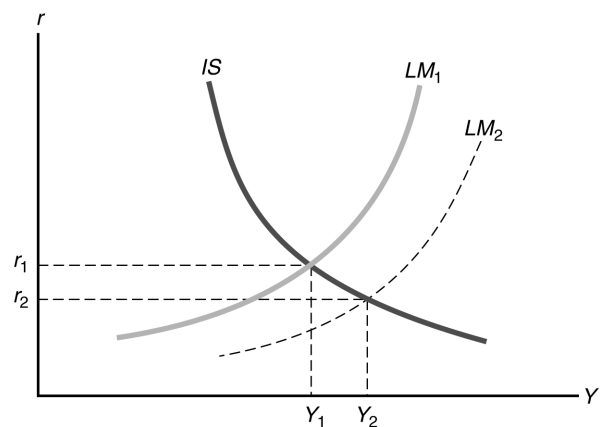
3. Increased investor confidence causes investors to increase their holding investments and decrease their holdings of cash, *ceteris paribus*. Thus the demand for money decreases, which causes a leftward shift in nominal money demand curve as shown below from PL_1 to PL_2 . This movement is represented by a rightward shift in the LM curve from LM_1 to LM_2 . The AD curve shifts from AD_1 to AD_2 with the increase in aggregate demand and causes output to rise from Y_1 to Y_2 and the price level to rise from P_1 to P_2 . Because the nominal wage is sticky at W , the real wage falls with the decrease in P , and employment increases from N_1 to N_2 . Keynesian unemployment is reduced from $N_4 - N_1$ to $N_3 - N_2$. The reduction is caused by both the decrease in the real wage represented by the movement down the labor demand curve and the decrease in the labor supply curve caused by the intertemporal substitution effect of the decrease in interest rates from r_1 to r_2 .



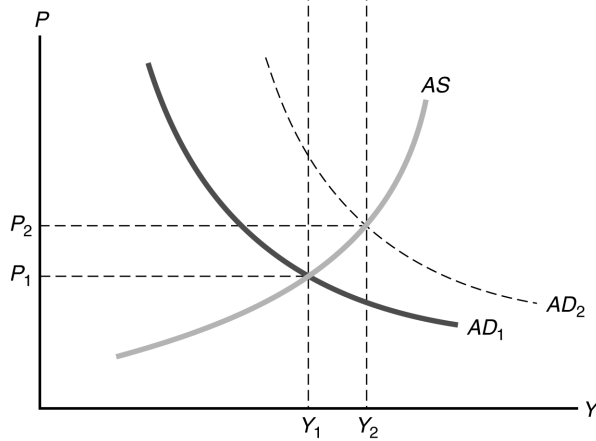
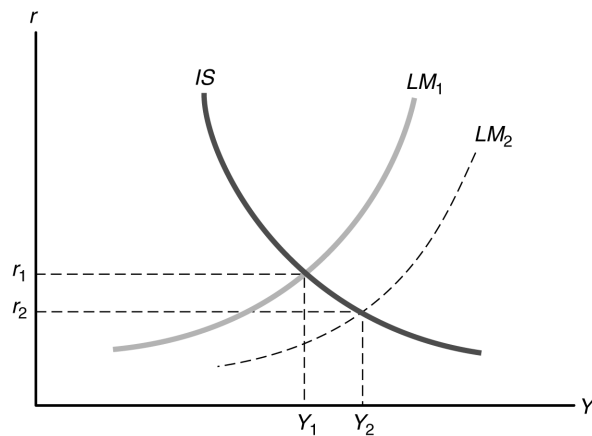
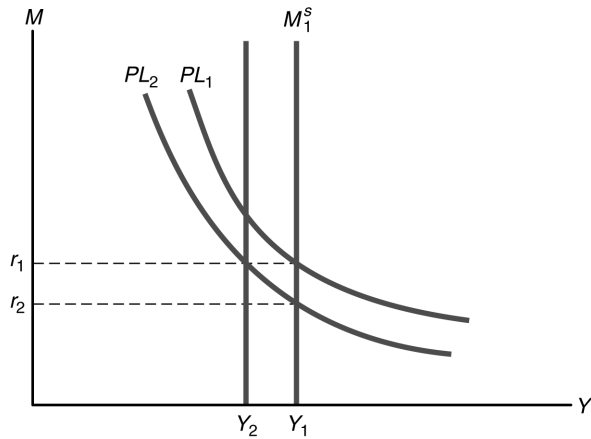


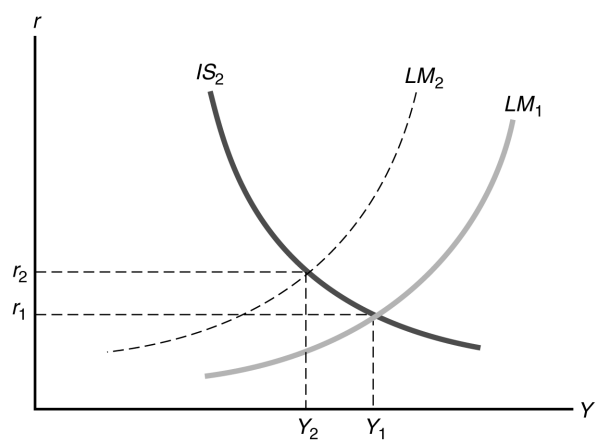
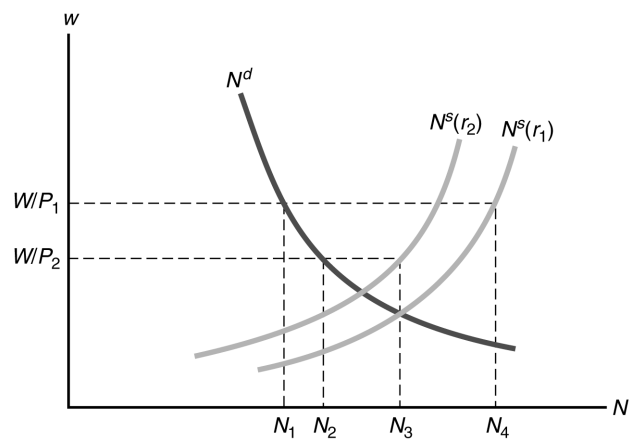
4. To reduce aggregate output to Y_1 , the central bank will have to reduce the money supply to driving up the interest rate from r_2 back to r_1 and thereby shifting back the LM curve from LM_2 to LM_1 as shown below. The reduction in LM decreases AD from AD_2 back to AD_1 and lowers price back down to P_1 .





5. To reduce aggregate output to Y_1 , the federal government will have to reduce the money supply to drive up the interest rate from r_2 back to r_1 and thereby shift back the LM curve from LM_2 to LM_1 as shown below. The reduction in LM decreases AD from AD_2 back to AD_1 and lowers price back down to P_1 .





Chapter 13

International Trade in Goods and Assets

■ Overview

In order to understand the role of international trade, this chapter presents three models of a small, open economy where domestic economic actors are price-takers from the rest of the world. The first model is an application of the static (atemporal) model from Chapter 5 where domestic prices are now set internationally. There are two goods in this model, and the amount traded depends on the *terms of trade* (the price of one good in terms of the other good). In equilibrium, the marginal rate of transformation between the two goods equals the terms of trade. Consumers are always better off with trade than without.

