Contents

FIGURE 1.1

OUTPUT OF THE CANADIAN ECONOMY, 1870–2000

In this graph, the output of the Canadian economy is measured by real gross domestic product (real GDP) with goods and services valued at their 1997 prices (see Chapter 2). Note the strong upward trend in output over time, as well as sharp fluctuations during the Great Depression (1930–1938), World War II (1939–1945), and the recessions of 1981–1982 and 1990–1992.

Sources: 1870–1926: Adapted from M.C. Urquhart, *Gross National Product, Canada*, 1870–1926, McGill-Queen's University Press, 1993, Tables 1.1 and 1.6. Data from Urquhart were rescaled. 1926–2000: Statistics Canada, CANSIM Series D100126.

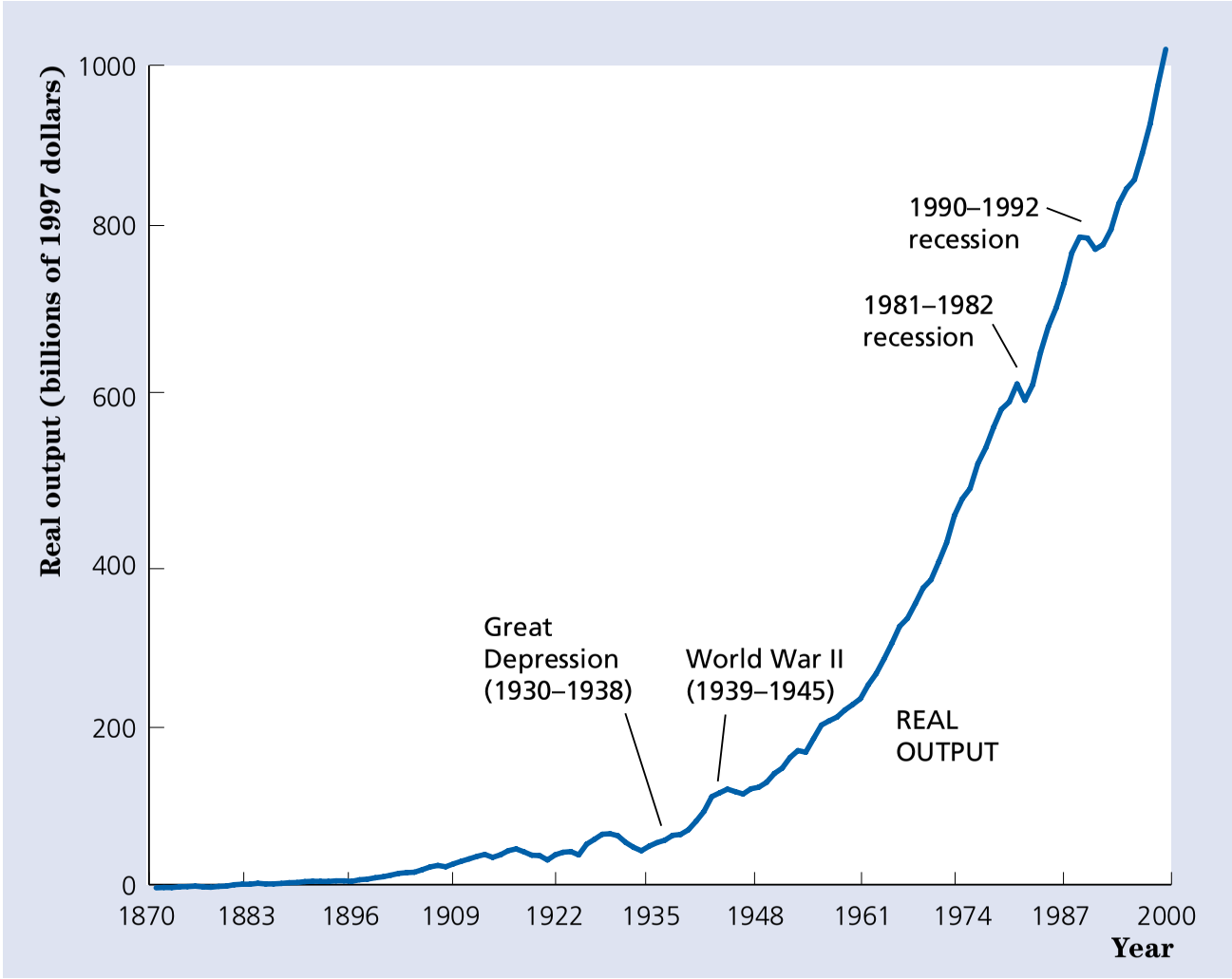


FIGURE 1.2

AVERAGE LABOUR PRODUCTIVITY IN CANADA, 1921–2000

Average labour productivity (output per employed worker) has risen over time, with a peak during World War II, reflecting increased wartime production and troughs during recessions. Productivity growth was particularly strong during the 1950s and 1960s but has slowed since then.

Sources: Employment: 1921–1945: *Historical Statistics of Canada*, Series D129, Civilian Over–14 Employment; 1946–1965: *Historical Statistics of Canada*, Series D139; 1966–2000: Statistics Canada, CANSIM Series D980595. Average labour productivity is output divided by employment.

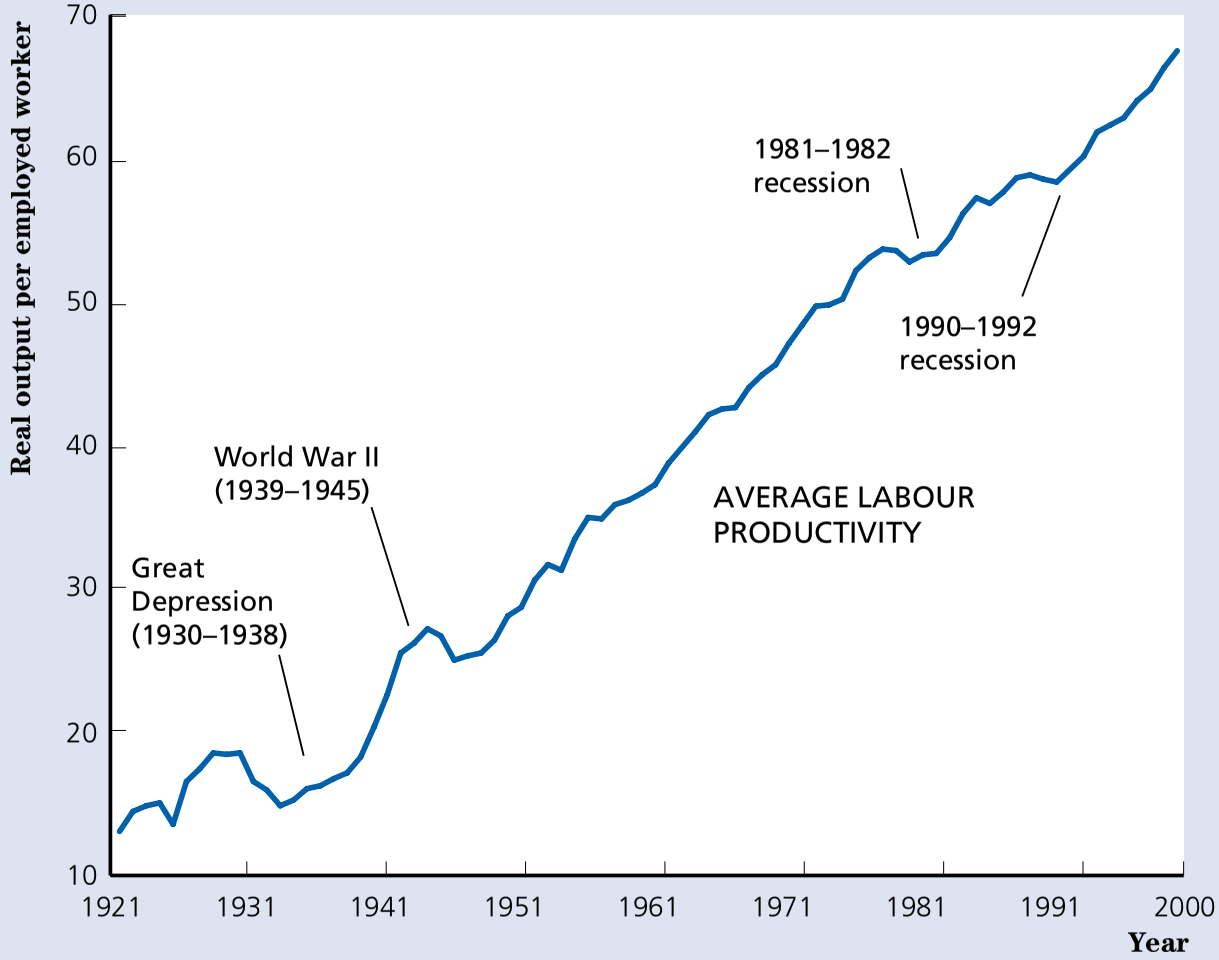


FIGURE 1.3

THE CANADIAN UNEMPLOYMENT RATE, 1921–2000

The figure shows the percentage of the labour force that was unemployed in each year since 1921. Unemployment peaked during the Great Depression of the 1930s and reached its low point during World War II. Since World War II the highest unemployment rates have occurred during the recessions of 1981–1982 and 1990–1992.

Sources: 1921–1945: *Historical Statistics of Canada*, Series D132 and D129; 1946–1965: *Historical Statistics of Canada*, Series D233; 1966–2000: Statistics Canada, CANSIM Series D980745.

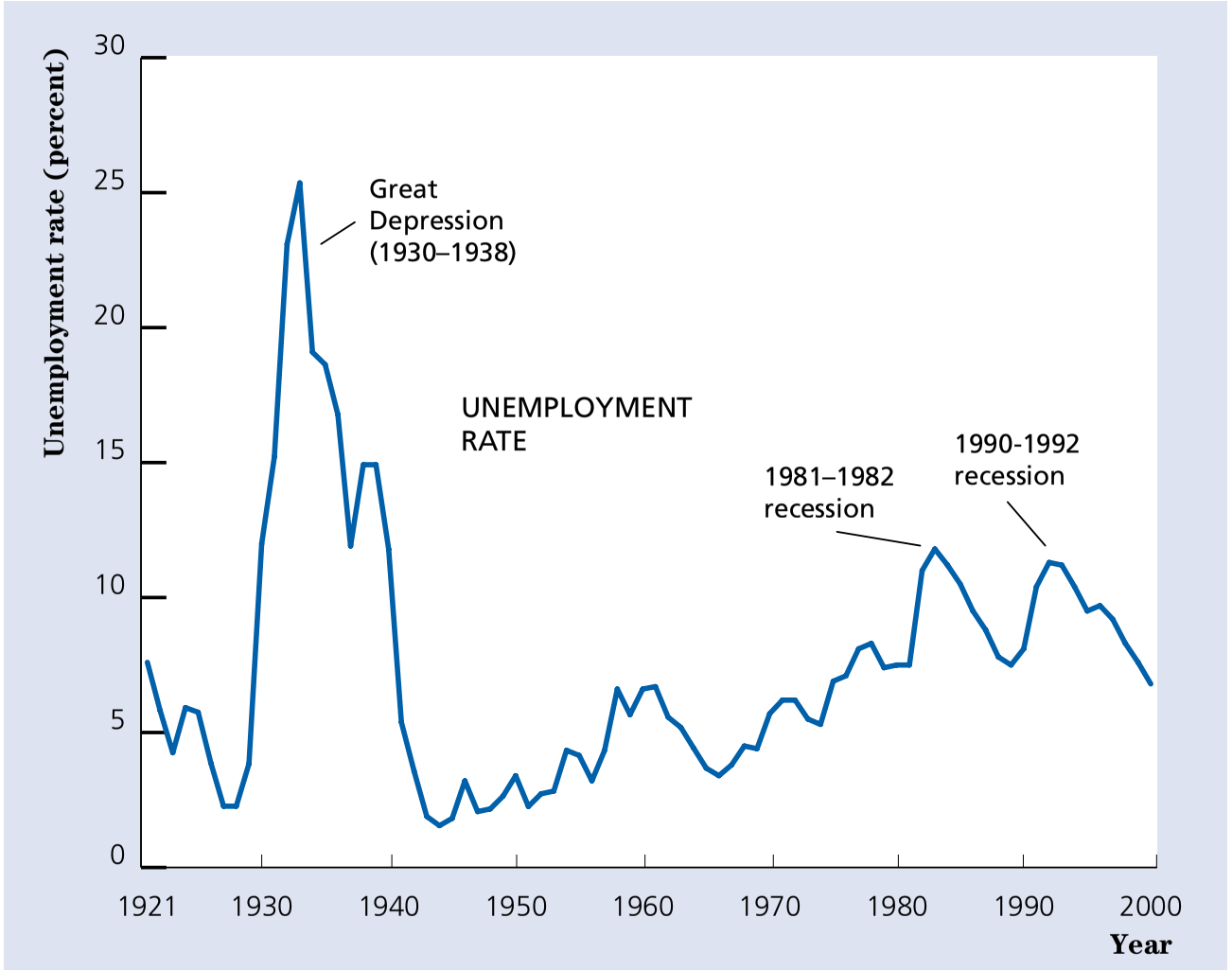


FIGURE 1.4

CONSUMER PRICES IN CANADA, 1913–2000

Prior to World War II, the average level of prices faced by consumers remained relatively constant, with periods of inflation (rising prices) offset by periods of deflation (falling prices). Since World War II, however, prices have risen more than tenfold. In the figure, the average level of prices is measured by the consumer price index, or CPI (see Chapter 2). The CPI measures the cost of a fixed set, or basket, of consumer goods relative to the cost of the same basket of goods in a base period, in this case 1992. Thus, a CPI of 138 in 1997 means that a basket of consumer goods that cost $100 in 1992 would cost $138 in 1997.

Sources: 1913–1975 (1971=100): *Historical Statistics of Canada*, Series K8; 1975–2000 (1992=100): Statistics Canada, CANSIM Series P100000. Data prior to 1975 were adjusted to a base with 1992 = 100.

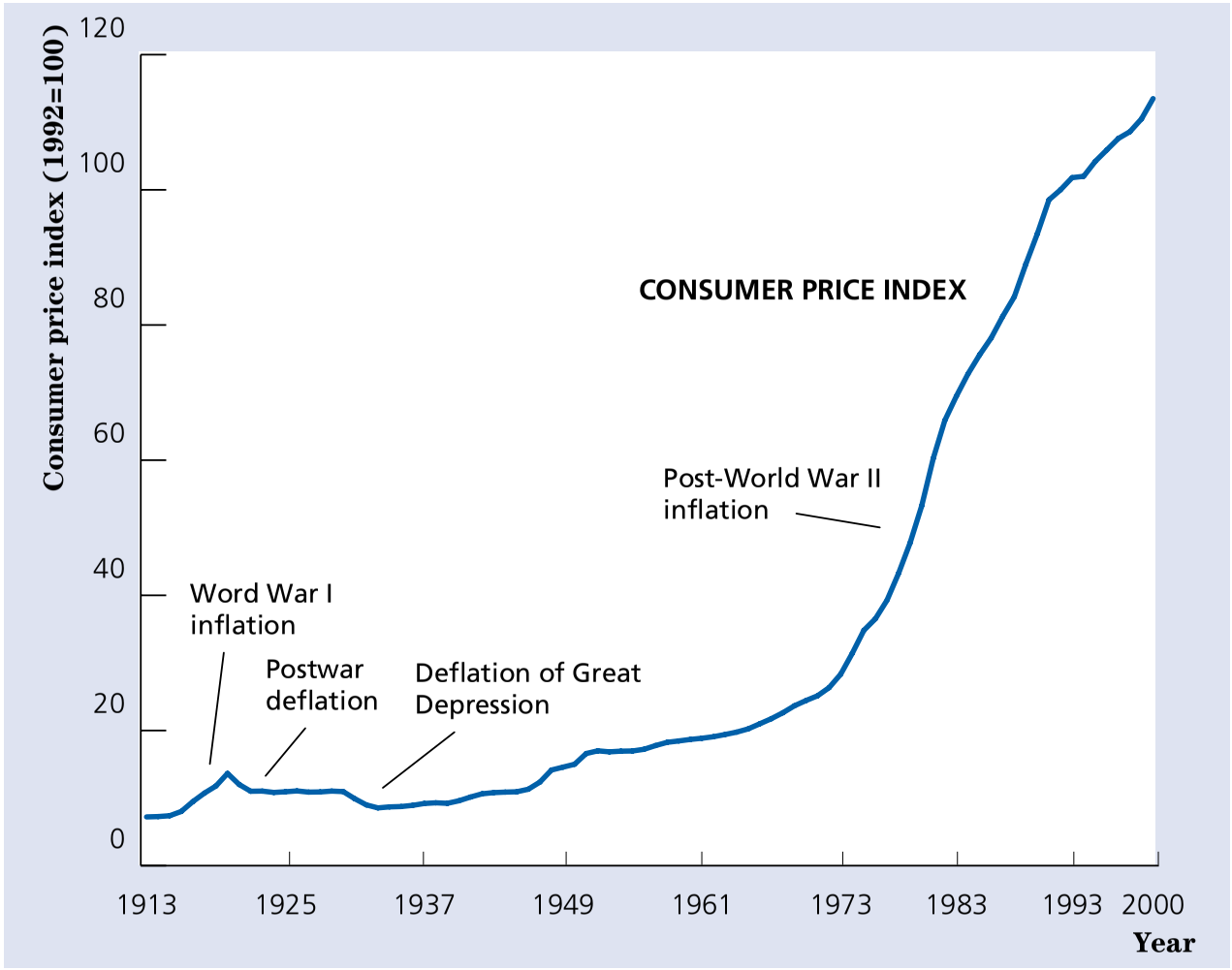


FIGURE 1.5

CANADIAN EXPORTS AND IMPORTS, 1926–2000

The figure shows Canadian exports (blue curve) and imports (black curve), each expressed as a percentage of total output. Exports and imports need not be equal in each year: During the late 1950s and early 1990s, Canadian exports were smaller than Canadian imports (shaded blue area). Since 1994, exports have exceeded imports (shaded grey area).

Sources: Exports and imports of goods and services, in current dollars, GDP at market prices: Statistics Canada, CANSIM Series D14833, D14836, D14816.