The second model in this chapter is a two-period model based on the model in Chapter 6, including a government sector (taxes and spending). The model shows that the current account surplus increases with savings, decreases with government spending, and is unaffected by a change in taxes (due to Ricardian equivalence). The effect on the current account surplus of a change in the real interest rate depends on the strength of the income and substitution effects (i.e. whether the domestic consumer is a lender or a borrower).

The third model examines the dynamics of growth and trade by including equilibrium in the capital market when the interest rate is set internationally. *Absorption* is defined as domestic consumption plus investment plus government purchases. The current account surplus is domestic output minus absorption. A rise in the world interest rate increases the current account surplus by decreasing absorption by raising output. Permanent increases in government spending increase output and the current account surplus, as does a rise in current total factor productivity. A rise in expected future total factor productivity does not affect current output and thus reduces the current account surplus. A current account deficit is good for the economy if it leads to greater investment in capital and thus greater future output.

■ True and False

- _____ 1. The economic activity of a small, open economy can affect the world prices.
- _____ 2. Though the economic activity of a small, open economy cannot affect world prices it can affect the world interest.
- _____ 3. The economic activity of a small, open economy can affect the terms of trade.
- _____ 4. A competitive equilibrium requires that the slope of the production possibilities curve equal the slope of the indifference curve.
- _____ 5. The terms of trade between two countries represents the real exchange rate between the two.
- _____ 6. If $MRT_{x,y} > p_{xy}$, firms can profit by taking inputs out of the production of X and putting them into the production of Y .
- _____ 7. The flatter the PPF , the more of a comparative advantage a country has in the production of the good on the x-axis.

- _____ 8. Free trade will not benefit potential trading partners that have the same preferences.
- _____ 9. If the substitution effects dominate income effects, an increase in the relative price of an imported good will lead to a trade switch in which the formerly imported good becomes the exported good and vice versa.
- _____ 10. An increase in current period income increases current spending and thus leads to a decrease in the current account surplus.
- _____ 11. A temporary increase in current government spending leads to a decrease in the current account surplus.
- _____ 12. For net borrowers, an increase in the real interest rate causes an increase in current consumption and a decrease in the current account surplus.
- _____ 13. If the United States began a policy of maintaining a current account surplus of zero, aggregate consumption would become more variable.
- _____ 14. The term absorption measures the amount of domestic output that is consumed by foreign countries.
- _____ 15. A positive total factor productivity shock abroad will cause the world real interest rate to rise and cause domestic output to decrease in a small open economy.
- _____ 16. A temporary decrease in government spending in a small, open economy results in an increase in the current account deficit as output supply decreases by less than output demand.
- _____ 17. Under a permanent change (increase or decrease) in government spending, output demand remains constant for small, open economies.
- _____ 18. A permanent increase in government spending results in a current account surplus increase for small, open economies.
- _____ 19. A temporary increase in government spending in a small, open economy causes the real interest rate to rise, inducing an increase in the labor supply and an increase in output supply.

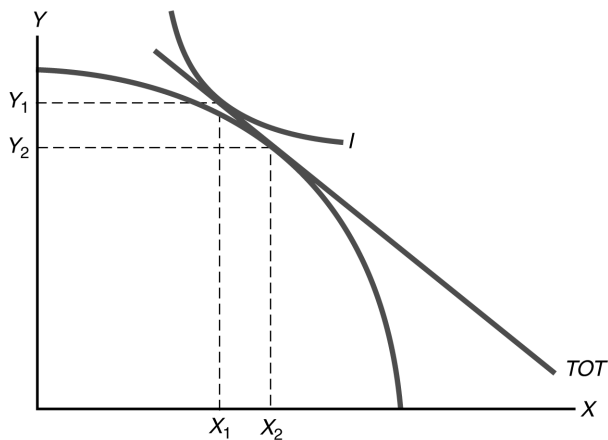
■ Short Answer

1. Name two reasons why international trade has increased in importance in recent years.
2. What does the small, open economy terminology imply about consumer and producer behavior in the country?
3. What two factors determine the pattern of trade for countries?
4. Under what conditions would the opening of trade not affect a country's welfare?
5. Under what theoretical conditions will a terms of trade shock cause business cycles in a country and what empirical support is there for terms of trade shocks causing business cycles?
6. What reasons might explain the discrepancy between the theory of consumption smoothing and the data on consumption smoothing?
7. What theoretical explanation is there that U.S. consumers believed increases in government expenditures in the 1980s were temporary.

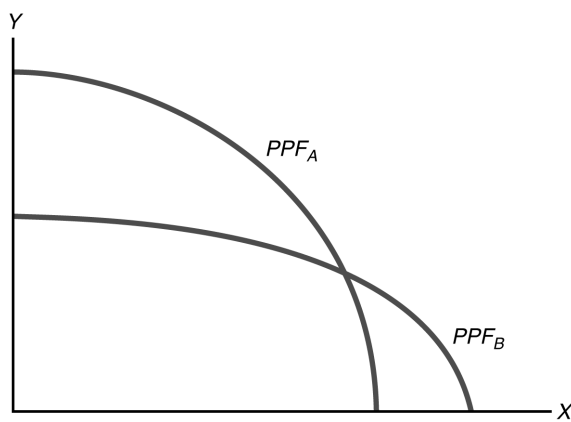
8. Explain why a small, open economy experiencing an isolated increase in its own total factor productivity will see an increase in its current account surplus.
9. Under what conditions might a current account deficit be followed by a current account surplus?
10. In what way might the U.S. current account deficits of the 1990s increase future U.S. economic welfare?

■ Graphic/Numeric

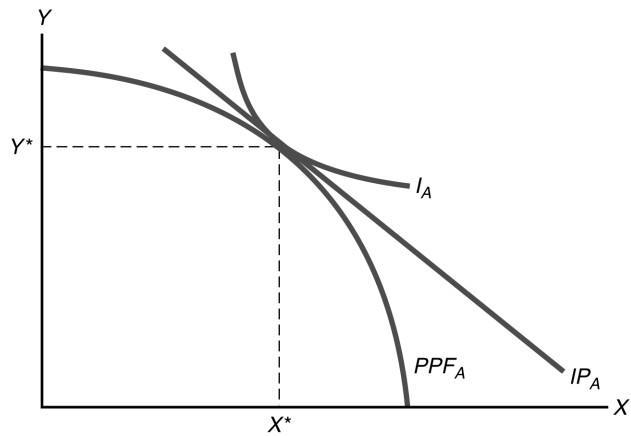
1. Is the country depicted in the graph below an importer of good X or good Y and in what amounts?



2. What is the value of the exports and imports for the country depicted above?
3. Which country, A or B in the graph below, has a comparative advantage in the production of Y ?



4. Country A's preferences and production as shown in plot below given by I_A and PPF_A , respectively. Given these factors, the domestic price ratio of X to Y is given by P_{XY} . Will the country benefit from free trade if the world price ratio, TOT_{XY} equals the domestic ratio P_{XY} ? Explain.



5. How would economic welfare be affected by an anticipated increase in total factor productivity that does not materialize?

■ Answers

True and False

1. False.
2. False.
3. False.
4. True.
5. True.
6. True.
7. True.
8. False.
9. True.
10. False. Due to consumption smoothing, current income rises more than current consumption and thus the current account surplus will increase.
11. True.
12. False. It causes a decrease in current consumption and an increase in the current account surplus.
13. True.
14. False.
15. True.

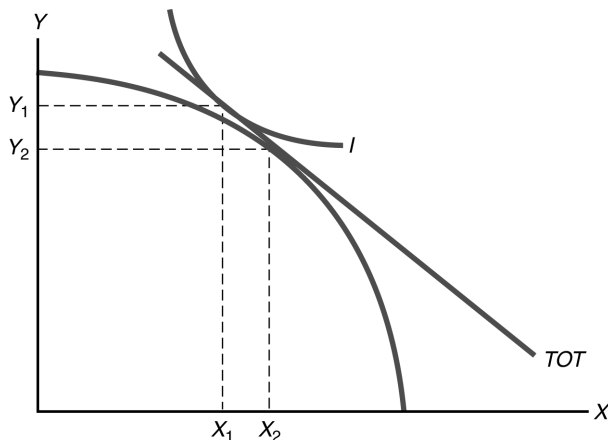
16. True.
17. True.
18. True.
19. False. Real interest rate is constant and determined by world real interest rate for small open economies.

Short Answer

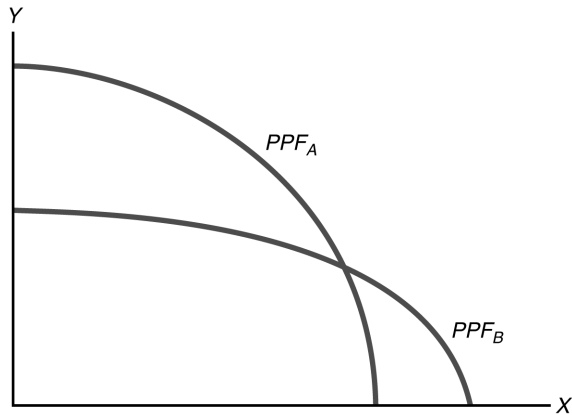
1. 1) Lower transport costs of goods and assets; 2) fewer government restrictions.
2. The term “small” implies that consumers and producers are price-takers and their collective action has no affect on world prices while “open” means it trades with other countries.
3. 1) Comparative advantage and 2) consumer preferences.
4. If its preferences and technology are exactly the same as abroad.
5. Countries in which international trade comprises a significant portion of GDP. Support comes from evidence from E. Mendoza claiming half of variability in real GDP is explained by trade shocks.
6. All countries might experience business cycle behavior simultaneously. If they coincide, the United States could be lending to foreign countries when its own output is low and borrowing from them when its output is high because the business cycles are more severe in the foreign countries.
7. The increase lead to the twin deficits, which are predicted under temporary, not permanent, increases in government expenditures.
8. An increase in TFP will have no effect on real interest rate and not affect consumption or investment but will shift Y^s to the right. Thus Y^d remains constant and Y^s shifts to the right causing an increase in CA . The TFP change must be temporary for consumers not to anticipate increased income.
9. If the CA is caused by expenditures on investments Y^s will eventually shift out and reduce the deficit. If investment is substantial enough, the current account can go into surplus.
10. If the CA is caused by expenditures on investments Y^s will increase thereby increasing consumption.

Graphic/Numeric

1. The country is an importer of Y in the amount $Y_1 - Y_2$ and an exporter of X in the amount $X_2 - X_1$.



2. Imports = $X_1 - X_2$ and Exports = $TOT_{XY}(Y_1 - Y_2)$.
3. The steeper shape of country A's *PPF* indicates that it has a comparative advantage in the production of Y .



4. This is the (unlikely) case in which no benefit is derived from trade as the same Pareto optimum that would occur with trade is already achieved without trade.
5. Investment and consumption would increase (though output would remain constant) in anticipation of the increased productivity. This would bring about a decrease in the current account surplus. The country will, most likely, be worse off in the future period when the productivity increase does not materialize. The country will experience excess capacity (due to excess investment) and a lower accumulation of foreign assets (from lower current account surplus).

Chapter 14

Money in the Open Economy

■ Overview

This chapter examines how international monetary policy affects the economy. The *law of one price* (purchasing power parity) states that prices in domestic currencies equalize internationally. The law of one price generally does not hold empirically at each point in time due to trade frictions, but over long periods of time it does appear to hold. The model in this chapter includes currencies and therefore an exchange rate (the cost of one currency in terms of another). With a flexible (market-determined) exchange rate, money is neutral and the domestic economy is insulated from price shocks from foreign countries (because the exchange rate adjusts). A flexible exchange rate does not, though, protect the economy from real shocks from abroad.

A fixed exchange rate transmits foreign price shocks directly to domestic prices, but protects the domestic economy from real shocks. Devaluation of the exchange rate also raises domestic prices. Thus, the type of shocks a country expects to experience partially determines its exchange rate system. Furthermore, under flexible exchange rates, domestic money supply can be controlled, while under fixed exchange rates the domestic country takes its monetary policy from its foreign trading partner (which is not necessarily a bad thing). Many countries limit foreign capital inflows and outflows (called *capital controls*) to reduce terms of trade volatility and their impact on the economy. But these restrictions also reduce economic efficiency by limited trading opportunities.

■ True and False

- _____ 1. Under a flexible exchange rate regime, the central bank's domestic monetary policy is unaffected by monetary policy abroad.
- _____ 2. Under a fixed exchange rate regime, the central bank cannot control its money supply independently.
- _____ 3. The real exchange rate equals zero when purchasing power parity holds.
- _____ 4. The law of one price is more likely to hold for washing machines than dental services.
- _____ 5. A country whose nominal exchange rate is fixed relative to some other currency for the indefinite future is known as a soft peg.
- _____ 6. Under a soft peg, a country can devalue and revalue its currency from time to time.
- _____ 7. A devaluation lowers the nominal exchange rate.
- _____ 8. A revaluation increases the value of a currency relative to others, which decreases the exchange rate.
- _____ 9. Dollarizing is the practice of printing money to finance government expenditures.

- _____ 10. Countries using currency boards relinquish control of their money supply to the host country but may still collect seignorage.
- _____ 11. The supply of euros is determined by market forces in all of the European Union countries.
- _____ 12. Assuming that purchasing power parity holds effectively eliminates changes in the terms of trade.
- _____ 13. In the small, open economy model, the foreign price level is exogenous while the exchange rate and domestic price level are endogenous.
- _____ 14. In the small, open economy model, movements in the exchange rate are caused by either shifts in money demand or shifts in money supply.
- _____ 15. In the small, open economy model with flexible exchange rates, the level of the nominal exchange rate has important effects on real variables.
- _____ 16. In the small, open economy with flexible exchange rates, a decrease in the money supply caused by the central bank results in an appreciation of the domestic currency.
- _____ 17. In the small, open economy model with flexible exchange rates, an increase in the domestic money supply leads to a proportionate increase in the domestic price level and exchange rate.
- _____ 18. In the small, open economy model with flexible exchange rates, an increase in the foreign price level leads to a currency depreciation for a small, open domestic economy.
- _____ 19. Under flexible exchange rates, the domestic inflation rate is determined by the money supply policies of the domestic central bank.
- _____ 20. Changes in foreign prices will affect either M , Y , r , or P in the domestic country.
- _____ 21. In the small, open economy model with flexible exchange rates, a decrease in the world real interest rate leads to an increase in the exchange rate and price level in the domestic economy.
- _____ 22. In the small, open economy model with flexible exchange rates, a decrease in the world real interest rate leads to an appreciation of domestic currency.
- _____ 23. Flexible exchange rates can insulate a small, open economy from nominal shocks abroad but not real shocks.
- _____ 24. The domestic money supply is determined by e in a fixed exchange rate system.
- _____ 25. In the small, open economy model with fixed exchange rates, an increase in the foreign price level causes an increase in the domestic price level.
- _____ 26. Fixed exchange rates can insulate a small, open economy from nominal shocks abroad but not real shocks.
- _____ 27. Devaluing domestic currency in an attempt to reduce a current account deficit can work in the long run for a small, open economy.
- _____ 28. If nominal shocks from abroad are frequent for a small, open economy, a fixed exchange rate is preferable to a flexible exchange rate to stabilize the domestic price level.
- _____ 29. If real shocks from abroad are frequent for a small, open economy, a fixed exchange rate is preferable to a flexible exchange rate to stabilize the domestic price level.