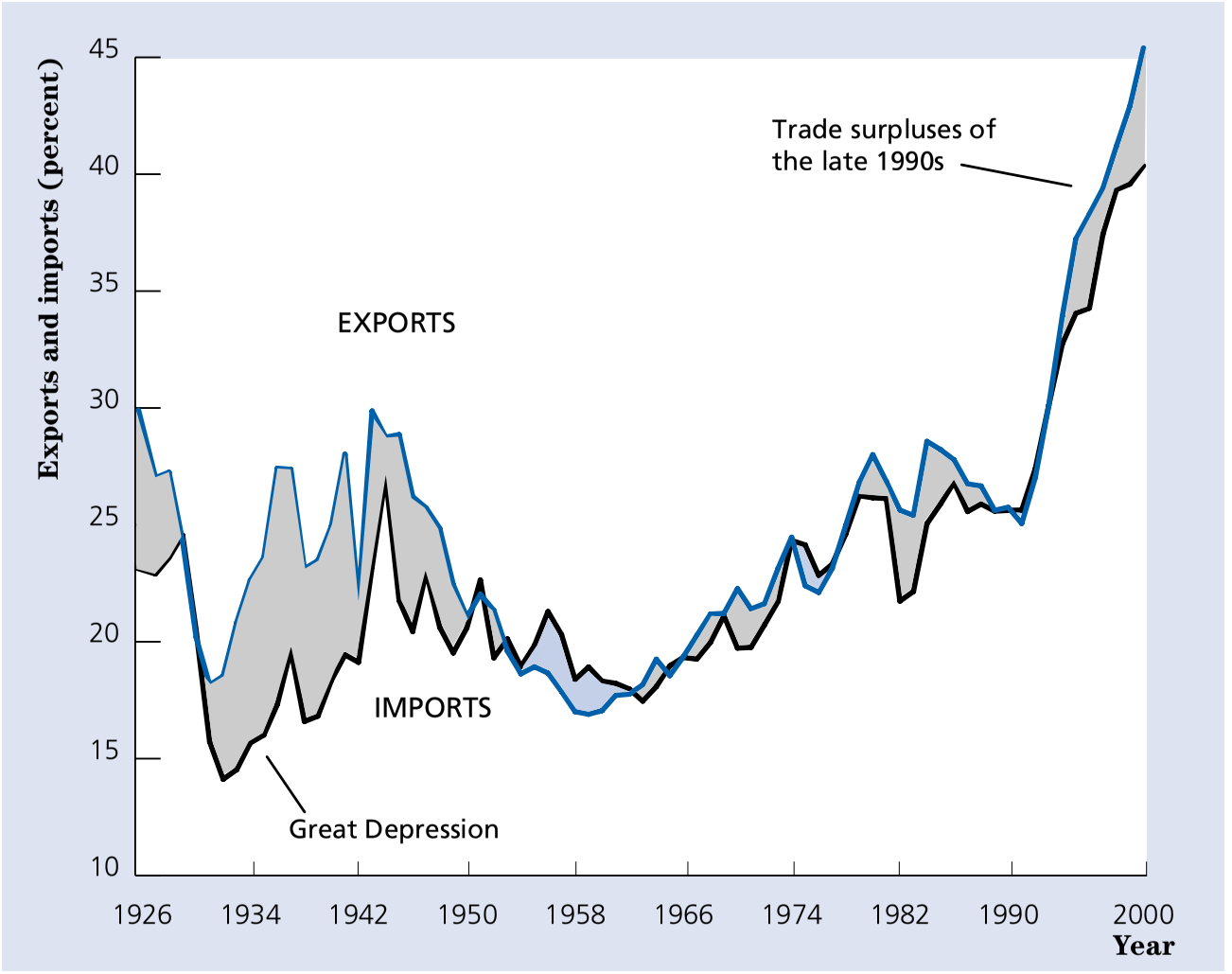


FIGURE 1.6

CANADA–US EXCHANGE RATE, 1950–2001

The figure shows the exchange rate between Canada and the United States, quarterly since 1950. The exchange rate is the value of the Canadian dollar expressed in US dollars. During the 1960s, the exchange rate was fixed within a narrow band, but since then, it has floated and has been subject to large fluctuations, falling below 65 US cents in recent years.

Source: *Bank of Canada Review*, Table A2. Reprinted with the permission of the Bank of Canada.

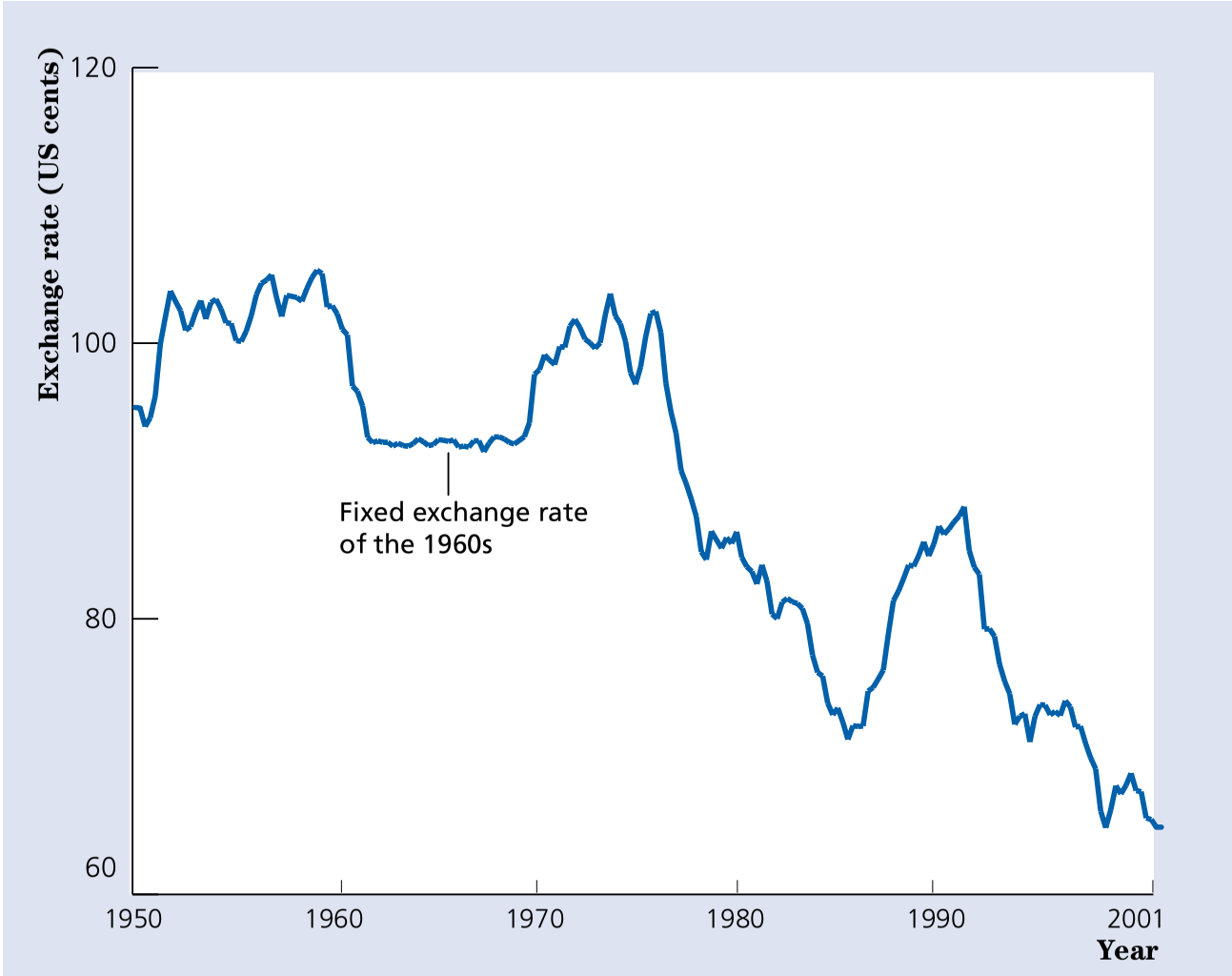


FIGURE 1.7

CANADIAN FEDERAL GOVERNMENT SPENDING AND REVENUE, 1926–2000

Canadian federal government spending (blue curve) and revenue (black curve) are shown as percentages of total output. Deficits, or excesses of spending over tax collections, are shaded in blue, and surpluses (excesses of revenue over spending) are shaded in grey. The federal government's share of the economy has grown since the Great Depression. Large deficits occurred during World War II and in recent years.

Source: Federal government spending and revenue in millions of dollars, GDP at market prices: Statistics Canada, CANSIM Series D15088, D15103.

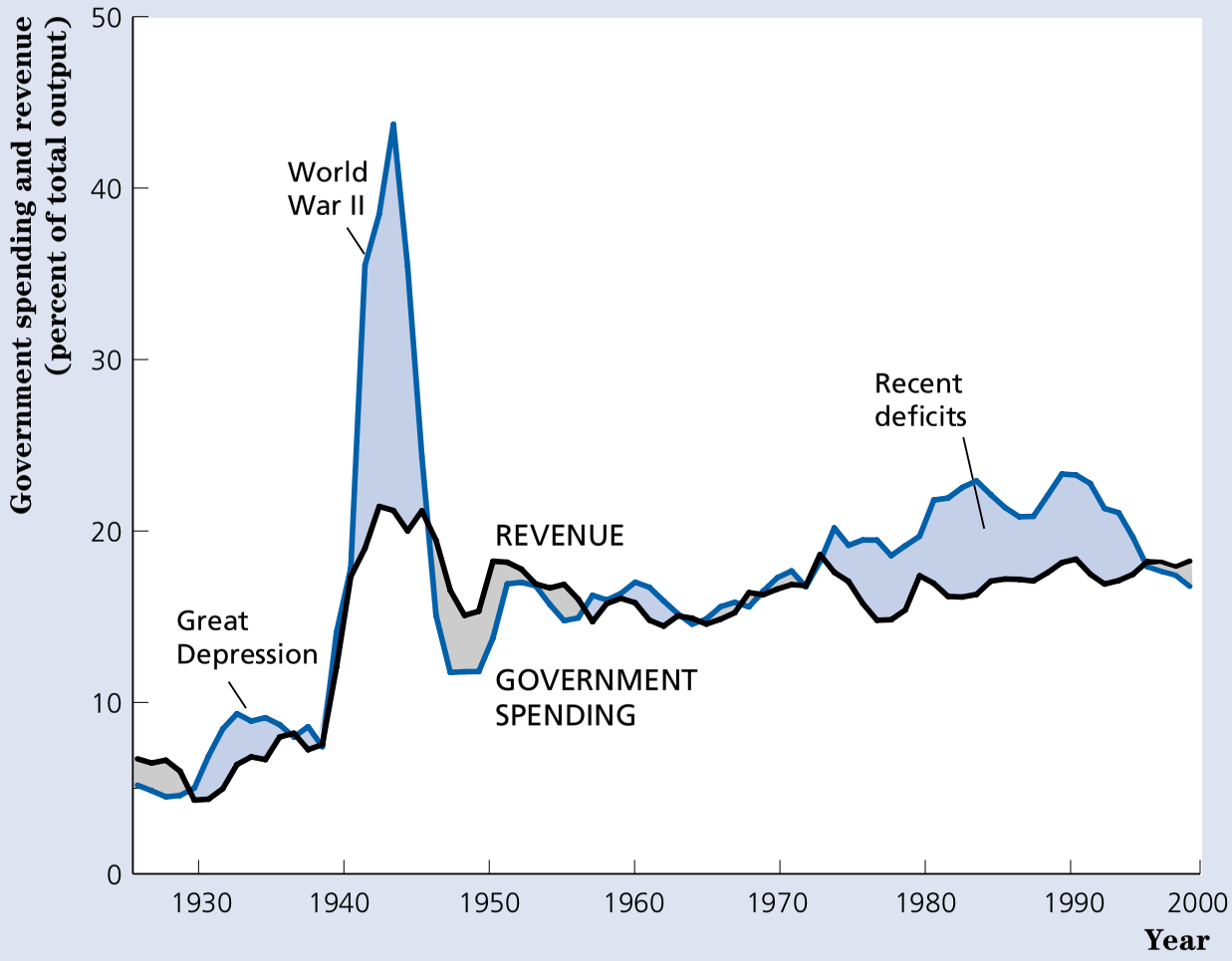


FIGURE 2.1

THE USES-OF-SAVING IDENTITY IN CANADA, 1926–2000

The figure illustrates the uses-of-saving identity— which states that private saving equals the sum of investment, the government budget deficit, and the current account balance— for Canada over the period 1926–2000. Each variable is measured as a percentage of GDP, and government saving is the combined saving of the federal, provincial, and municipal governments.

Source: *Canadian Economic Observer, Historical Statistical Supplement*, cat. no. 11-210.

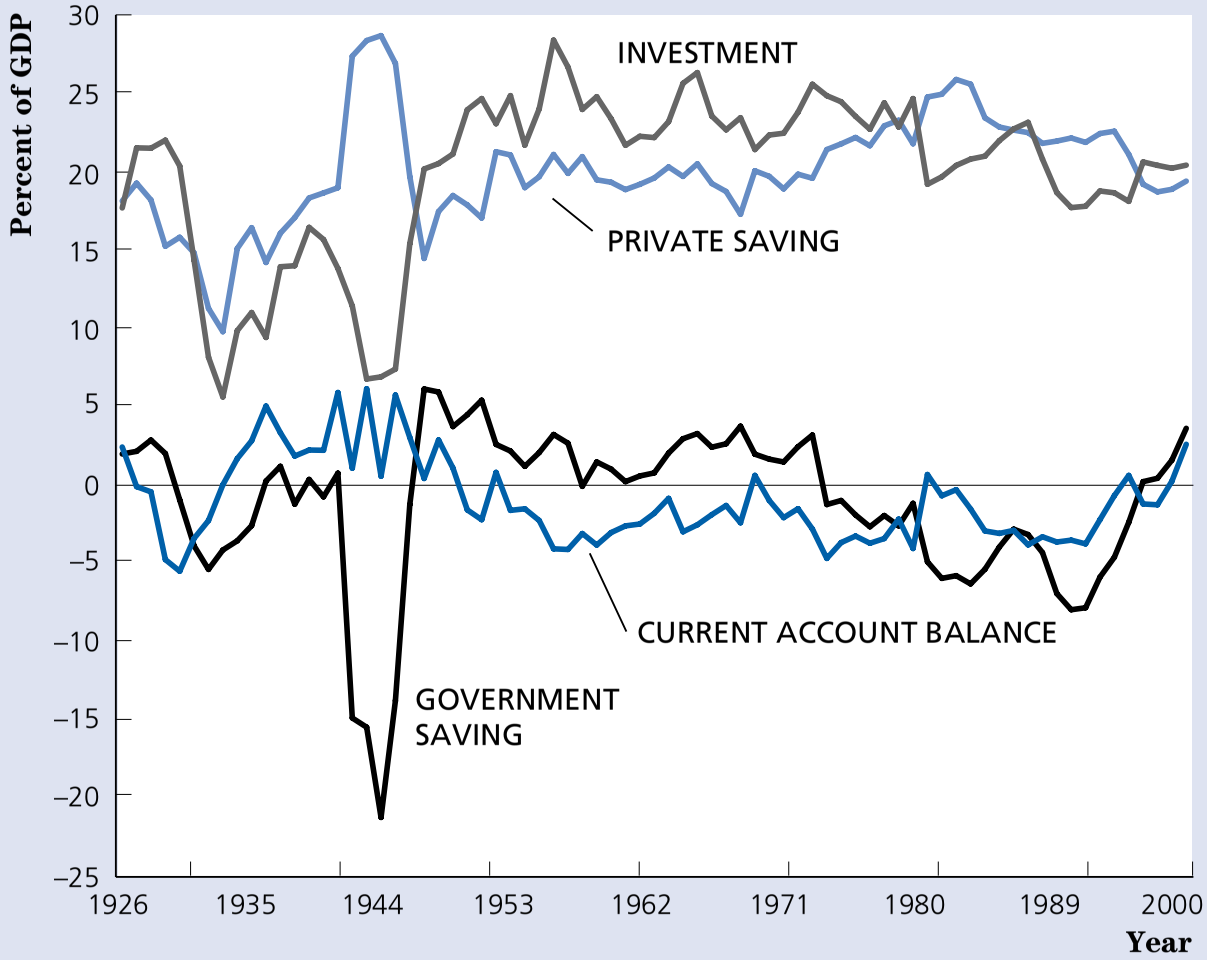


FIGURE 2.2

THE INFLATION RATE IN CANADA, 1951–2000

Here, inflation is measured as the annual percentage change in the GDP deflator. Inflation fell after the Korean War, then rose during the 1960s and 1970s, before falling sharply in the 1980s and again in the 1990s.

Source: Statistics Canada, CANSIM Series D100465.

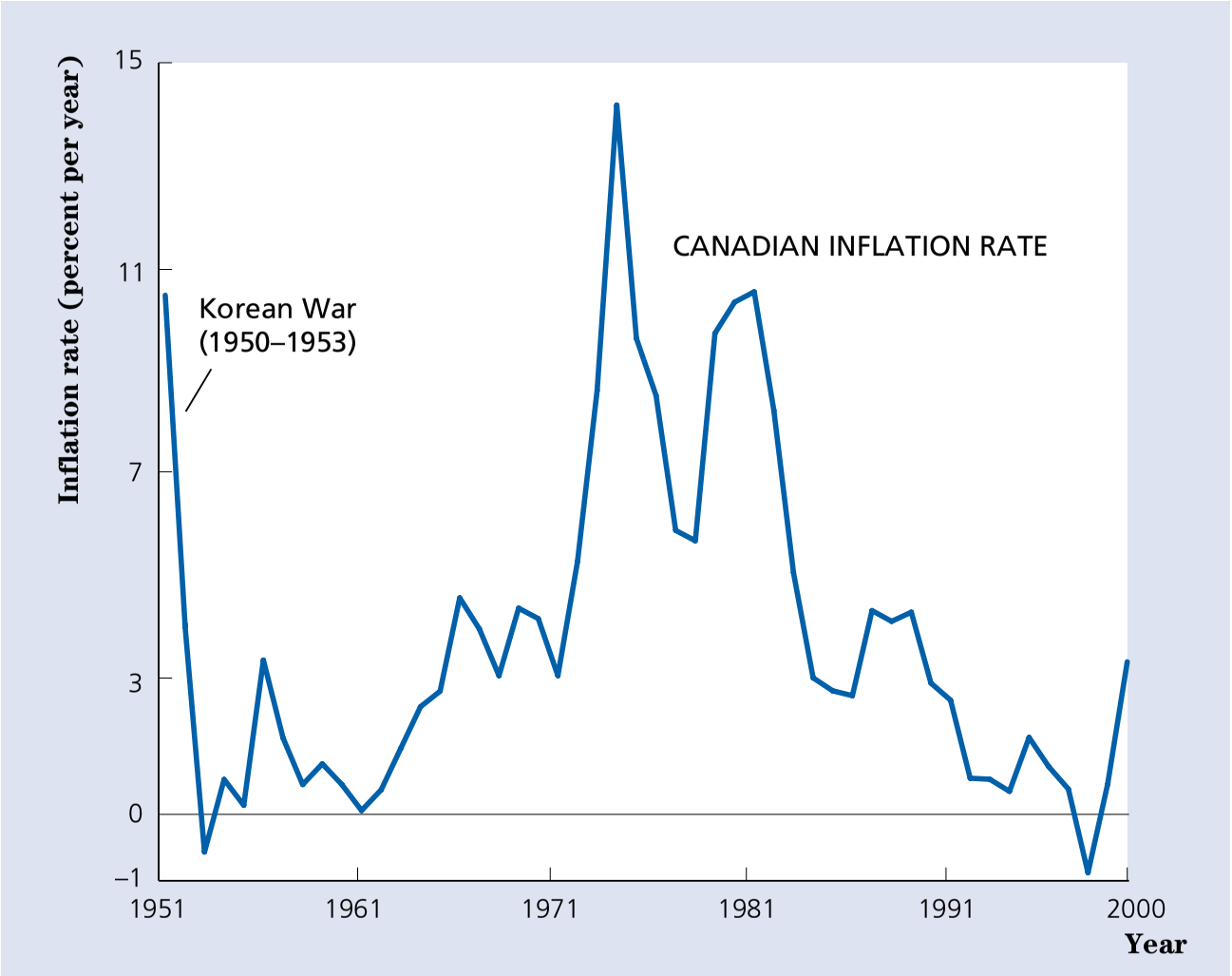


FIGURE 2.3

NOMINAL AND REAL INTEREST RATES IN CANADA, 1951–2001

The nominal interest rate shown is the interest rate on three-to-five-year Government of Canada bonds. The real interest rate is measured as the nominal interest rate minus the average inflation rate (using the GDP deflator) over the current and subsequent two years. The real interest rate was unusually low (actually negative) in the mid–1970s. In the early 1980s, both nominal and real interest rates were very high. Nominal interest rates did not fall as much as inflation did, so real interest rates were high again in the mid–1990s.

Source: The implict price deflator for GDP is the same as that in Figure 2.2. Inflation rates for 1998–2000 are assumed to be 1%. The average interest rate on three-to-five-year federal government bonds is reprinted with permission from the Bank of Canada, *Banking and Financial Statistics,* Table F1 or Statistics Canada, CANSIM B14010.

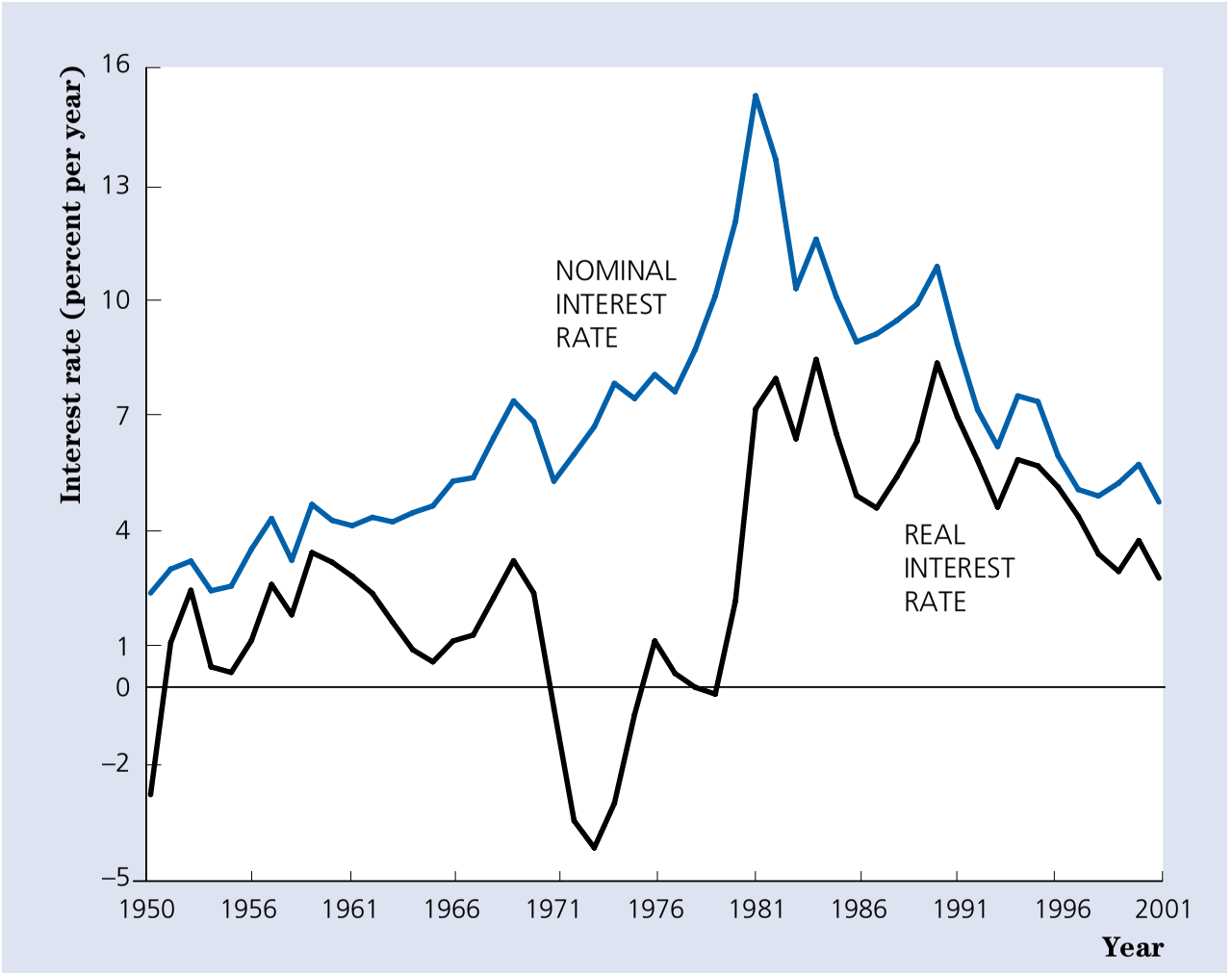


FIGURE 3.1

THE PRODUCTION FUNCTION RELATING OUTPUT AND CAPITAL

This production function shows how much output the Canadian economy could produce for each level of Canadian capital stock, holding labour and productivity at 2000 levels. Point *A* corresponds to the actual 2000 output and capital stock. The production function has diminishing marginal productivity of capital: Raising the capital stock by $100 billion in order to move from point *B* to point *C* raises output by $56 billion, but adding another $100 billion in capital to go from point *C* to point *D* increases output by only $49 billion.

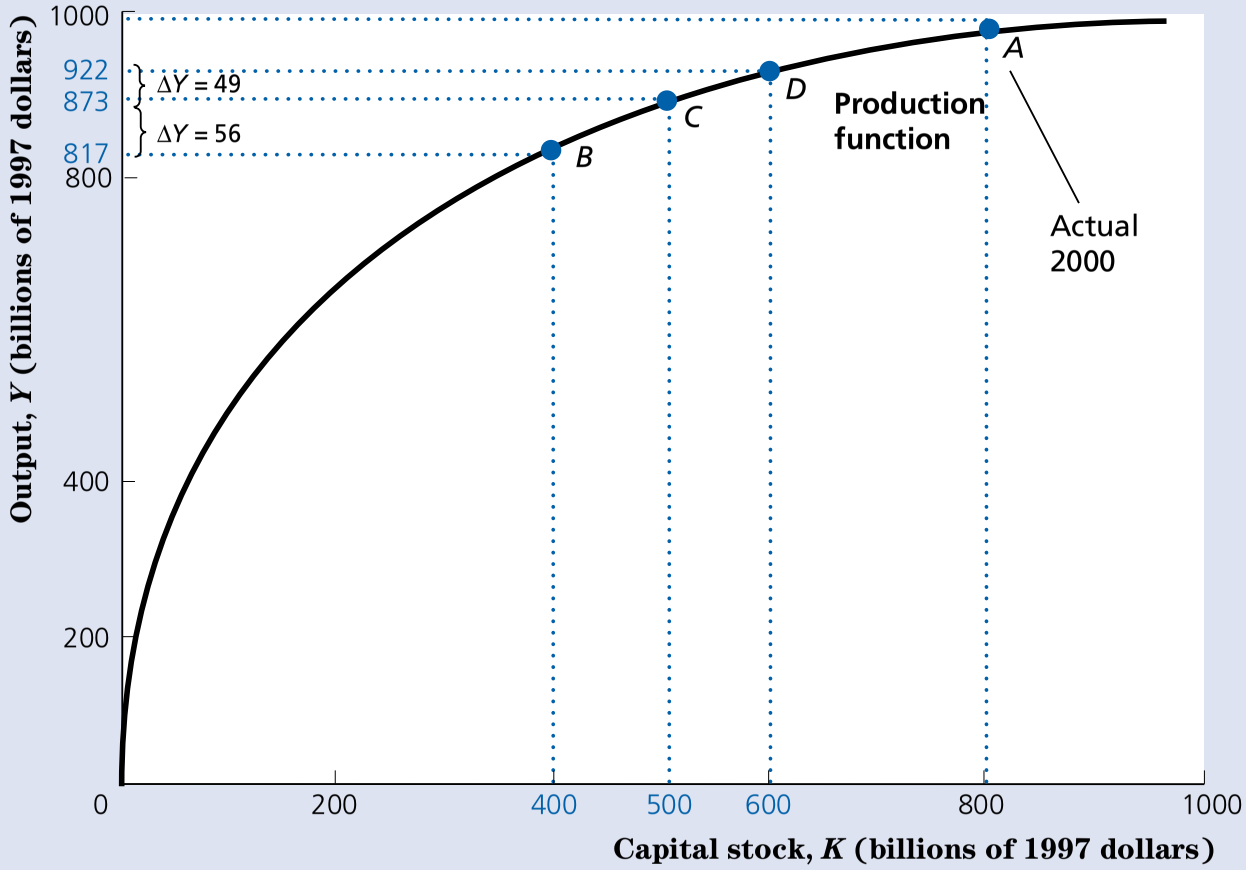


FIGURE 3.2

THE MARGINAL PRODUCT OF CAPITAL

The marginal product of capital (*MPK*) at any point can be measured as the slope of the line tangent to the production function at that point. Because the slope of the line tangent to the production function at point *B* is greater than the slope of the line tangent to the production function at point *D*, we know that the *MPK* is greater at *B* than at *D*. At higher levels of capital stock, the *MPK* is lower, reflecting diminishing marginal productivity of capital.

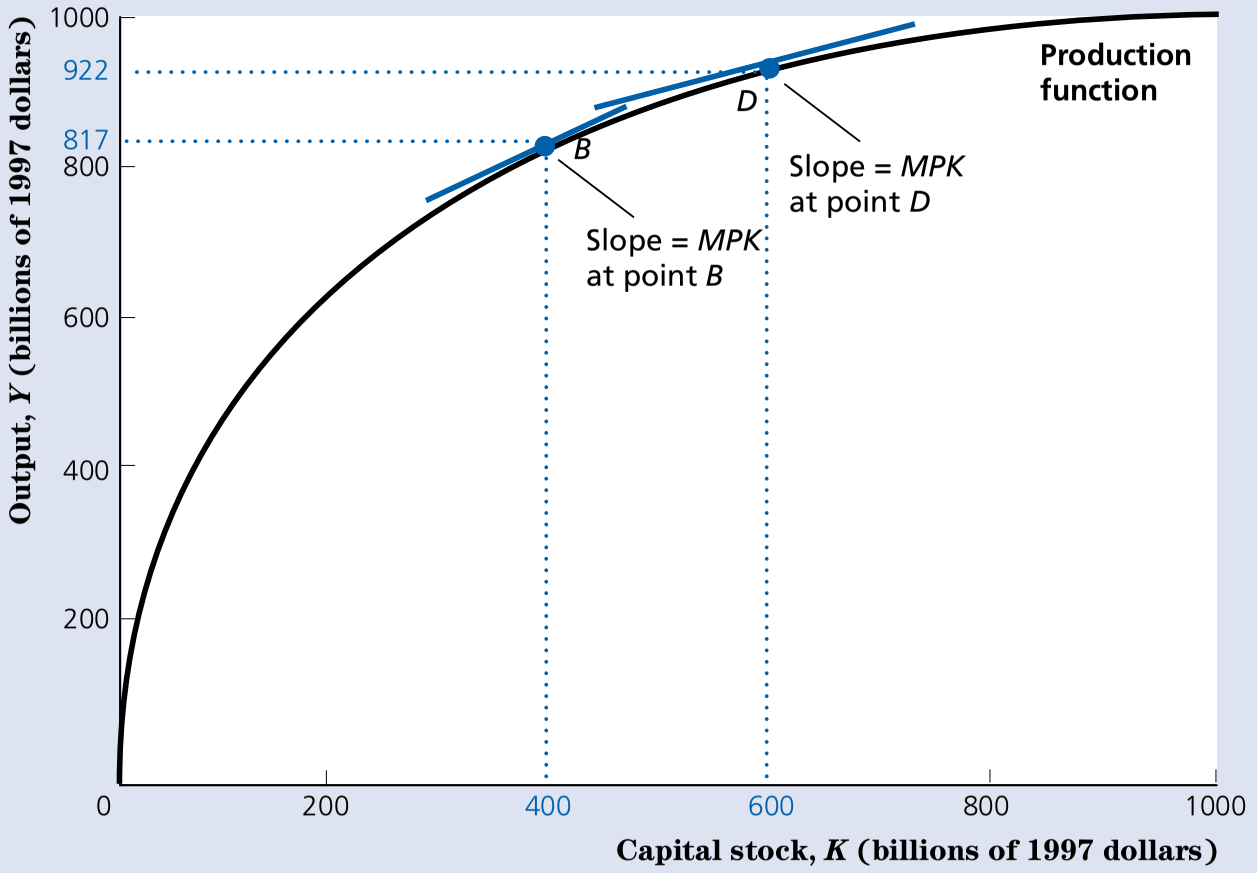


FIGURE 3.3

THE PRODUCTION FUNCTION RELATING OUTPUT AND LABOUR

This production function shows how much output the Canadian economy could produce at each level of employment (labour input), holding productivity and the capital stock constant at 2000 levels. Point *A* corresponds to actual 2000 output and employment. The marginal product of labour (*MPN*) at any point is measured as the slope of the line tangent to the production function at that point. The *MPN* is lower at higher levels of employment, reflecting diminishing marginal productivity of labour.

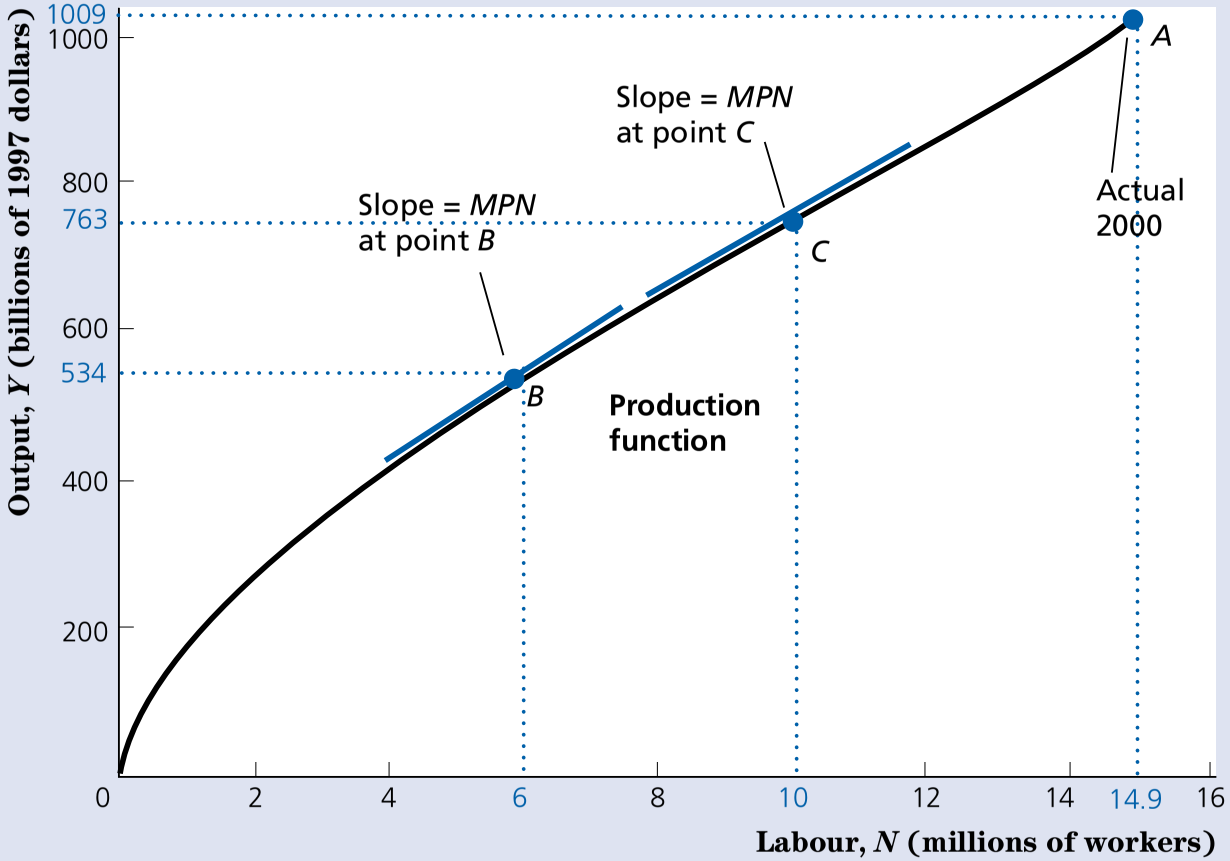


FIGURE 3.4

AN ADVERSE SUPPLY SHOCK THAT LOWERS THE *MPN*

An adverse supply shock is a downward shift of the production function. For any level of labour, the amount of output that can be produced is now less than before. The adverse shock reduces the slope of the production function at every level of employment.