- _____ 30. The type of exchange rate regime determines how a domestic, small, open economy is affected by shocks from abroad.
- _____ 31. Under a fixed exchange rate, the money supply is not under the control of the domestic government.
- _____ 32. The capital account surplus is the negative of the current account surplus.
- _____ 33. The balance of payments is positive for countries that export more than they import in goods and services.
- _____ 34. Nominal exchange rates change by a smaller amount when capital controls are in place than when they are not.
- _____ 35. Though capital controls reduce fluctuations in the nominal exchange rate they create inefficiencies for the small, open economy.

■ Short Answer

1. Under what conditions is purchasing power parity not likely to hold?
2. Why is purchasing power parity not likely to hold for mass goods?
3. Describe two of the three ways in which a country can implement a hard-peg fixed exchange rate and give real world examples of each.
4. What purpose does the IMF serve in international affairs?
5. Explain how the flexible exchange rate system insulates the small, open economy from foreign inflation.
6. What variables must remain constant to insulate the small, open economy with flexible exchange rates from changes in the foreign price level?
7. How does a fixed exchange rate help a weak central bank?
8. Explain why the balance of payments always equals zero (assuming no measurement errors).
9. Explain the difference between foreign direct investment and portfolio inflows and outflows.
10. How does the Edwards article on capital controls in Chile conclude regarding whether capital controls there were beneficial or not?

■ Graphic/Numeric

1. Consider a small open economy with a flexible exchange rate. What happens to the domestic labor supply, domestic output supply, domestic absorption, the exchange rate, and the domestic price level when the world real interest rate falls and
 - (a) Money demand decreases: $L(Y_2, r_2^*) < L(Y_1, r_1^*)$;
 - (b) Money demand increases: $L(Y_2, r_2^*) > L(Y_1, r_1^*)$;
 - (c) Money demand remains constant: $L(Y_2, r_2^*) = L(Y_1, r_1^*)$.

2. Explain and show graphically how a central bank in a flexible exchange rate system can stabilize the exchange rate when the real interest rate falls under all three of the above scenarios (a–c).
3. Consider a small, open economy with strict capital controls restricting all capital inflows and outflows. Show graphically and explain what happens when a positive total factor productivity shock occurs domestically. Assume the current account is initially zero.

■ Answers

True and False

1. True.
2. True.
3. False. The real exchange rate equals one when purchasing power parity holds.
4. True. The latter is a service.
5. False. A country whose nominal exchange rate is fixed relative to some other currency for the indefinite future is known as a hard peg.
6. True.
7. False. A devaluation does not lower the nominal exchange rate.
8. True.
9. False. Dollarizing is when a non-dollar currency is replaced with U.S. dollars.
10. True.
11. False. The supply of euros is determined by the European Central Bank.
12. True.
13. True.
14. True.
15. False. In the small, open economy model with flexible exchange rates, the level of the nominal exchange rate has no effects on real variables.
16. True.
17. True.
18. False. In the small, open economy model with flexible exchange rates, an increase in the foreign price level leads to a currency appreciation as the exchange rate falls for a small, open domestic economy.
19. True.
20. False. Changes in foreign prices will not affect M , Y , r , or P in the domestic country.

21. True.
22. False. In the small, open economy model with flexible exchange rates, a decrease in the world real interest rate leads to an depreciation of domestic currency.
23. True.
24. True.
25. True.
26. False. Fixed exchange rates can insulate a small, open economy from real shocks abroad but not nominal shocks.
27. False. Devaluing domestic currency in an attempt to reduce a current account deficit will not work in the long run for a small, open economy.
28. False. If nominal shocks from abroad are frequent for a small, open economy, a fixed exchange rate is not preferable to a flexible exchange rate to stabilize the domestic price level.
29. True.
30. True.
31. True.
32. True.
33. False. The balance of payments always balances to equal zero save measurement errors.
34. True.
35. True.

Short Answer

1. It would not hold for nontraded goods or goods whose transportation costs differ significantly. Difficulty in moving goods, labor, and capital in general impede purchasing power parity.
2. It is a service.
3. Dollarization, occurs in Ecuador; currency boards, occurs in Hong Kong; and mutual agreement to a common currency, EU is example.
4. The IMF lends to countries that have no other legitimate sources of funds.
5. The exchange rate falls (rises) commensurate with the increase (decrease) in foreign prices and no real effects occur.
6. Y, r^* , and M must be held constant.
7. If the domestic currency is fixed against a price-stable country, assuming purchasing power parity, the country with the weak central bank essentially adopts the monetary policy of the price-stable country.

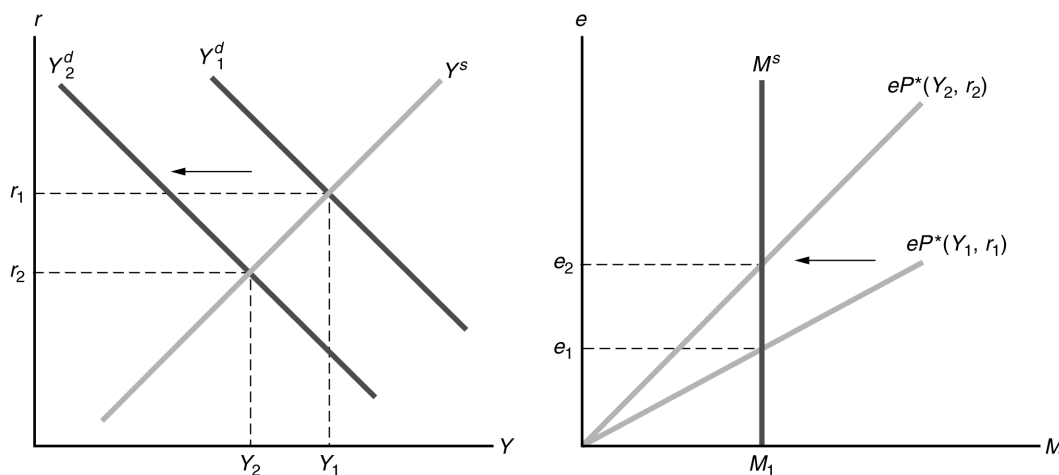
8. The balance of payments always equals zero because it is an identity. The value of the trade account or current account is the negative of the capital account. If a country imports more than it exports, it has a current account deficit. The money to fund that deficit comes back to the country via the capital account.
9. FDI represents funds spent on physical capital, such as building in foreign countries, while portfolio inflows and outflows are investments in financial assets.
10. Edwards argues that capital controls in Chile, and in general, are inefficient. Many Chileans cleverly avoided (or evaded) the controls while small and medium-sized Chilean firms experienced higher borrowing costs due to the controls.