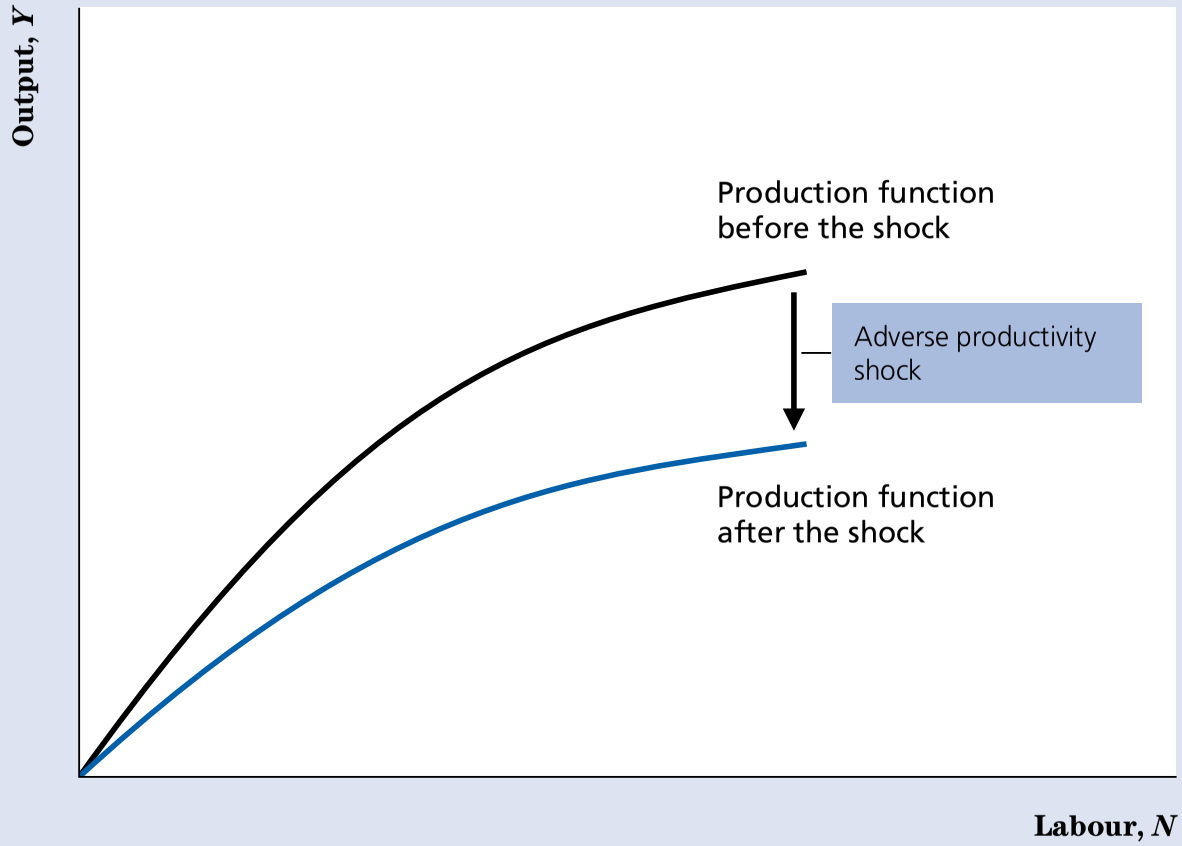


FIGURE 3.5

THE DETERMINATION OF LABOUR DEMAND

The amount of labour demanded is determined by locating the point on the *MPN* curve at which the *MPN* equals the real wage rate; the amount of labour corresponding to that point is the amount of labour demanded. For example, when the real wage is w^*, the *MPN* equals the real wage at point *A* and the quantity of labour demanded is N^*. The labour demand curve, *ND*, shows the amount of labour demanded at each level of the real wage. The labour demand curve is identical to the *MPN* curve.

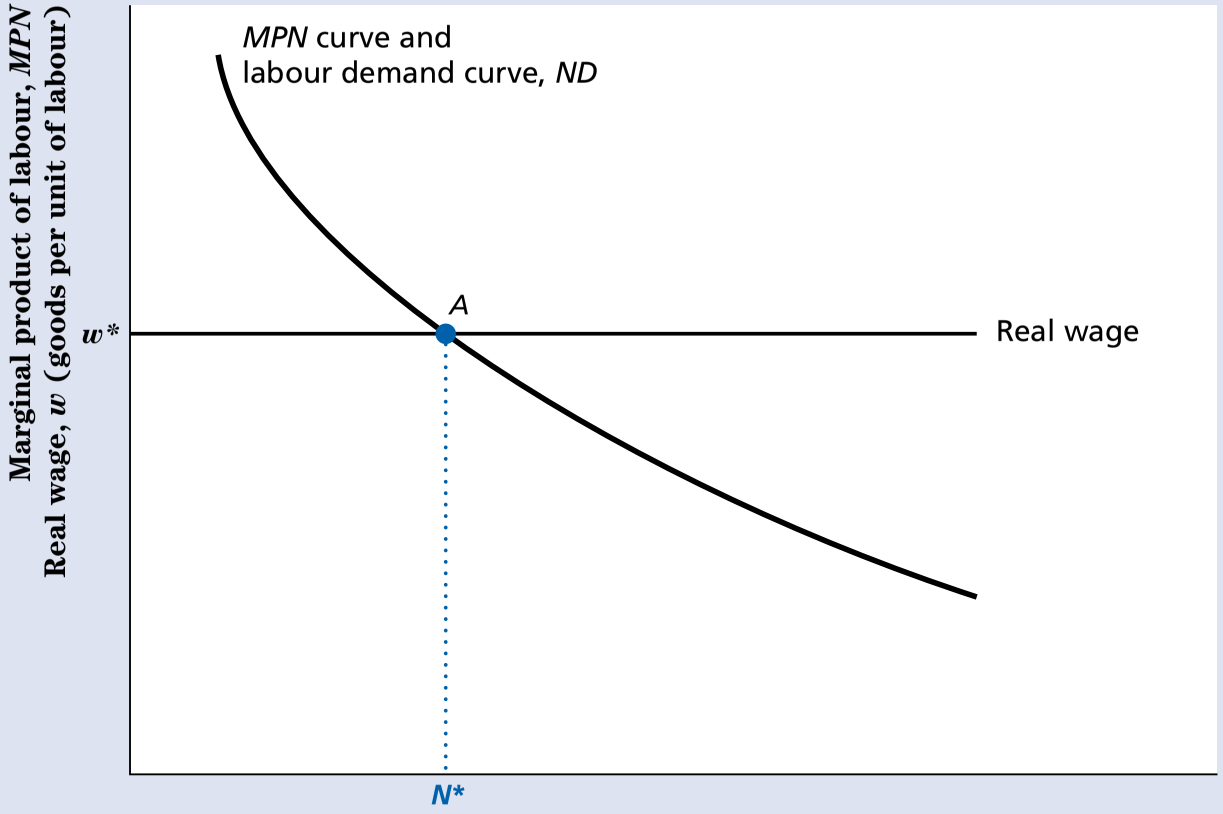


FIGURE 3.6

THE EFFECT OF A BENEFICIAL SUPPLY SHOCK ON LABOUR DEMAND

A beneficial supply shock that raises the *MPN* at every level of labour shifts the *MPN* curve upward and to the right. Because the labour demand curve is identical to the *MPN* curve, the labour demand curve shifts upward and to the right from ND^1 to ND^2. For any real wage, firms demand more labour after a beneficial supply shock.

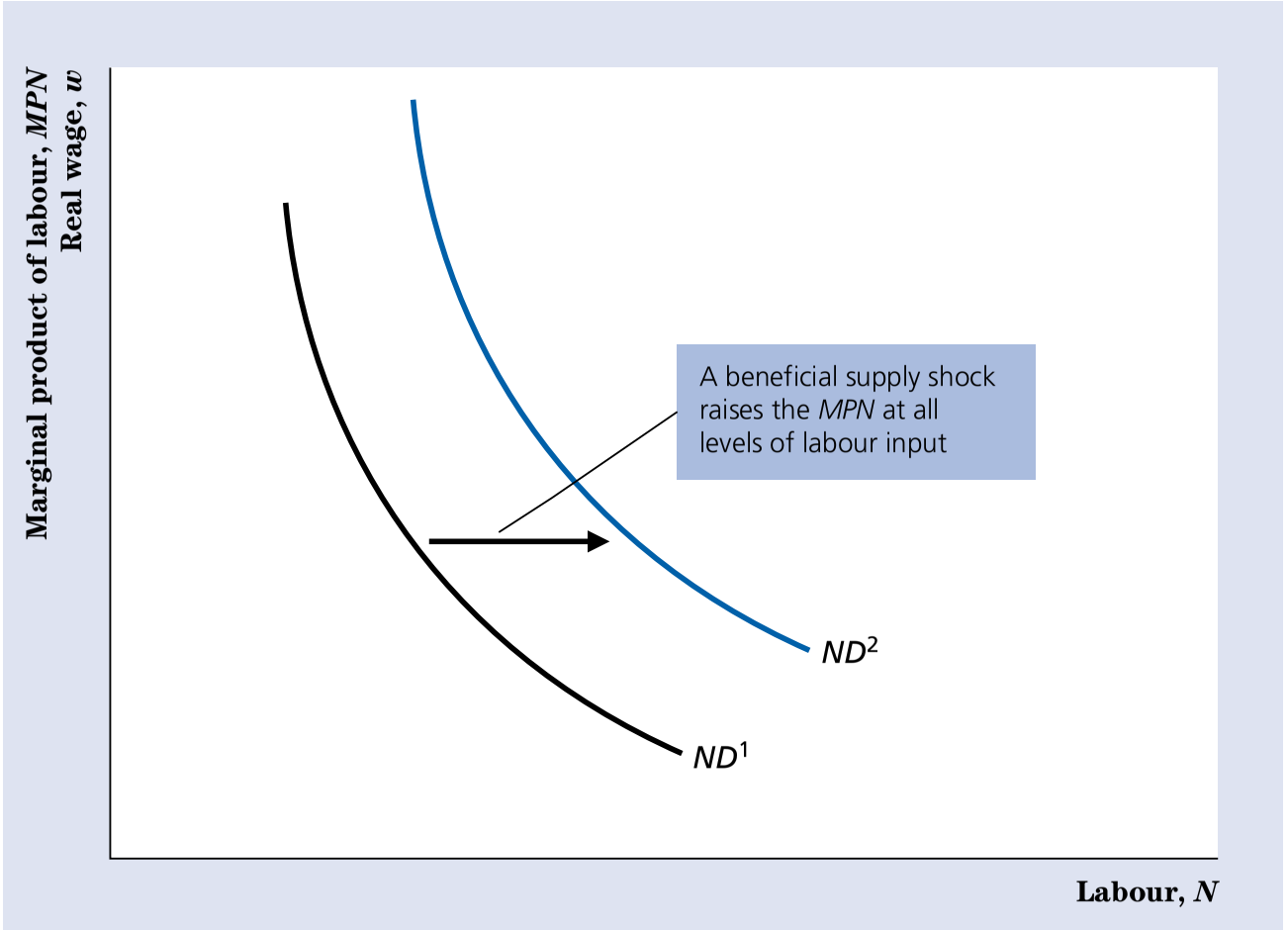


FIGURE 3.7

THE LABOUR SUPPLY CURVE OF AN INDIVIDUAL WORKER

The horizontal axis shows the amount of labour that a worker will supply for any given current real wage on the vertical axis. The labour supply curve slopes upward, indicating that—with other factors including the expected future real wage held constant—an increase in the current real wage raises the amount of labour supplied.

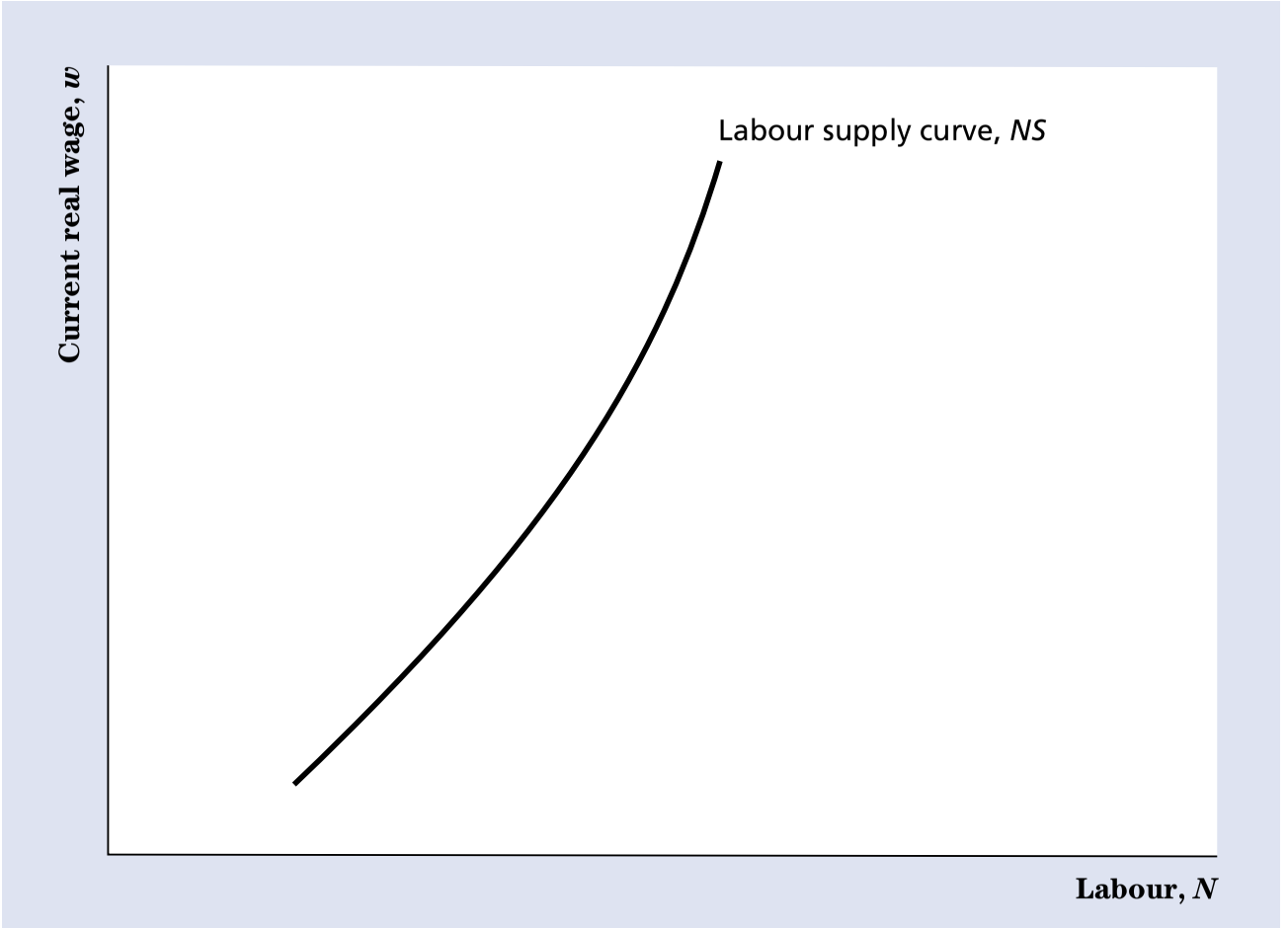


FIGURE 3.8

THE EFFECT ON LABOUR SUPPLY OF AN INCREASE IN WEALTH

An increase in wealth reduces the amount of labour supplied at any real wage. Therefore, an increase in wealth causes the labour supply curve to shift to the left. Similarly, an increase in the expected future real wage, which has the effect of making the worker wealthier, reduces the amount of labour supplied at any given current real wage and shifts the labour supply curve to the left.

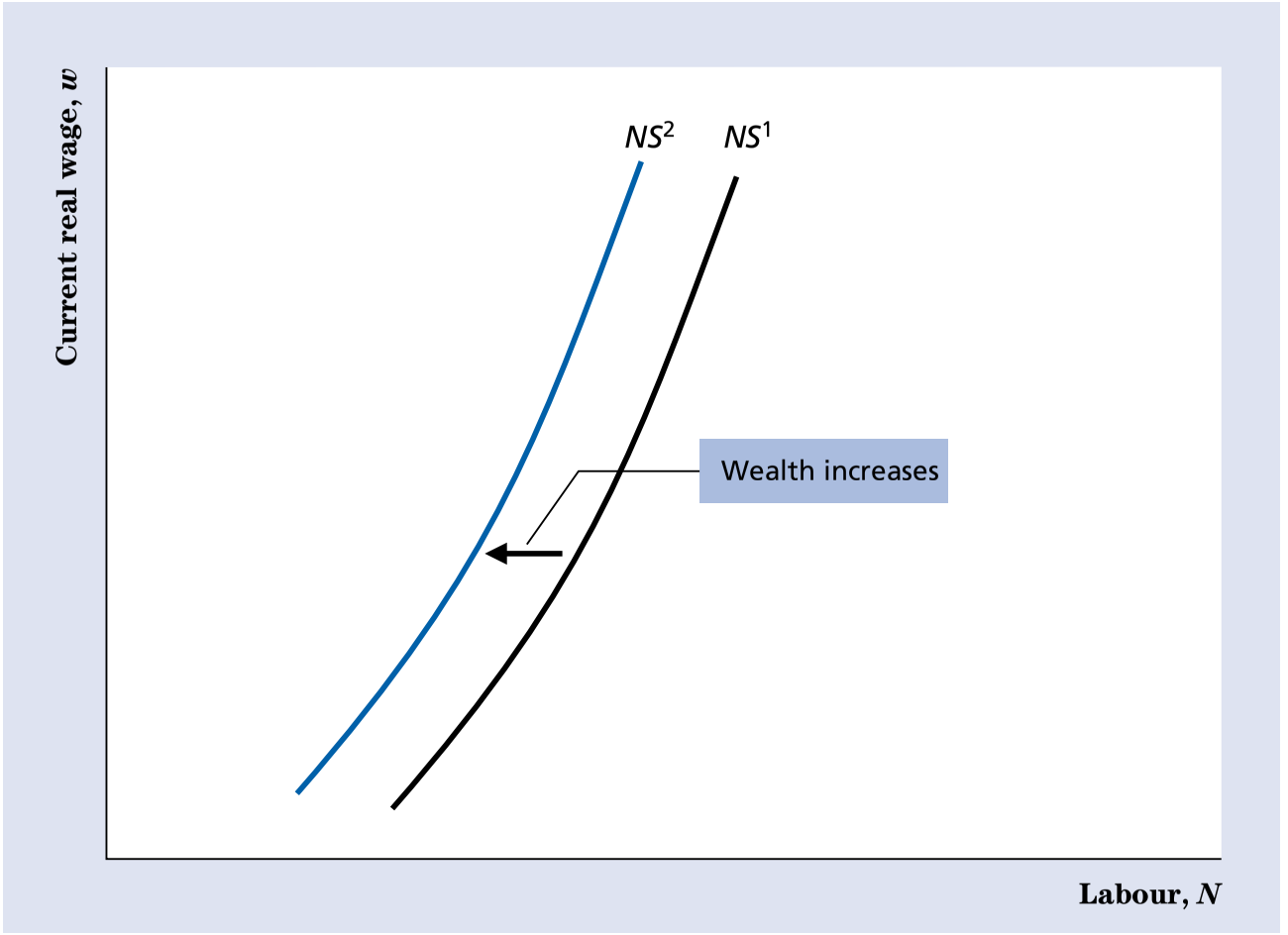
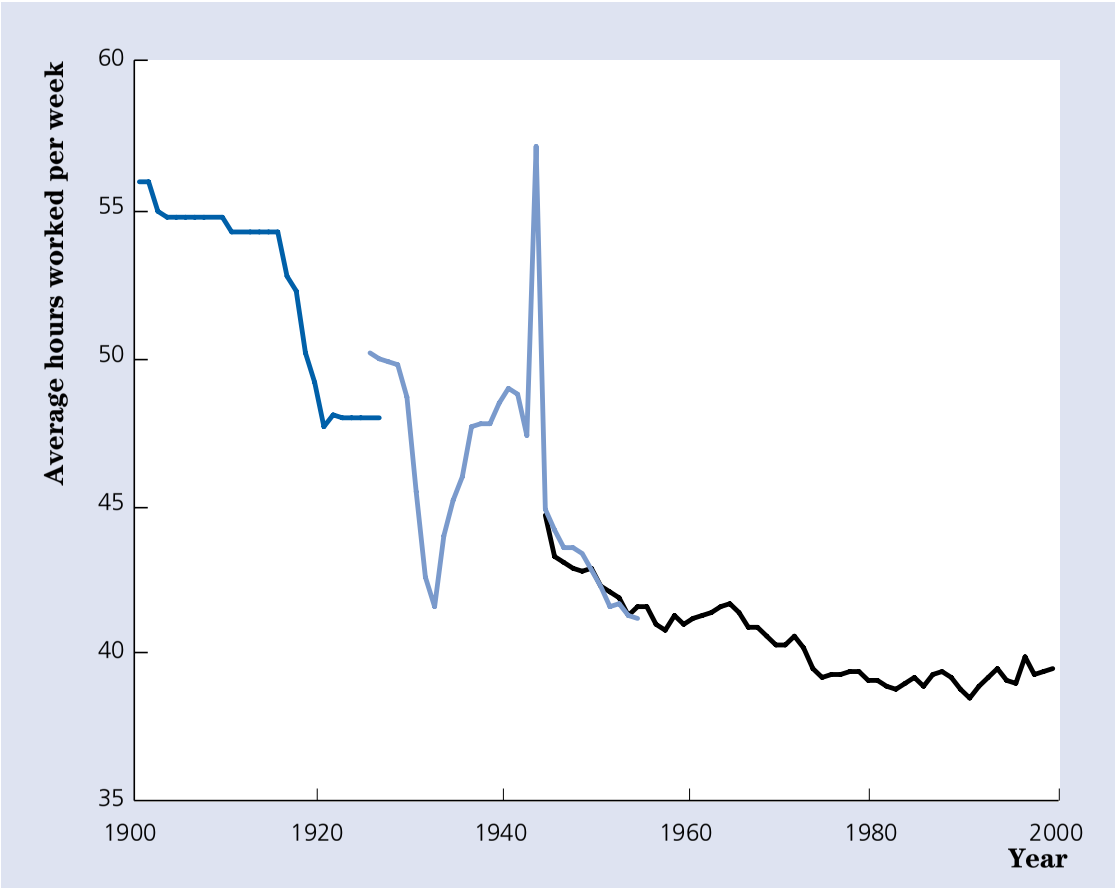


FIGURE 3.9

AVERAGE WEEKLY HOURS, CANADIAN MANUFACTURING

Reflecting the income effect of wages on labour supply, the steady increase in the real wage in Canada during the 20th century tended to reduce the average weekly hours of manufacturing workers. Weekly hours fluctuated sharply during the Great Depression and World War II, then declined further in the postwar period.



Source: For 1901–1927, average weekly hours of machinists in Halifax, Montreal, Toronto, Winnipeg, and Vancouver: Adapted from *Wages and Hours of Labour in Canada, 1901–1920,* Report No. 1, Department of Labour, Canada, Table II(d) and *Wages and Hours of Labour in Canada, 1920–1927,* Report No. 11, Department of Labour, Canada, Table I(b). For 1926–1955, average weekly hours of non-agricultural workers: *Historical Statistics of Canada,* (1st ed., 1965), Series D408. For 1945–2000, average weekly hours in manufacturing: *Historical Statistics of Canada,* Series E131, and *Employment, Earnings, and Wages,* Statistics Canada, cat. no. 72-002.

FIGURE 3.10

THE WORKWEEK AND REAL GDP PER PERSON IN 35 COUNTRIES

The point corresponding to each country shows the country's real GDP per person in 1988 on the horizontal axis and the average number of hours worked per week in manufacturing on the vertical axis. Because of the income effect on labour supply, richer countries tend to have short workweeks.

Source: Average hours per week: Based on *United Nations Statistical Yearbook, 1988–1989,* Table 41, p. 316; real GDP per capita in 1985 dollars: Based on Robert Summers and Alan Heston, "The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950–1988," *Quarterly Journal of Economics,* May 1991, pp. 327–368, Table II.

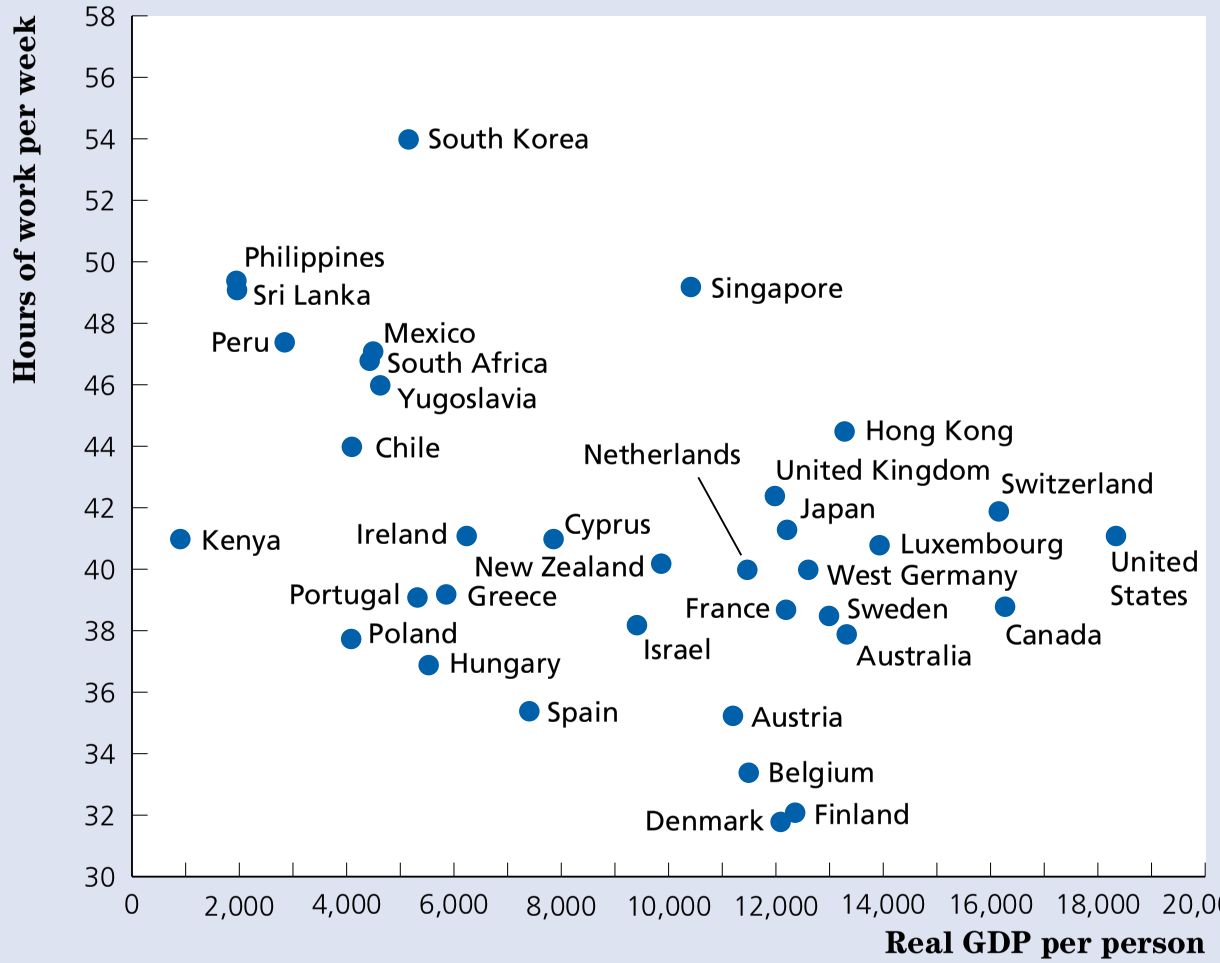


FIGURE 3.11

LABOUR MARKET EQUILIBRIUM

The quantity of labour demanded equals the quantity of labour supplied at point *E*. The equilibrium real wage is $\overline{w}$, and the corresponding equilibrium level of employment is $\overline{N}$, the full-employment level of employment.

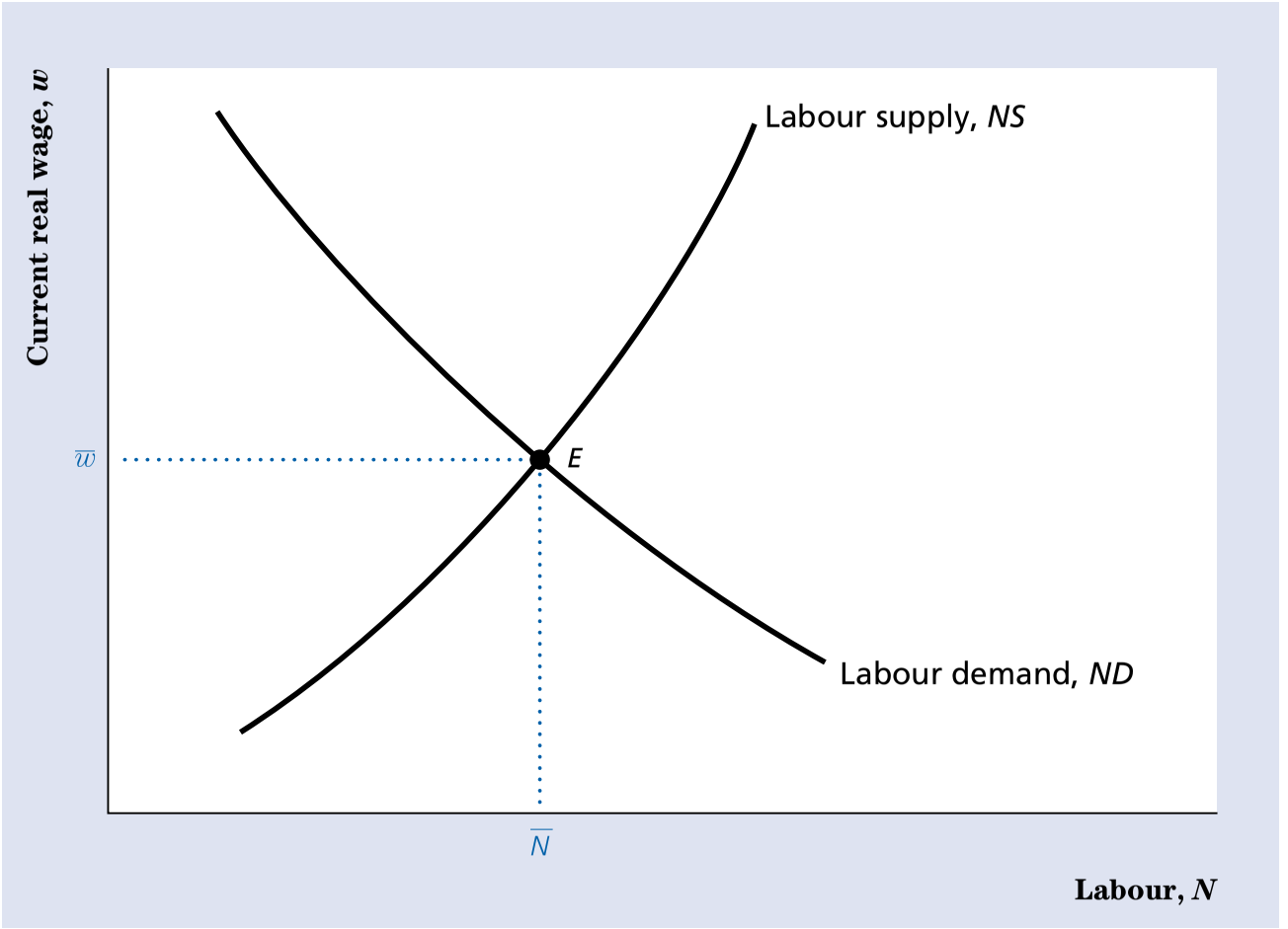


FIGURE 3.12

EFFECTS OF A TEMPORARY ADVERSE SUPPLY SHOCK ON THE LABOUR MARKET

An adverse supply shock that lowers the marginal product of labour (see Figure 3.4) reduces the quantity of labour demanded at any real wage level. Thus, the labour demand curve shifts left, from ND^1 to ND^2, and the labour market equilibrium moves from point *A* to point *B*. The adverse supply shock causes the real wage to fall from $\overline{w}_1$ to $\overline{w}_2$ and reduces the full-employment level of employment from $\overline{N}_1$ to $\overline{N}_2$.

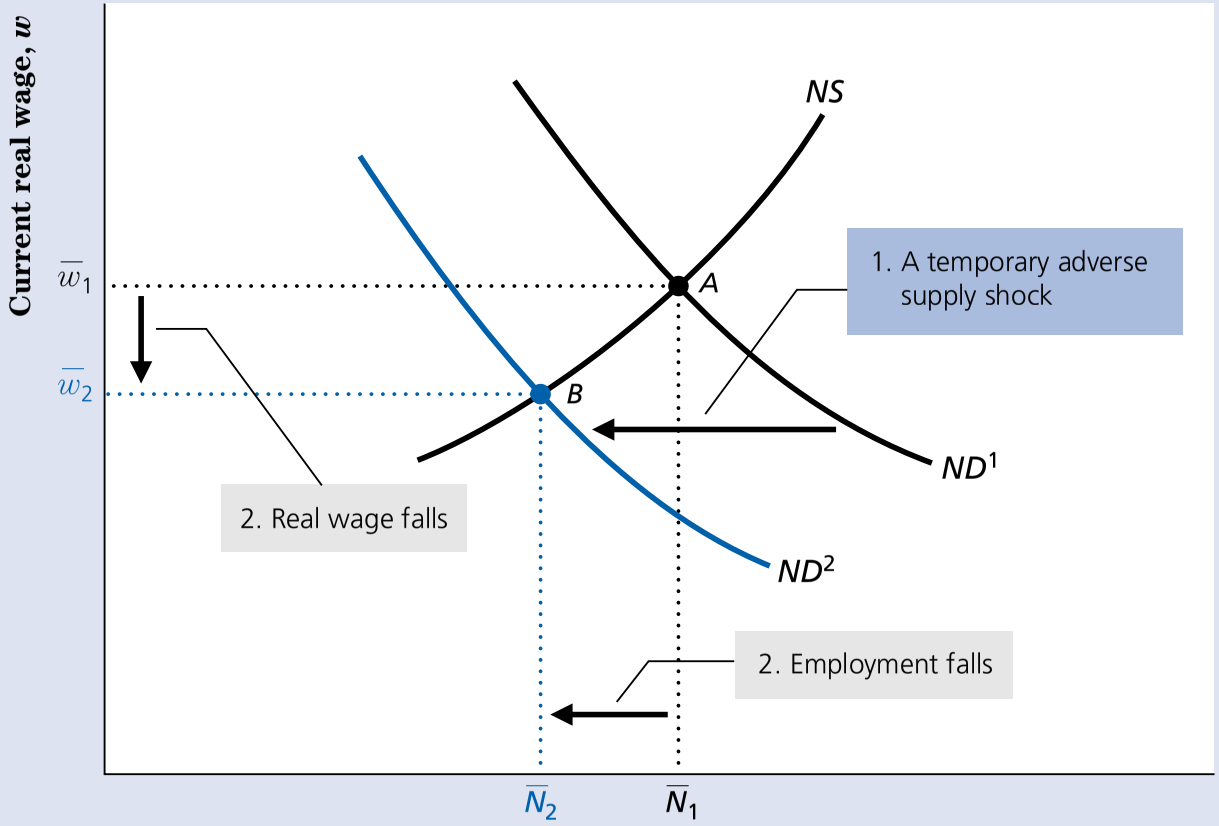
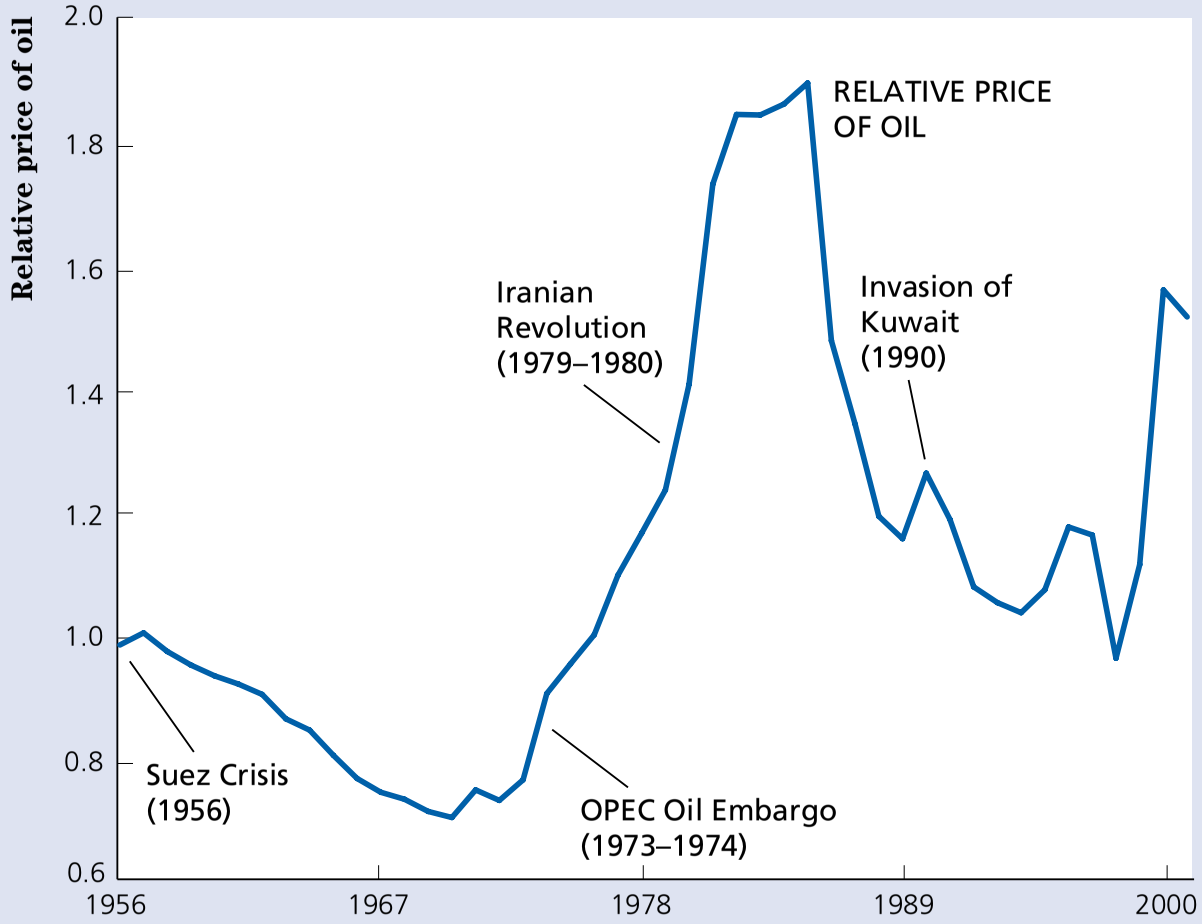