Graphic/Numeric

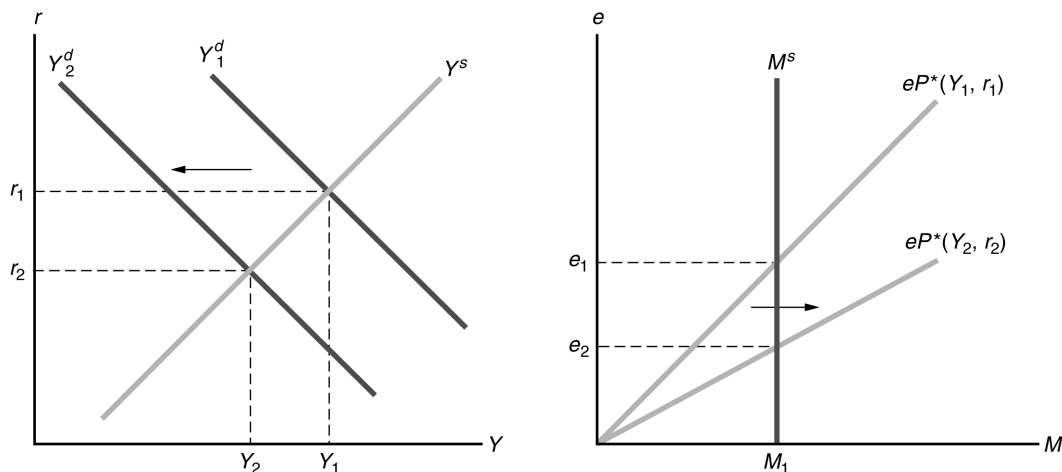
1. Assume that the world real interest rate falls from r_1 to r_2 as shown below. The decrease in r causes a decrease in output from Y_1 to Y_2 due to the intertemporal substitution of leisure by the consumer. Domestic absorption rises since the decrease in interest rates causes demand for investment goods to increase. Consumption may increase, decrease or stay constant as the decrease in output induces a decrease while the decrease r induces an increase in consumption. Total absorption may rise or fall, but any decrease in absorption will be smaller than the decrease in domestic output, so that the current account surplus falls.

The decrease in r causes the demand for money to rise, while the decrease in domestic output causes the demand for money to fall. There are the three possible scenarios

- (a) $L(Y_2, r_2^*) < L(Y_1, r_1^*)$ —decrease in nominal money demand from $eP^*L(Y_1, r_1)$ to $eP^*L(Y_2, r_2)$ and a commensurate increase in the exchange rate from e_1 to e_2 . Because purchasing power parity dictates $P = eP^*$, the increase from e_1 to e_2 implies that P must rise (as P^* has not changed).

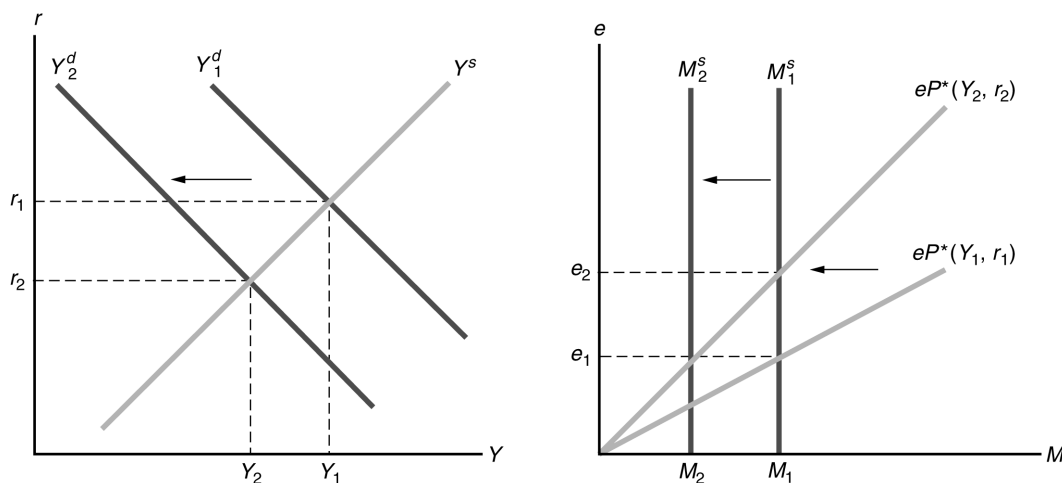


- (b) $L(Y_2, r_2^*) > L(Y_1, r_1^*)$ —increase in nominal money demand from $eP^*L(Y_1, r_1)$ to $eP^*L(Y_2, r_2)$ and a commensurate decrease in the exchange rate from e_1 to e_2 . Because purchasing power parity dictates $P = eP^*$, the decrease from e_1 to e_2 implies that P must fall (as P^* has not changed).

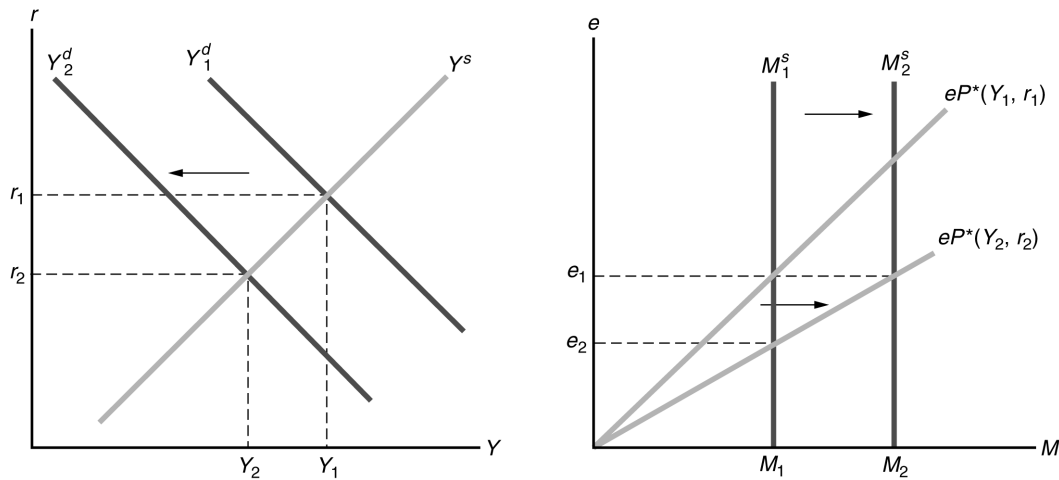


- (c) $L(Y_2, r_2^*) = L(Y_1, r_1^*)$ —nominal money demand is not affected by the decrease in r and thus the exchange rate remains constant at e_1 and the domestic price level remains constant. (No graph required.)

2. (a) $L(Y_2, r_2^*) < L(Y_1, r_1^*)$. Under a flexible exchange rate system, the central bank stabilizes the price level by decreasing the money supply from M_1 to M_2 to counter the initial rise in P and bring the exchange rate back to e_1 as shown below.