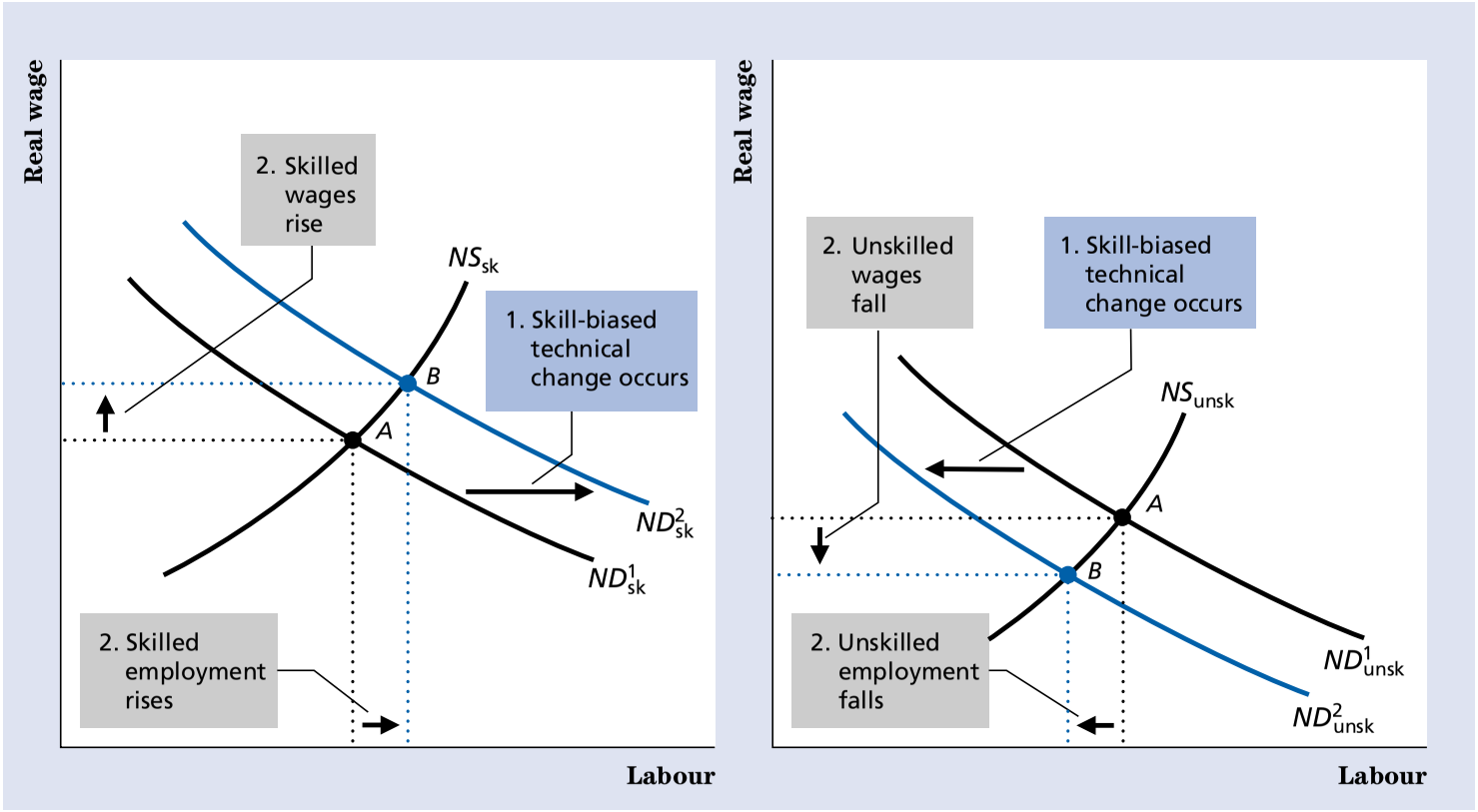
FIGURE 3.13

RELATIVE PRICE OF OIL, 1956–2001

The figure shows the industrial product price index of refined petroleum relative to the GDP deflator. Note the impact of the 1973-1974 and 1979-1980 oil shocks, the decline in petroleum prices during the second half of the 1980s, and the temporary jump in the price of oil in 2000 following output reductions by OPEC.

Source: GDP deflator: Statistics Canada, CANSIM Series D100465. Data prior to 1981 are not chain-weighted and so have been spliced. Oil price: industrial product price index, refined petroleum, Statistics Canada, CANSIM P3275.





(a) Skilled workers **(b) Unskilled workers**

FIGURE 3.14

THE EFFECTS OF SKILL-BIASED TECHNICAL CHANGE ON WAGE INEQUALITY

The supply and demand for skilled labour is shown in (a), and the supply and demand for unskilled labour is shown in (b). The initial equilibrium is shown as point *A* in both parts. Because skilled workers have a higher *MPN* than unskilled workers, their real wage is higher.

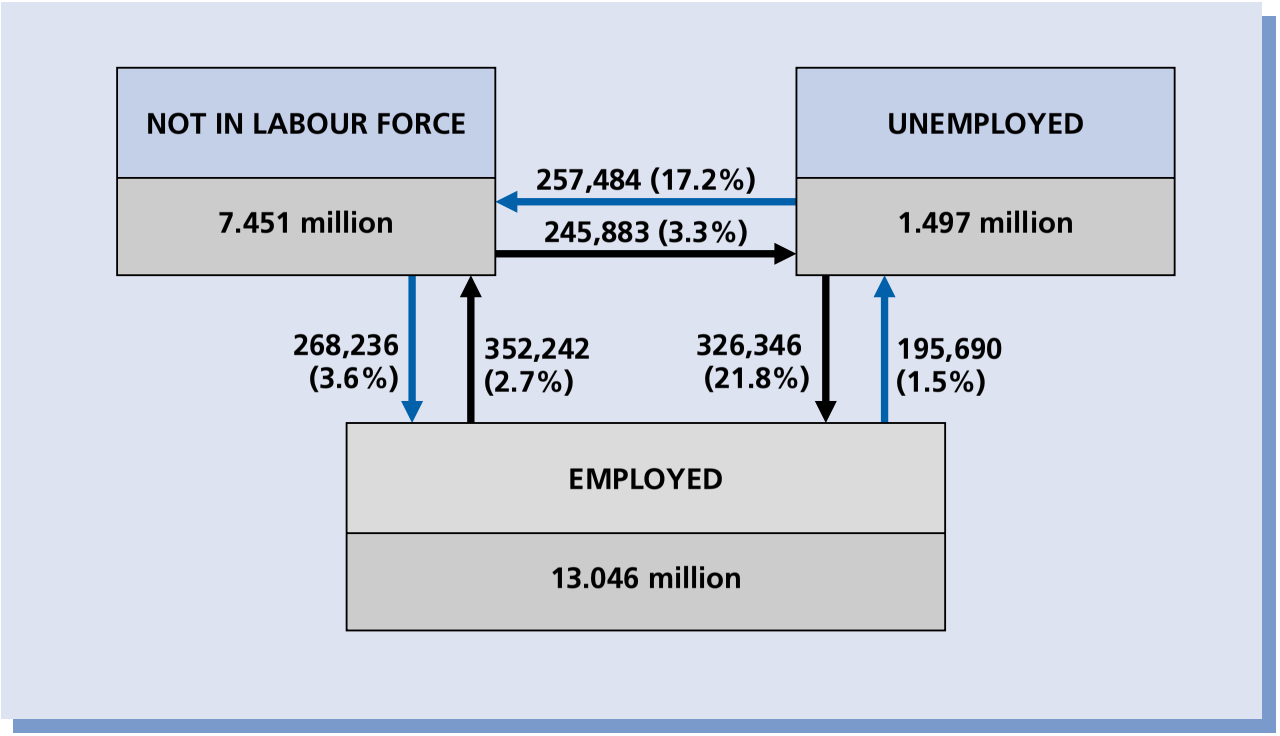
A skill-biased technical change increases the *MPN* of skilled workers relative to the *MPN* of unskilled workers. A rise in the *MPN* of skilled workers raises the demand, from ND^1_{sk} to ND^2_{sk} in (a). If the *MPN* of unskilled workers actually falls, demand for unskilled labour falls, from ND^1_{unsk} to ND^2_{unsk} in (b). At the new equilibrium, point *B* in both parts, the wages of skilled workers have risen relative to those of unskilled workers.

FIGURE 3.15

CHANGES IN EMPLOYMENT STATUS IN A TYPICAL MONTH

The arrow between two boxes represents a change from one employment status to another; the label on the arrow shows the number of people in one status who switched to the other status in a typical month, during the period 1990–1994. For example, the arrow from the unemployed box to the employed box shows that 326,346 unemployed workers (21.8% of the unemployed) became employed the following month. The arrow from the employed box to the unemployed box shows that 195,690 employed workers (1.5% of the employed) became unemployed during the following month.

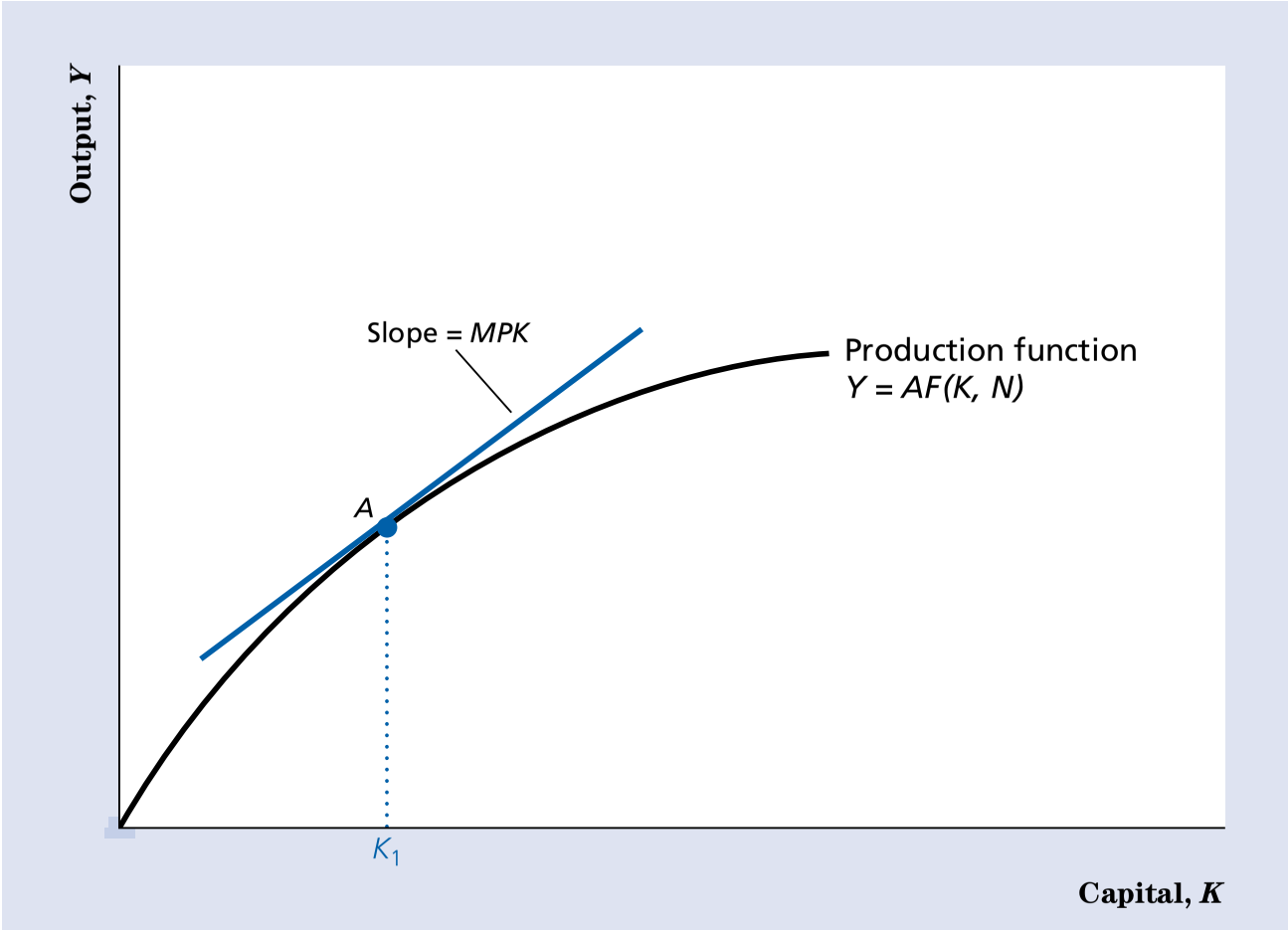
Source: Adapted from Stephen R. G. Jones and W. Craig Riddell, "Gross Flows of Labour in Canada and the United States," *Canadian Public Policy*, February 1998, pp. 103–120.



Key Diagram 1

The Production Function

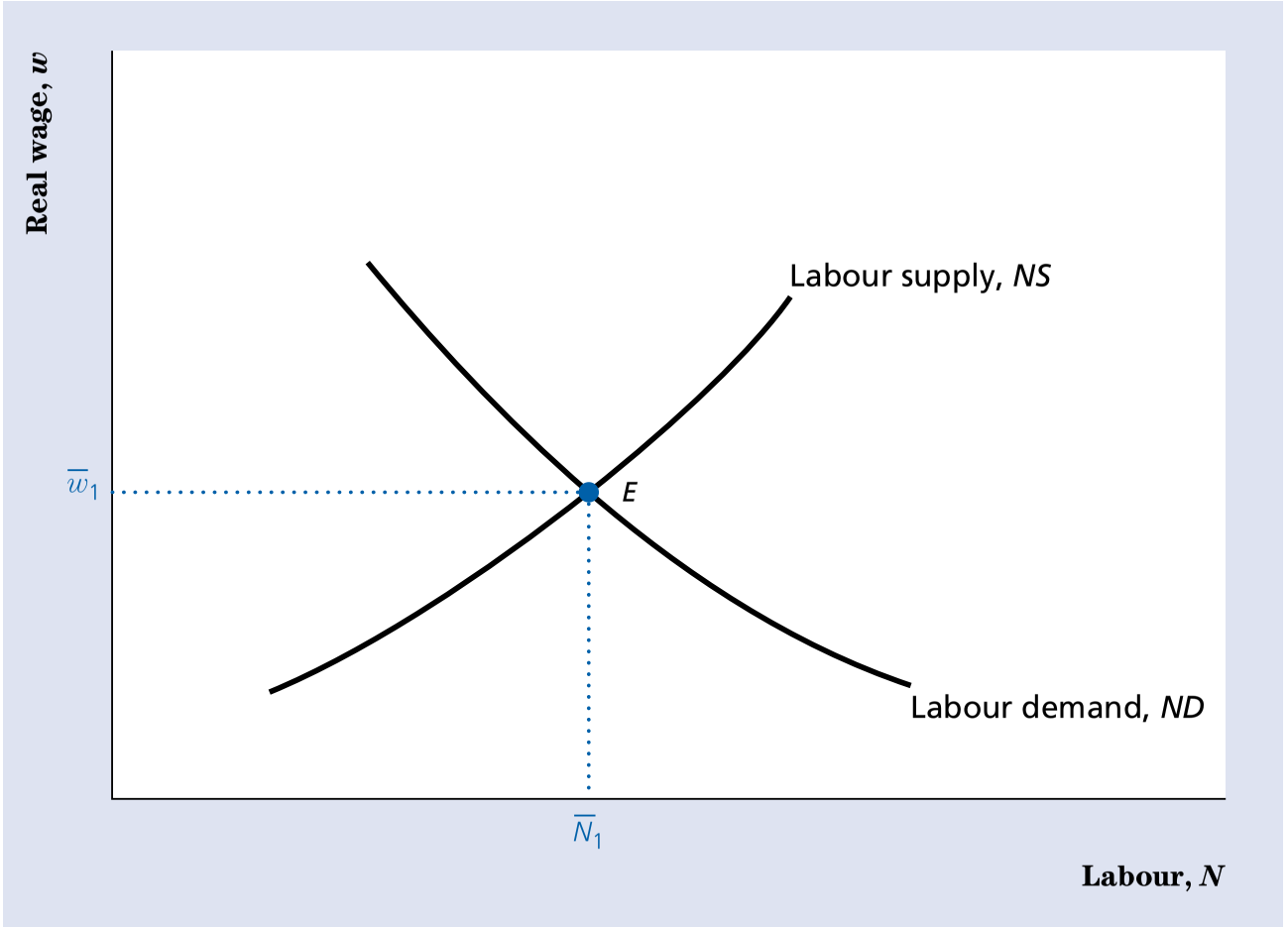
The production function indicates how much output an economy or a firm can produce with any given quantities of capital and labour.



KEY DIAGRAM 2

THE LABOUR MARKET

An economy's level of employment and the real wage are determined in the labour market.



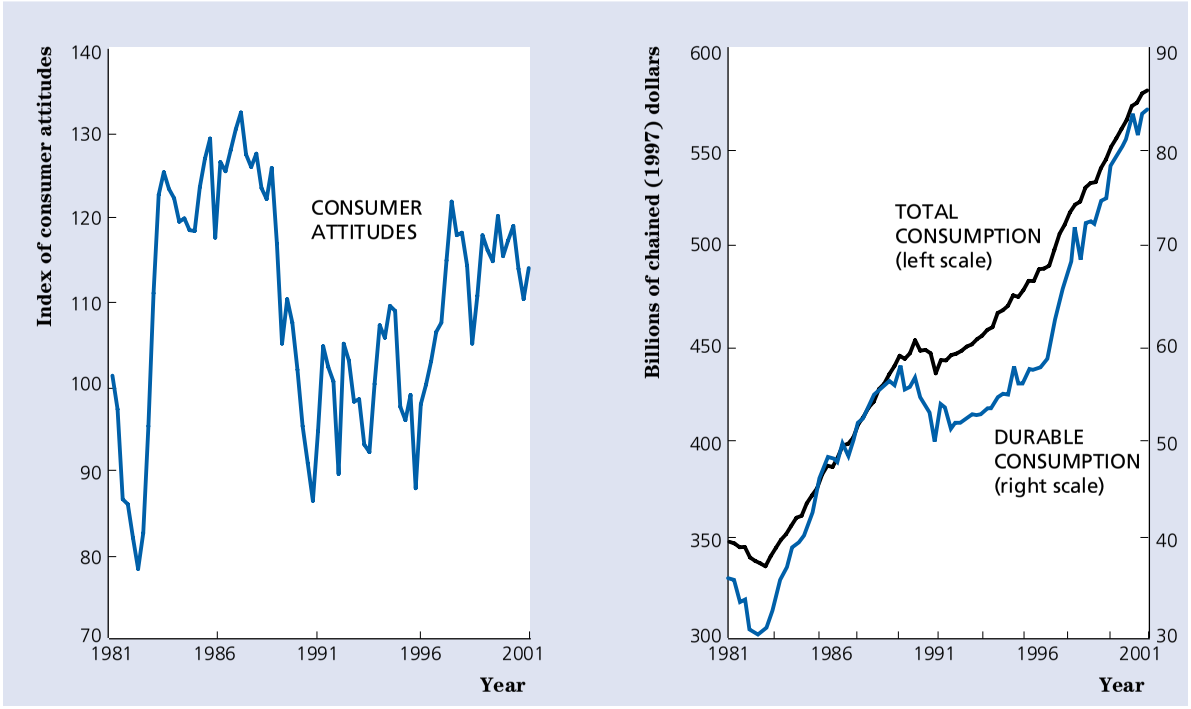


FIGURE 4.1(a)

THE INDEX OF CONSUMER ATTITUDES, 1981–2001

The quarterly index of consumer attitudes is based on what consumers tell interviewers about their expectations for the future of the economy. The index of consumer attitudes dipped deeply but briefly during the early 1980s. In the early 1990s it fell for a longer period, then rose to a higher level during the late 1990s.

Source: CBISA—Index of Consumer Attitudes, All Respondents, Canada & Regions, Seasonally Adjusted. The Conference Board of Canada, 2001. The Conference Board of Canada is a membership-based, not-for-profit, independent applied-research organization.

FIGURE 4.1(b)

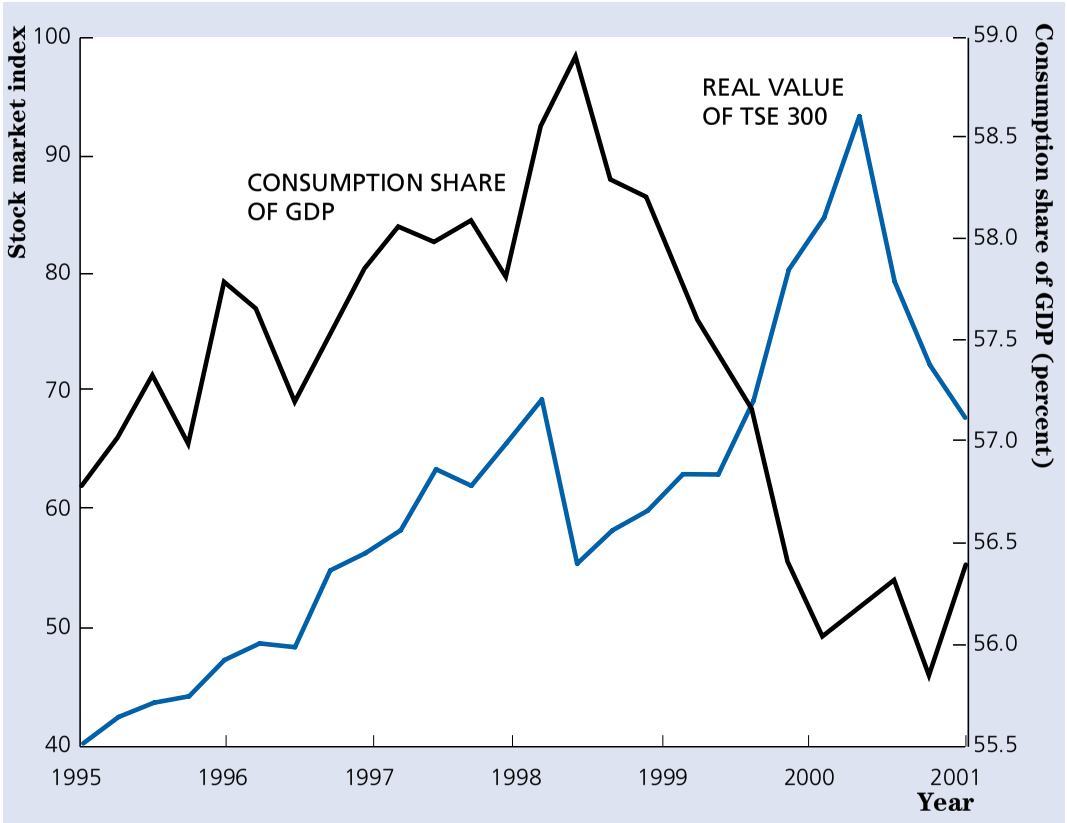
TOTAL CONSUMPTION EXPENDITURES AND CONSUMPTION EXPENDITURES ON DURABLE GOODS, 1981–2001

Total consumption expenditures are measured on the left vertical axis, and consumption expenditures on durable goods are measured on the right vertical axis. Total consumption expenditures fell but then recovered quickly in the early 1980s. In the early 1990s, they fell again but recovered more slowly. Consumption expenditures on durable goods reacted more strongly, but with a similar pattern over the past twenty years.

Source: Personal consumption expenditures and durable goods consumption expenditures in billions of chained 1997 dollars: Statistics Canada, CANSIM Series D100199 and D100200.

FIGURE 4.2

STOCK MARKET VALUE AND CONSUMPTION AS A SHARE OF GDP, 1995–2001



The real value of the TSE 300 price index (found by dividing by the CPI) is measured on the left vertical axis. Personal consumption expenditures, measured as a percentage of GDP, are measured on the right vertical axis. Note that the measure of stock market wealth and the consumption share rose together during the mid–1990s. But the consumption share of GDP peaked near 59% in the middle of 1998, even though stock prices fell early in 1998. The peak in the consumption share long preceded the peak in the real value of the stock market, which suggests that factors other than stock market wealth were the main causes of changes in consumption during this period.

Source: Quarterly average value of the TSE 300: Statistics Canada, CANSIM Series B4237; quarterly average CPI: CANSIM Series P100000; personal consumption expenditures and GDP in current dollars: CANSIM Series D14817 and D14840. Dividends have not been included in valuing the stock market.

FIGURE 4.3

DETERMINATION OF THE DESIRED CAPITAL STOCK

The desired capital stock (50 cubic metres of oven capacity in this example) is the capital stock that maximizes profits. When the capital stock is 50 cubic metres, the expected future marginal product of capital MPK^f is equal to the user cost of capital *uc*. If the MPK^f is larger than *uc*, as it is when the capital stock is 40 cubic metres, the benefit of extra capital exceeds the cost, and the firm should increase its capital stock. If the MPK^f is smaller than *uc*, as it is at 60 cubic metres, the cost of extra capital exceeds the benefit, and the firm should reduce its capital stock.

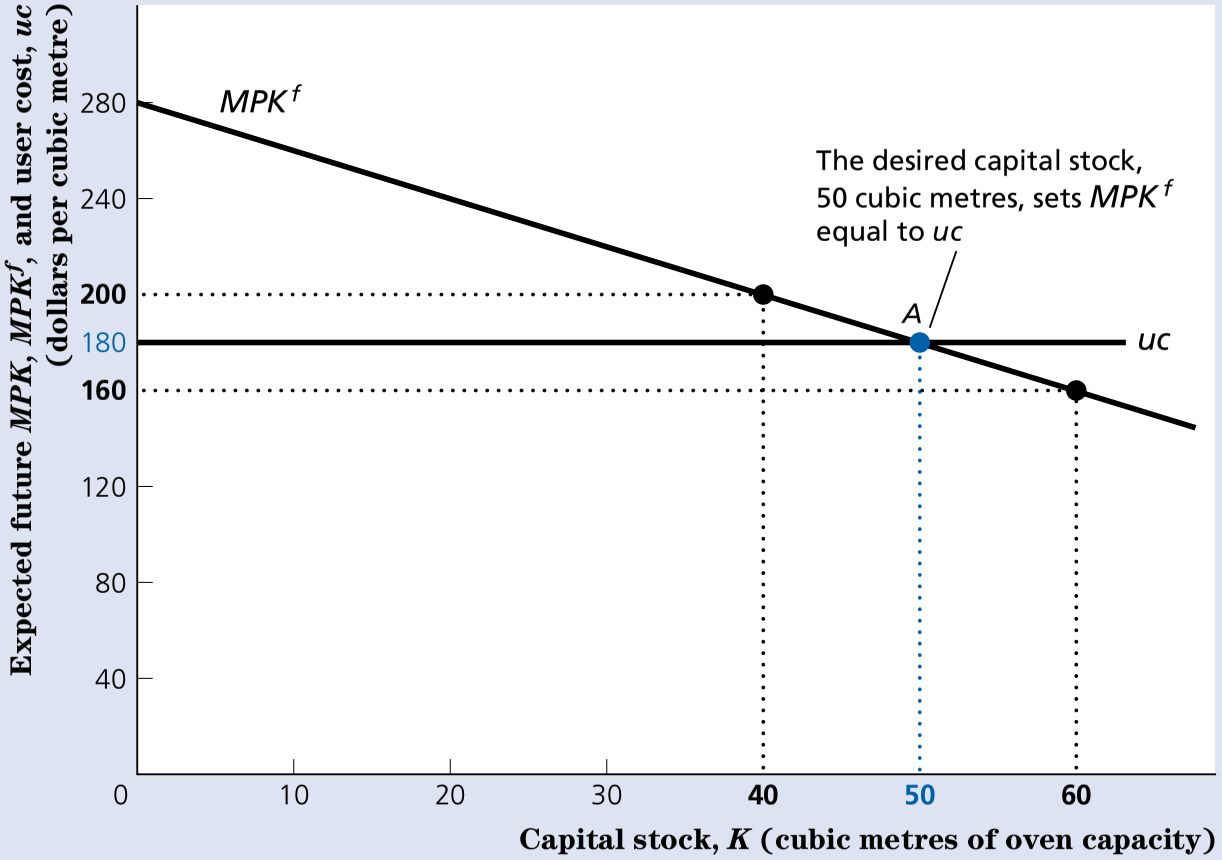


FIGURE 4.4

A DECLINE IN THE REAL INTEREST RATE RAISES THE DESIRED CAPITAL STOCK

For the Tony's Bakery example, a decline in the real interest rate from 8% to 6% reduces the user cost, *uc*, of a cubic metre of oven capacity from $180 to $160 per cubic metre and shifts the user cost line down from uc^1 to uc^2. The desired capital stock rises from 50 (point *A*) to 60 (point *C*) cubic metres of oven capacity. At 60 cubic metres, the MPK^f and the user cost of capital again are equal, at $160 per cubic metre.

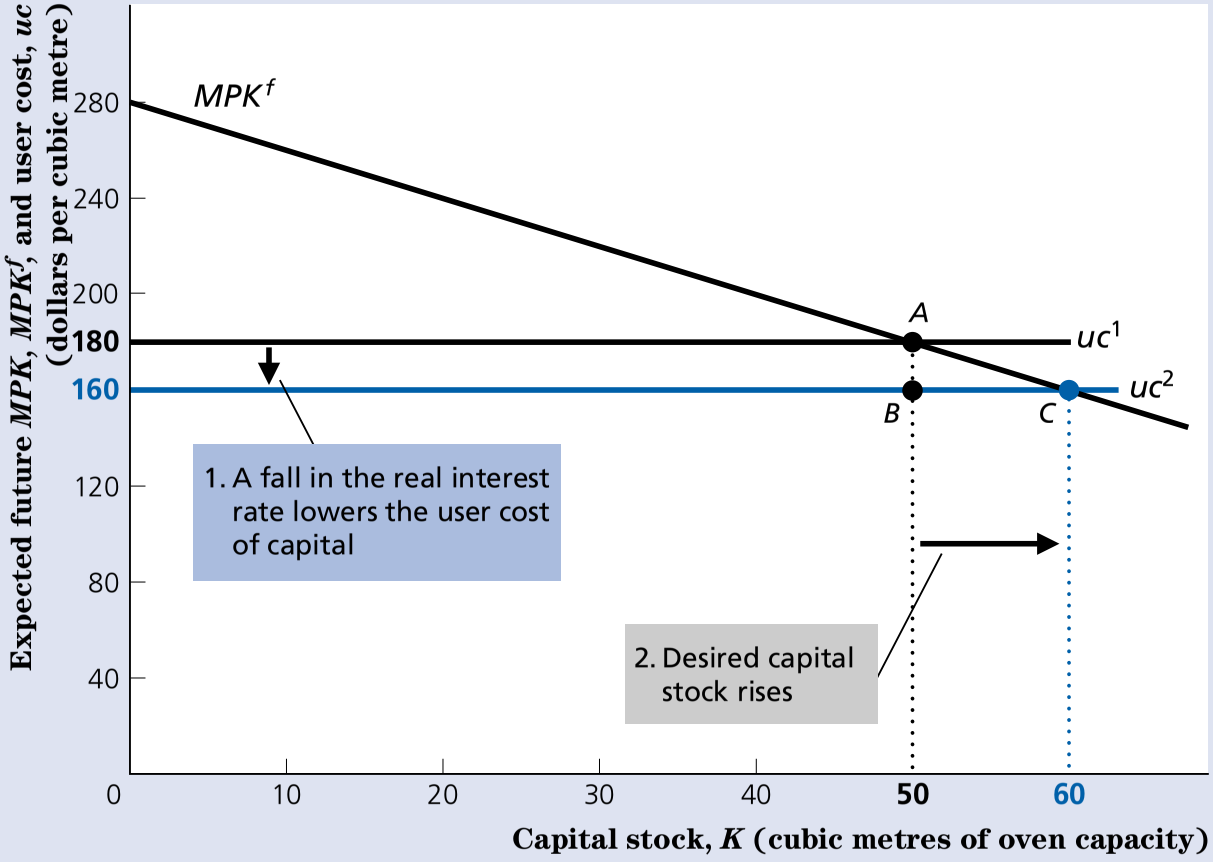


FIGURE 4.5

AN INCREASE IN THE EXPECTED FUTURE *MPK* RAISES THE DESIRED CAPITAL STOCK

A technological advance raises the expected future marginal product of capital, MPK^f, shifting the MPK^f curve upward *from* MPK^{f1} to MPK^{f2}. The desired capital stock increases from 50 (point *A*) to 60 (point *D*) cubic metres of oven capacity. At 60 cubic metres, the MPK^f equals the user cost of capital *uc* at $180 per cubic metre.

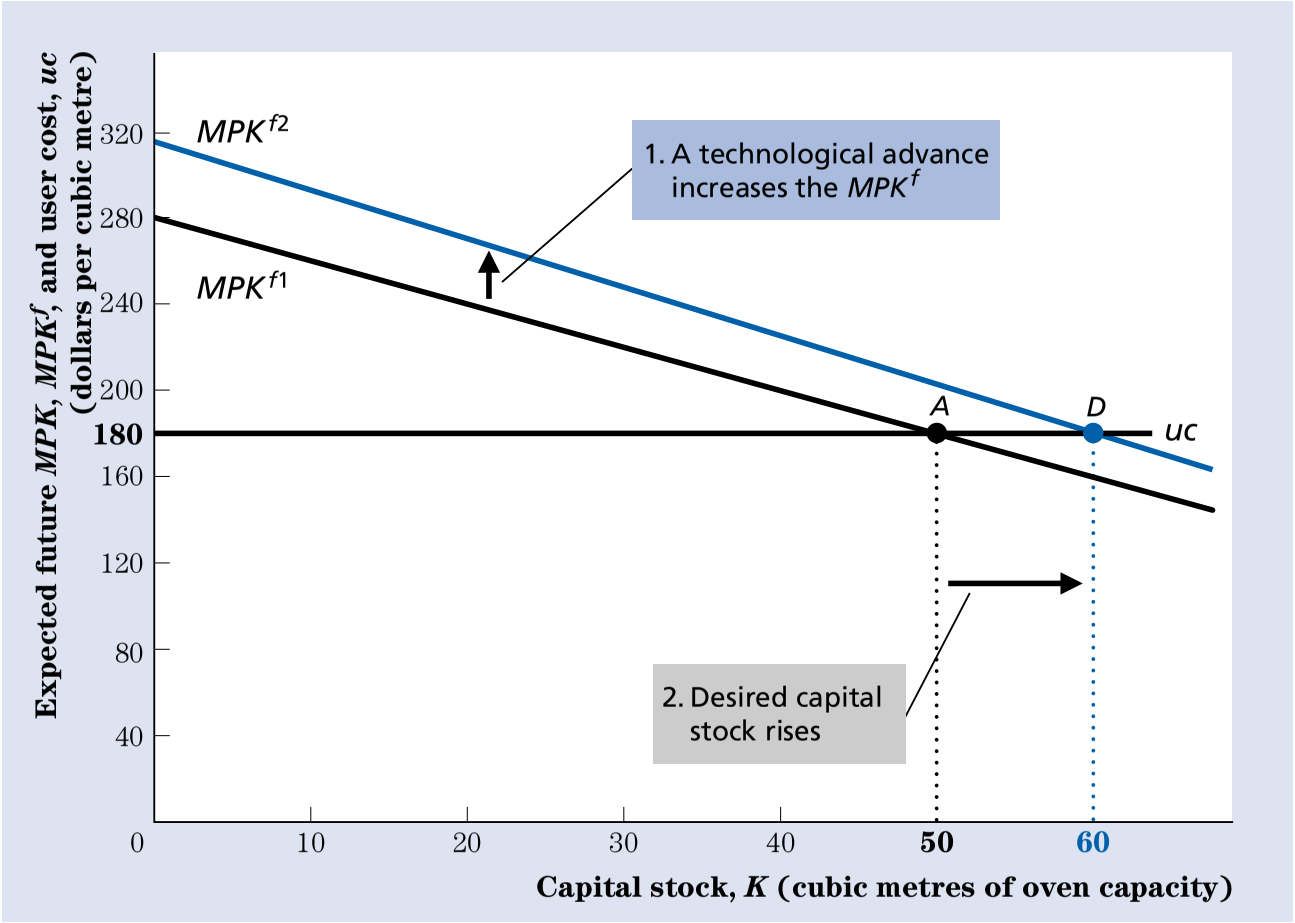


FIGURE 4.6

GROSS AND NET INVESTMENTS, 1926–2000

The figure shows private gross and net investments in Canada since 1926 as percentages of GDP. During some years of the Great Depression and World War II, net investment was negative, implying that the private capital stock was shrinking.

Source: *Canadian Economic Observer, Historical Statistical Supplement*, cat. no. 11-210, Table 1. Gross investment is investment in business fixed capital, and depreciation is capital consumption allowances.