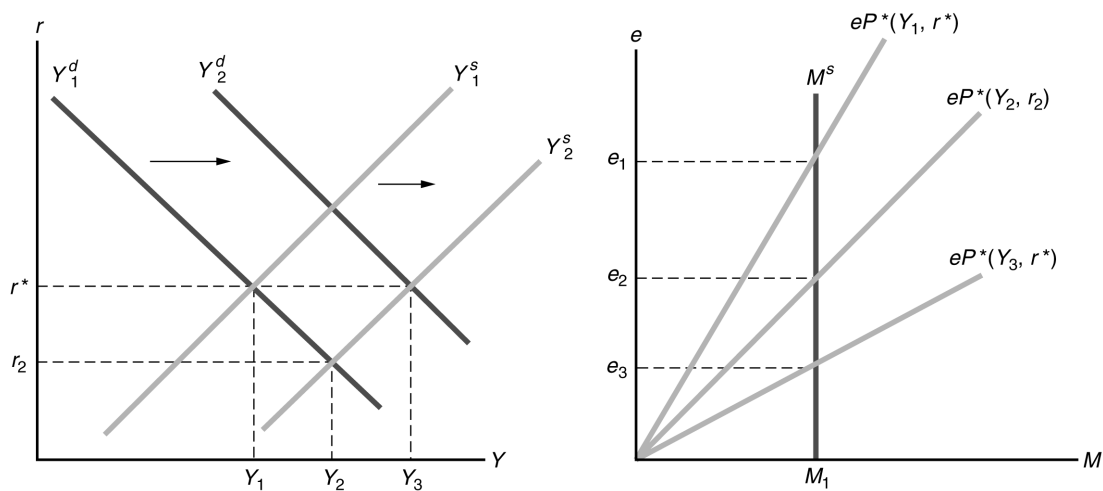


- (b) $L(Y_2, r_2^*) > L(Y_1, r_1^*)$. Under a flexible exchange rate system, the central bank stabilizes the price level by increasing the money supply from M_1 to M_2 to counter the initial fall in P and bring the exchange rate back to e_1 .



- (c) $L(Y_2, r_2^*) = L(Y_1, r_1^*)$. The central bank does not need to stabilize the price level because it has not changed.

3. A positive domestic total factor productivity shock shifts the output supply curve from Y_1^s to Y_2^s and would create a current account surplus and lead to an outflow of domestic capital. Without capital controls, output demand would increase to Y_1^d and output would increase from Y_1 to Y_3 . The increase in Y would increase the nominal money demand as $L(Y_3, r^*) > L(Y_1, r^*)$ and would cause the exchange rate to fall from e_1 to e_3 . With capital controls, the capital account must equal zero and so with the current account. Thus the domestic interest rate must fall to r_2 and output will only increase to Y_2 . The smaller output increase implies a smaller increase in nominal money demand and smaller decrease in the exchange rate. The post-shock exchange rate with capital controls is e_2 .



Chapter 15

Money, Inflation, and Banking

■ Overview

This chapter discusses the role of banks and money in solving the problem associated with barter (the necessity of a double coincidence of wants). The monetary intertemporal model is used to examine the long-run effects of changes in the monetary growth rate. Employing the Fisher relation, where an increase in the money growth rate is reflected in a one-for-one increase in inflation, an increase in the money growth rate is shown to decrease employment, output and consumption. The optimal money growth rate for this model is given by the Friedman Rule in which the money growth rate equals the negative of the real interest rate. Reasons are given for why this rule is not practiced in the real world. This model shows that though money is *neutral* (a change in the stock of money in the economy has no effect on real variables, only changing prices as shown in Chapter 10), it is not *superneutral* (a change in the growth in money does affect real variables). Indeed, inflation is caused by money growth and distorts consumers' choices by raising the opportunity cost of holding money (the nominal interest rate). Thus, inflation causes an economic inefficiency (i.e. utility would be higher without inflation). Such an inefficiency can be eliminated by deflating the economy (shrinking the money supply) so that the nominal interest rate is zero (called the Friedman rule). The model also shows that declines in total factor productivity (e.g. from an increase in energy prices) raises the price level.

The benefits of financial intermediation are discussed and then modeled using the Diamond-Dybvig banking model. Financial intermediaries reduce lending costs by collecting information on borrowers, and facilitate the creation of money through lending. The Diamond-Dybvig model uses the “insurance” aspect of financial intermediation and shows how bank runs can occur. Issues of bank runs in the United States and Canadian systems are discussed.

■ True and False

- _____ 1. The gold standard refers to commodity-backed paper currency.
- _____ 2. During the Free Banking Era, thousands of banks existed in the United States and issued bank notes that were backed by the government.
- _____ 3. In the absence of a double coincidence of wants, fiat money can be a Pareto improvement.
- _____ 4. Fiat money works as a medium of exchange because it is backed by commodities and other assets owned by the Federal Reserve.
- _____ 5. *Ceteris paribus*, consumers prefer assets that mature further in the future rather than sooner.
- _____ 6. The effective real wage is given by $\frac{P_w}{P}$.
- _____ 7. The liquidity of an asset refers to the likelihood of the asset's value fluctuating over time.
- _____ 8. A car is a liquid asset in that it provides a stream of benefits.

- _____ 9. Risks that cannot be diversified away are known as nondiversifiable risk.
- _____ 10. The existence of financial intermediaries implies more borrowing by risky borrowers.
- _____ 11. Transaction deposits are known as outside money.
- _____ 12. The FDIC insures only deposits greater than or equal to \$100,000.
- _____ 13. The Friedman rule for optimal money growth is that money should grow at a rate such that the real interest rate will be zero.

■ Short Answer

1. Describe two of the three problems inherent in using commodity money as a medium of exchange.
2. Explain how the high cost of producing commodity money is beneficial to its use as a medium of exchange.
3. In what important ways does commodity-backed paper currency differ from commodity money?
4. In what ways is a credit card not a form of money?
5. Describe two of the characteristics that define financial intermediaries.
6. Mathematically derive the optimality condition between current leisure and current consumption. In other words, derive equation (7),

$$MRS_{l,c} = \frac{P_w}{P'(1+r)} ,$$

from your text.

7. What mathematical simplification was used to derive the optimality condition between current leisure and current consumption?
8. What is the definition of *superneutrality* of money?
9. Describe four potential lending problems that financial intermediaries are designed to solve.
10. Describe three of the four properties of assets.
11. In what sense are the liabilities of depository institutions used in transactions?
12. What constraints do depository institutions face in maximizing their profits?
13. Explain the difference between *inside money* and *outside money*.
14. Provide two explanations for why Canada and the United States have had different experiences with bank runs.
15. Describe two ways in which government intervention has produced moral hazard in the banking industry.
16. In what ways do deductibles help insurance companies?

■ Answers

True and False

1. True.
2. False. During the Free Banking Era, thousands of banks issued bank notes but they were not backed by the government making the quality of different bank' notes difficult to evaluate.
3. True.
4. False. It is not backed by anything but the word of the U.S. government to redeem the notes.
5. False. Consumers prefer short-term over long-term assets, *ceteris paribus*.
6. False. The effective real wage is a function of next periods price level, P' , and is therefore given by $\frac{P_w}{P'}$.
7. False. The liquidity of an asset refers to how long it takes to sell or *liquidate* it for its market value.
8. False. A car, like a house, can often take weeks and be costly to sell.
9. True.
10. True. Loans would go to the least-risky borrowers in the absence of financial intermediaries.
11. False. This is money created inside the banking system and is therefore referred to as inside money.
12. False. Deposits are only guaranteed up to \$100,000.
13. False. The *nominal* interest rate will equal zero under the Friedman rule.

Short Answer

1. 1) Difficult to verify its quality—bits are shaved off and metals can be adulterated. 2) Commodity money is costly to produce. 3) Using scarce commodities for money has an opportunity cost—could use it for other purposes such as jewelry.
2. High production costs means it is scarce and a limited money supply reduces inflationary pressure.
3. Commodity-backed paper currency allows consumers to avoid carrying large quantities of the commodity when they wish to make purchases while allowing consumers the security of money that comes with commodity money.
4. Credit cards allow consumers to receive credit from the vender for the purchase of a good or service.
5. 1) It borrows from one group to lend to another. 2) It is well-diversified 3) It transforms assets. 4) It processes information.

6. To derive the optimality condition between current leisure and current consumption, we begin with the given equation above (7) in the text,

$$MRS_{l,c} = \frac{MRS_{lc'}}{MRS_{cc'}} = \frac{Pw}{P'(1+r)}.$$

Note that $\frac{P'}{P} = 1 + i$ and thus $\frac{Pw}{P'(1+r)} = \frac{w}{(1+i)(1+r)}$ or $\frac{w}{(1+i+r+ir)}$.

The simplification used is that $ir \approx 0$, which combined with $R = i + r$, gives

$$MRS_{l,c} = \frac{w}{(1+R)}$$

7. The mathematical simplification used to derive the optimality condition between current leisure and current consumption is that the real interest rate times inflation is approximately equal to zero, $ri \approx 0$.
8. *Superneutrality* of money occurs when a change in the money *growth rate* has no effects on real variables.
9. 1) Matching borrowers and lenders is costly. 2) Must evaluate credit risks. 3) Replication of costs when multiple lenders for a single loan are required. 4) Lenders economize on information costs making lending risky. 5) Loans tend to be illiquid. 6) Loans have longer maturities than lenders wish.
10. 1) Rate of return—the payoff on the asset over time divided by the initial investment in the asset minus one: $r_t^a = (q_{t+1} + 1 + d)/q_t - 1$. 2) Risk—risk is divided into diversifiable and nondiversifiable risk. The former is the risk that an asset brings to a portfolio of assets while the latter is the risk that cannot be avoided through diversification. 3) Maturity—the time it takes for an asset to pay off. 4) Liquidity—how long it takes to sell or *liquidate* an asset for its market value.
11. The liabilities of depository institutions are their deposits, which are turned into checking accounts that depositors use as money under M1.
12. The institutions must meet the reserve requirements and have enough excess reserves to meet the demand for withdrawals.
13. Inside money is money created inside the banking system such as transactions deposits.
14. 1) Canadian commercial banks issued their own currency which was considered safe by the public and could be easily created during times of high money demand. 2) Canadian banks are better diversified geographically.
15. FDIC encourages risky behavior as does the implicit “too big to fail” doctrine.
16. Deductibles help insurance companies by eliminating some moral hazard. For instance, moral hazard occurs when a homeowner has full coverage against fire and therefore, faces no (monetary) costs if a fire occurs. Deductibles place a portion of the costs onto the insured which induces the homeowner to exercise greater care in fire prevention.

Chapter 16

Unemployment: Search and Efficiency Wages

■ Overview

The *unemployment rate* is the proportion of the labor force that is without jobs. The *participation rate* is the proportion of the total population that has or wants jobs. These rates are affected by demographics, gender proportions, government policy, industry life cycles, and most importantly by aggregate output. The participation rate is procyclical while the unemployment rate is countercyclical.

This chapter characterizes the reasons for unemployment by developing two models of the labor market: a *search model* and an *efficiency wage model*. The labor market search model begins with a worker's reservation wage (indifference point at taking a job or continuing to search) and models job search and separation decisions as utility maximizing choices. The model shows that an employed worker's utility rises when his or her wage rises, income taxes fall, and the probability of being let go from the current job falls. For an unemployed worker, utility increases when unemployment benefits rise, the probability of job offers rise, and when taxes on benefits fall. Unemployment insurance raises the unemployment rate as it induces the unemployed to extend the job search (i.e. increases the reservation wage).

The efficiency wage model presumes that work effort increases with the real wage. This occurs because employers cannot determine ex ante a worker's true effort level, and because workers have an incentive to shirk. The equilibrium efficiency wage maximizes the ratio of worker effort and the real wage, but may cause unemployment. Total factor productivity can raise output and employment in this model, but government spending does not. This model fails to fit several important business cycle facts, but still appears to be plausible.

■ True and False

- _____ 1. Data on unemployment in the U.S. reveal that the unemployment rate tends to be above trend when real GDP is below trend.
- _____ 2. Data on unemployment in the United States reveal that the unemployment rate for younger workers tends to be lower than that for older workers.
- _____ 3. The typical replacement ratio for workers in the United States is about 30 percent.
- _____ 4. The participation rate for men and women in the labor force has increased significantly since the 1950s.
- _____ 5. Increases in output lead to decreases in participation rates as jobs become more scarce for potential workers.

- _____ 6. Unemployment in all the OECD countries is higher than in the United States because of the generous unemployment insurance compensation in Europe.
- _____ 7. Under the search model of unemployment, unemployment increases when the average wage is less than the average reservation wage.
- _____ 8. An increase in unemployment insurance leads to a decrease in V_u .
- _____ 9. In the efficiency model, profit maximization may require paying above market wage rates.
- _____ 10. Under the efficiency wage theory, firms wish to maximize the ratio of worker effort to worker wages.
- _____ 11. Both the Keynesian sticky wage theory and efficiency wage theory imply long-term unemployment.
- _____ 12. The labor supply curve is vertical in the efficiency wage model.
- _____ 13. Employment in the efficiency wage model is determined by the labor demand curve.
- _____ 14. Output in the efficiency wage model is determined by the output supply curve.
- _____ 15. The efficiency wage theory implies that consumption, investment, employment, and the real wage are all procyclical under productivity shocks.
- _____ 16. In the efficiency wage model, shocks that affect output demand have no effect on aggregate output and changes in government spending do not affect any variables.
- _____ 17. A decrease in the job offer rate, p , can come from better information technology.
- _____ 18. In the United States, unemployment insurance benefits are taxed at a higher rate than earned income.

■ Short Answer

1. How do sectoral shifts affect unemployment?
2. What is the most important factor in the increase in labor force participation since the 1950s?
3. Under what conditions will changes in output demand increase unemployment but not affect employment?
4. Describe two factors that affect the job offer rate, p .
5. How might an increase in government unemployment insurance increase unemployment?
6. How might an increase in government unemployment insurance increase gross domestic product?
7. Describe the two informational problems that arise in work effort in the efficiency wage model.
8. Name three moral hazard problems attendant to increases in unemployment insurance.

■ Graphic/Numeric

1. Explain and illustrate the effect of a decrease in unemployment insurance on the labor market using the search model.

■ Answers

True and False

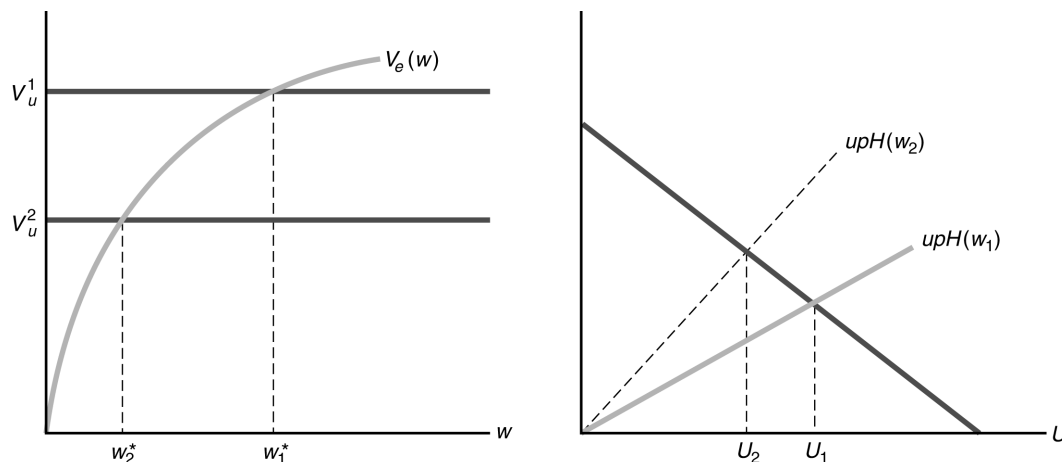
1. True.
2. False.
3. False. The actual replacement ratio is near 50 percent.
4. False. The participation rate for men has declined while that for women has increased.
5. False. Increases in output lead to increases in participation rates.
6. False. The generous unemployment insurance does not seem to significantly affect unemployment and only nine out of fifteen OECD countries have higher unemployment than the United States.
7. True. The worker will search more in such a situation.
8. False. It would increase the welfare of the unemployed, V_u .
9. True.
10. True.
11. False. The Keynesian model assumes stickiness only in the short run.
12. False. The output supply curve is vertical while the labor supply curve is upward sloping.
13. True.
14. True.
15. False. The real wage is acyclical in the theory and is counter to the data on business cycles.
16. False. Though changes in output demand have no effect on aggregate output, changes in government spending affect interest rates and unemployment.
17. False. This would lead to an increase in p .
18. False. They are taxed at the same rate.

Short Answer

1. A change in the structure of aggregate production causes worker displacement. Older workers may be unemployed for extended periods as they attempt to acquire new skills. *Ceteris paribus*, the greater the shifts, the higher the restructuring and the higher the unemployment.
2. The increase in women's participation rates.
3. An increase in output demand raises interest rates causing greater labor supply with wages constant at the efficiency wage. Because labor demand remains constant, the gap between labor supply and demand increases.
4. 1) Information technology and 2) government intervention through employment centers and the like.
5. Opportunity cost of not working falls, inducing more unemployment and raising V_u .
6. Comparative advantage may be easier to attain with longer search time.
7. Adverse selection—the better the worker, the higher the reservation wage implying higher wages will raise the average work effort. Moral hazard—monitoring costs give workers incentive to decrease work effort (shirk) while higher wages raise the opportunity cost of getting caught thereby inducing higher work effort than at lower wage.
8. Three moral hazard problems attendant to increases in unemployment insurance are 1) Workers become choosier with higher UI, thereby increasing time spent searching. 2) Workers are more likely to shirk as the cost of being fired falls with increased UI. 3) Workers put less effort into searching for jobs as UI increases.

Graphic/Numeric

1. A decrease in unemployment insurance will reduce the reservation wage from w_1^* to w_2^* . This increases the flow of workers from unemployment to employment as shown by the decrease in unemployment from U_1 to U_2 .



Chapter 17

Inflation, the Phillips Curve, and Central Bank Commitment

■ Overview

A *Phillips curve* is a positive relationship between inflation and economic activity (this chapter focuses on output growth above trend). Such a relationship appeared to hold in the United States and United Kingdom in the 1950s and 1960s, but had disappeared by the 1980s and onward. This chapter uses a variant of the Friedman-Lucas money surprise model of Chapter 11 to explore the reasons for this. The model shows that monetary shocks can generate surprise inflation, but that over time the Fed's ability to do this diminishes as consumers learn to expect this.

Inflation was quite high in the United States in the 1970s when the Fed rapidly increased the money supply, possibly to exploit the Phillips curve and thus stimulate the economy. Because this inflation did not raise output as predicted, the Fed's desire to use this technique stopped by the 1980s (but could be revived). An alternative explanation for the inflation in the 1970s is that Fed policy makers were unable to commit to a stable monetary policy during the 1970s but (somehow) were able to do this in the 1980s and 1990s. This explanation is rather weak for the U.S. experience, but appears consistent with the experience in other countries such as Hong Kong and Argentina that have used central bank commitment devices such as currency boards (a fixed exchange rate backed by foreign currency reserves).

■ True and False

- _____ 1. Hyperinflations are always associated with large government deficits.
- _____ 2. The Phillips curve represents a positive relationship between the rate of inflation and the deviation of real aggregate output from trend.
- _____ 3. The data for the 1950s and 1960s are consistent with the view that the Fed was exploiting a stable short-run Phillips curve with significant changes in inflation.
- _____ 4. In U.S. data there exists a Phillips curve relationship in the 1970s and before.
- _____ 5. The Phillips curve relation appears to be constant over time.
- _____ 6. The U.S. data is consistent with the argument that there was greater stability in expected inflation prior to 1970 than after.
- _____ 7. The apparent lack of a Phillips curve relation in the 1970s is consistent with the argument that there were significant shifts in inflation expectations during the 1970s.
- _____ 8. The central bank learning explanation of the Fed's behavior over the last 50 years implies that high and variable inflation is less likely to appear in the United States.
- _____ 9. If the Federal Reserve believes that the Phillips curve shifts with inflationary expectations, there can be no long-run trade-off between inflation and aggregate output.

- _____ 10. The New Zealand central bank was able to get inflation under control by changing the rules under which the central bank operated as a commitment device.
- _____ 11. Keynesian type objectives such as “full employment” and “sustained growth” were eliminated from the New Zealand central bank’s goals via the change in law.
- _____ 12. Rational expectations hypothesis assume that agents use all information efficiently and therefore do not make errors in their forecasts.
- _____ 13. The Hong Kong Monetary Authority operates an unambiguously pure currency.

■ Short Answer

1. How do the three inflation models presented in the chapter explain the U.S. inflation during the 1970s?
2. What are the grounds for and against strict Federal Reserve rules on money growth targeting?

■ Answers

True and False

1. True.
2. True.
3. False. The data are consistent with the view that the Fed was unaware of the potentially exploitable short-run Phillips curve.
4. True.
5. False. The Phillips curve seems to shift over time.
6. True.
7. True.
8. True. The idea is that the Fed learns from previous mistakes such as the high and variable inflation it induced (according to the theory) in the 1970s.
9. True. The public will not be fooled and output will settle at its trend level, Y^T .
10. True.
11. True.
12. False. Efficient use of information implies agents do not make “systematic errors.”
13. False. The currency board system of Hong Kong is not written into law but is based on an explicit agreement. Moreover, the HKMA is not committed to purchase U.S. dollars at a particular rate.

Short Answer

1. The money surprise model claims shocks to the economy caused the inflation. The central bank learning story argues high inflation was caused by a lack of knowledge on the part of the Fed concerning how the economy works. The central bank commitment story argues that the Fed was unable to commit to not using surprise inflation.
2. For: 1) making rules on an ad hoc basis does not provide consistency for agents to make long-term decisions. Against: 1) any rule can be later shown to be inappropriate and 2) there is increasing instability in the relationships among monetary aggregates, prices and real activity in the 1980s and 1990s.