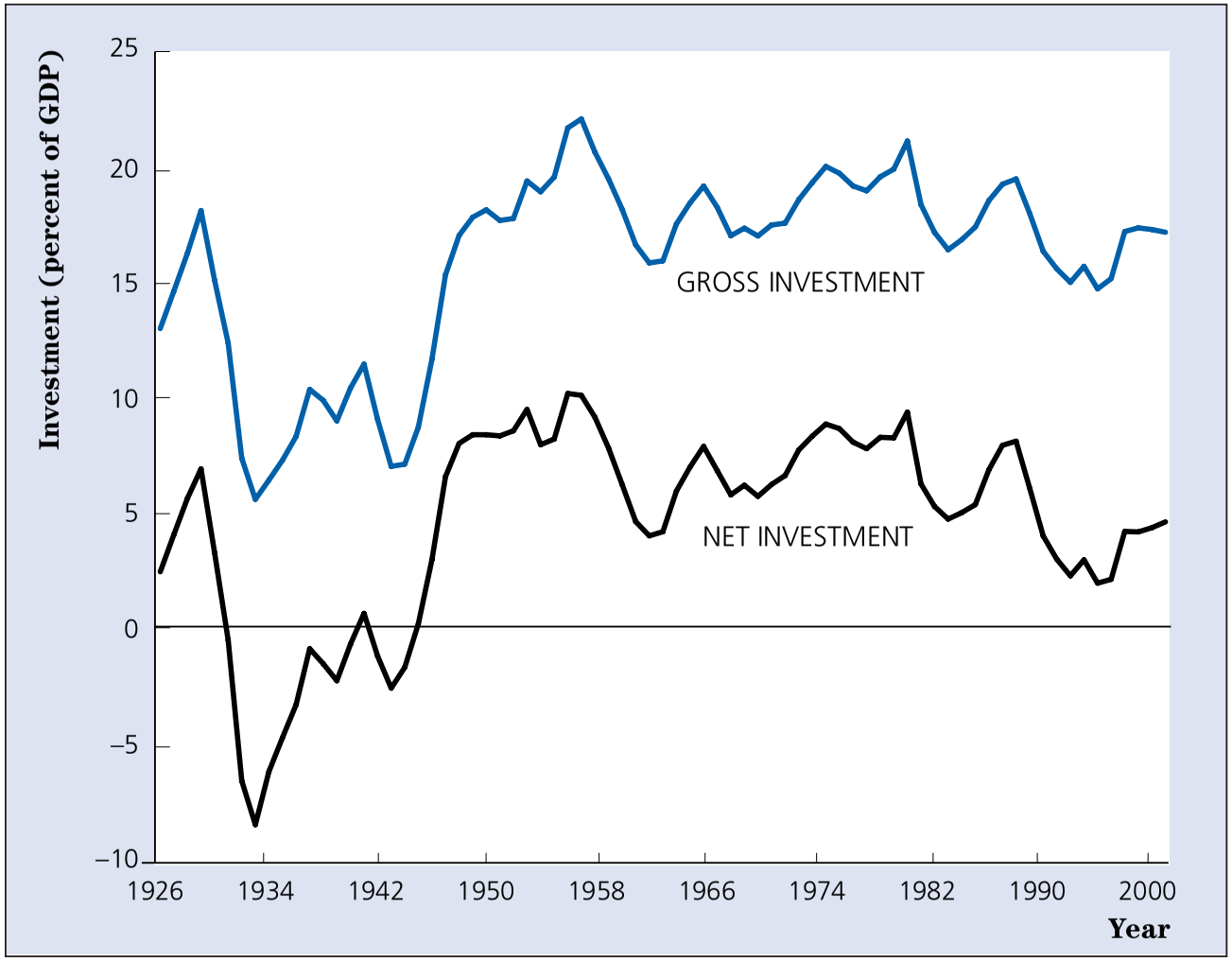


FIGURE 4.7

GOODS MARKET EQUILIBRIUM

Goods market equilibrium occurs when desired national saving equals desired investment. In the figure, equilibrium occurs when the real interest rate is 6% and both desired national saving and desired investment equal 100. If the real interest rate were, say, 3%, desired investment (150) would not equal desired national saving (85), and the goods market would not be in equilibrium. Competition among borrowers for funds would then cause the real interest rate to rise until it reaches 6%.

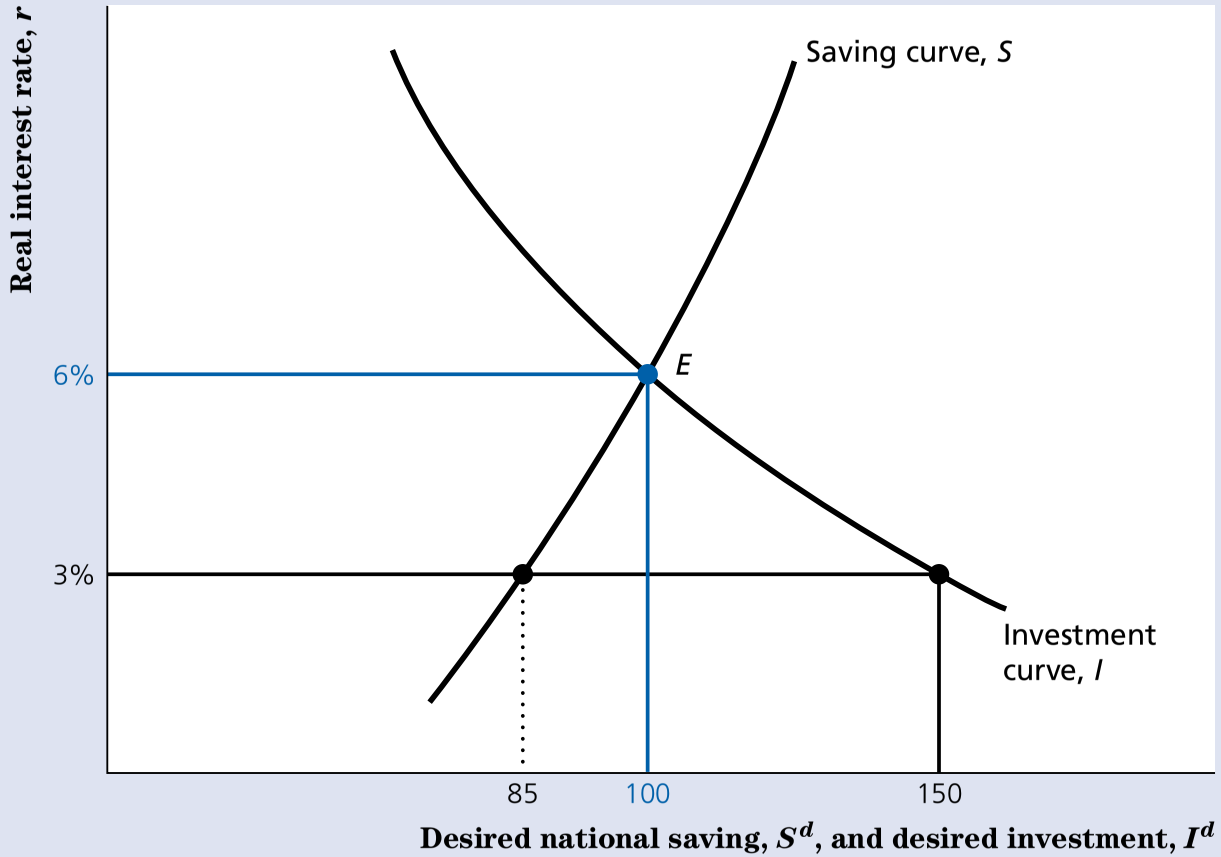


FIGURE 4.8

A DECLINE IN DESIRED SAVING

A change that reduces desired national saving, such as a temporary increase in current government purchases, shifts the saving curve to the left, from S^1 to S^2. The goods market equilibrium point moves from E to F. The decline in desired saving raises the real interest rate, from 6% to 7%, and lowers saving and investment, from 100 to 85.

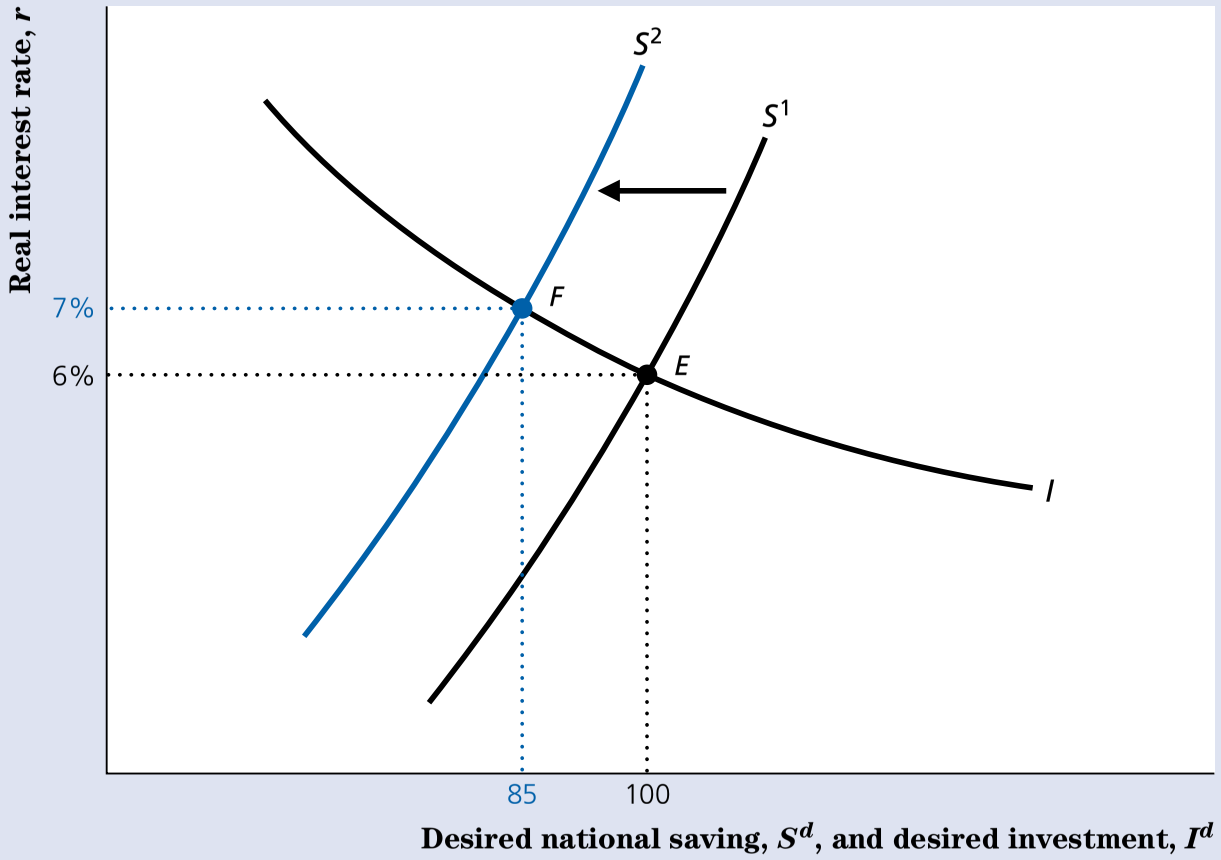


FIGURE 4.9

SHARES OF GOVERNMENT PURCHASES AND INVESTMENT IN CANADIAN GDP, 1926–2000

The graph shows the percentages of Canadian GDP devoted to government purchases and to private investment since 1926. Note the sharp increase in government purchases during World War II and the tendency for investment's share to mirror that of government spending.

Source: *Canadian Economic Observer, Historical Statistical Supplement*, cat. no. 11-210, Table 7.

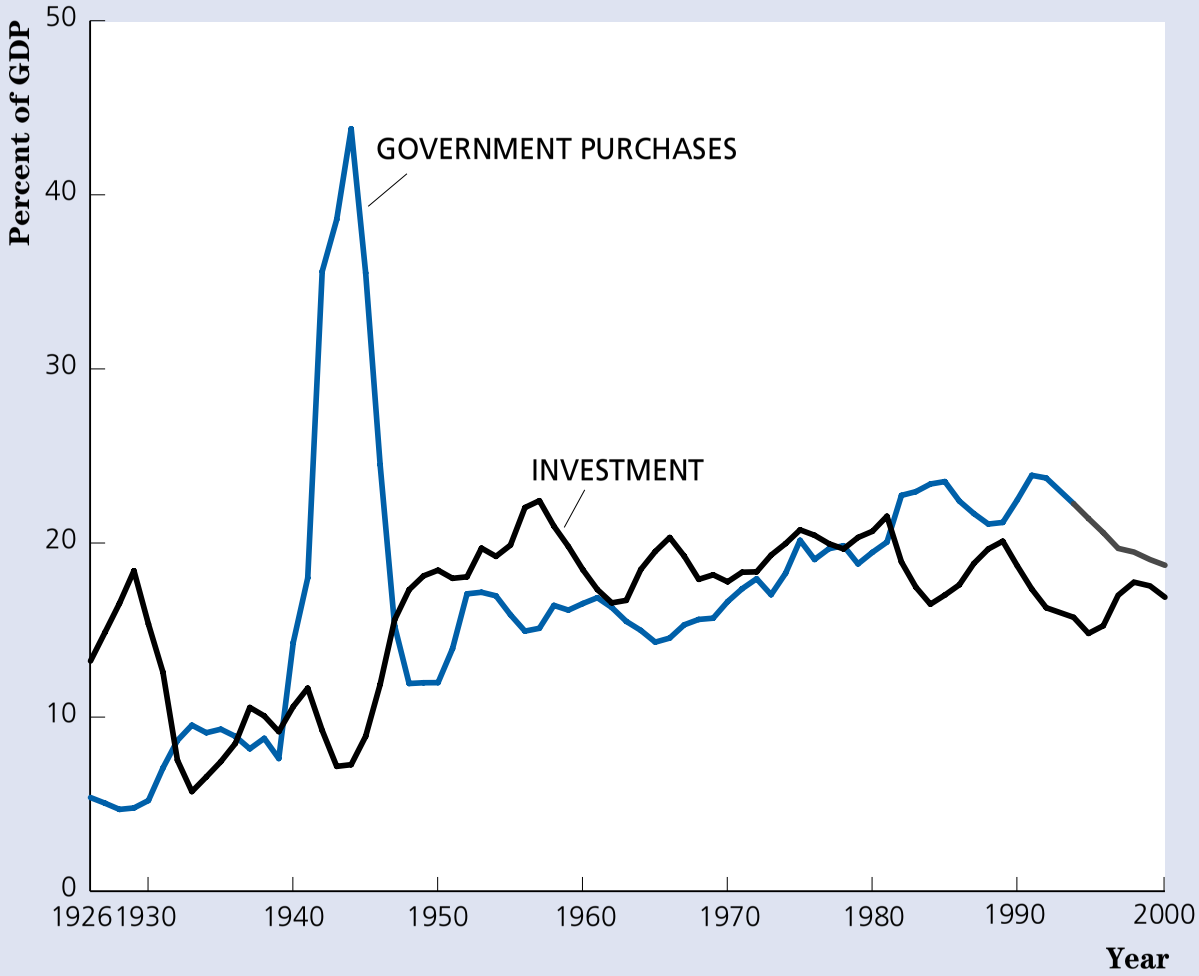
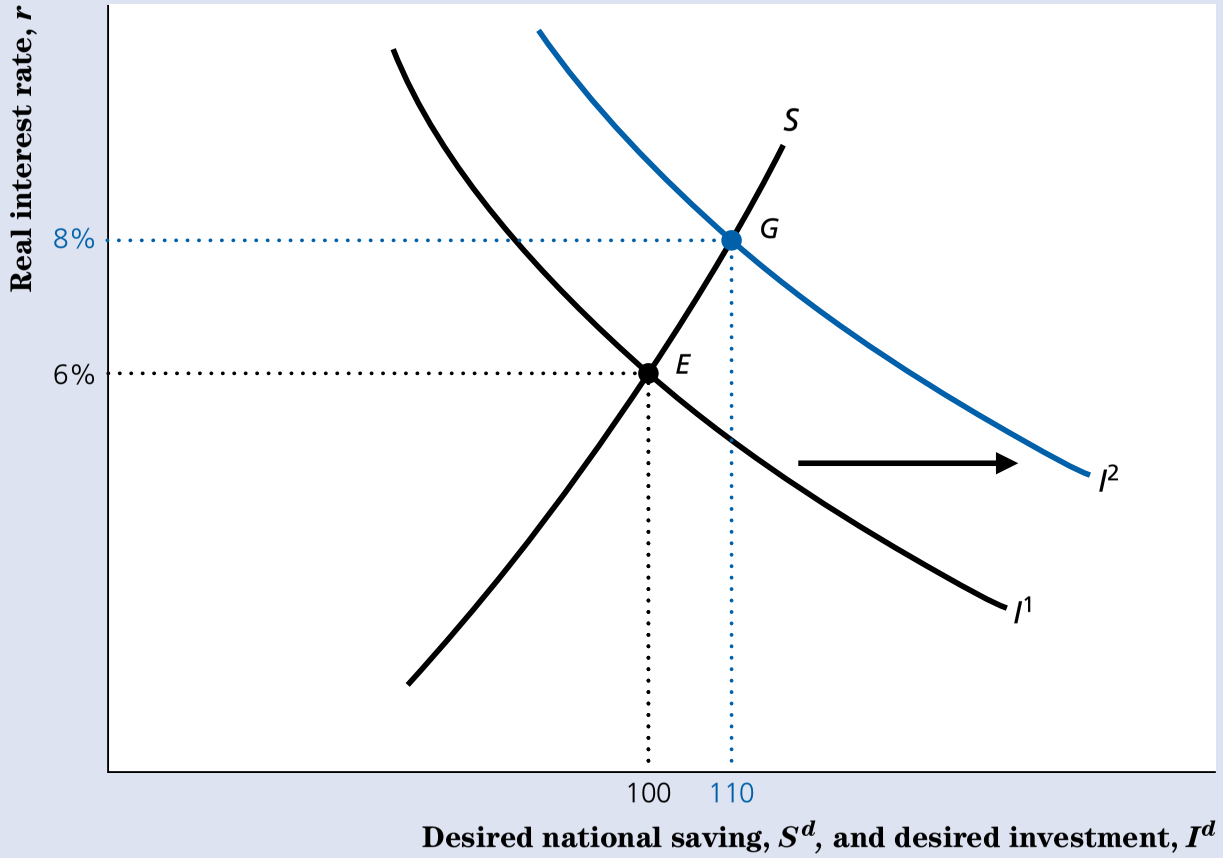


FIGURE 4.10

AN INCREASE IN DESIRED INVESTMENT

A change in the economy that increases desired investment, such as an invention that raises the expected future *MPK*, shifts the investment curve to the right, from I^1 to I^2. The goods market equilibrium point moves from *E* to *G*. The real interest rate rises from 6% to 8%, and saving and investment also rise, from 100 to 110.



KEY DIAGRAM 3

THE SAVING–INVESTMENT DIAGRAM

In an economy with no foreign trade, the goods market is in equilibrium when desired national saving equals desired investment. Equivalently, the goods market is in equilibrium when the aggregate quantity of goods supplied equals the aggregate quantity of goods demanded.

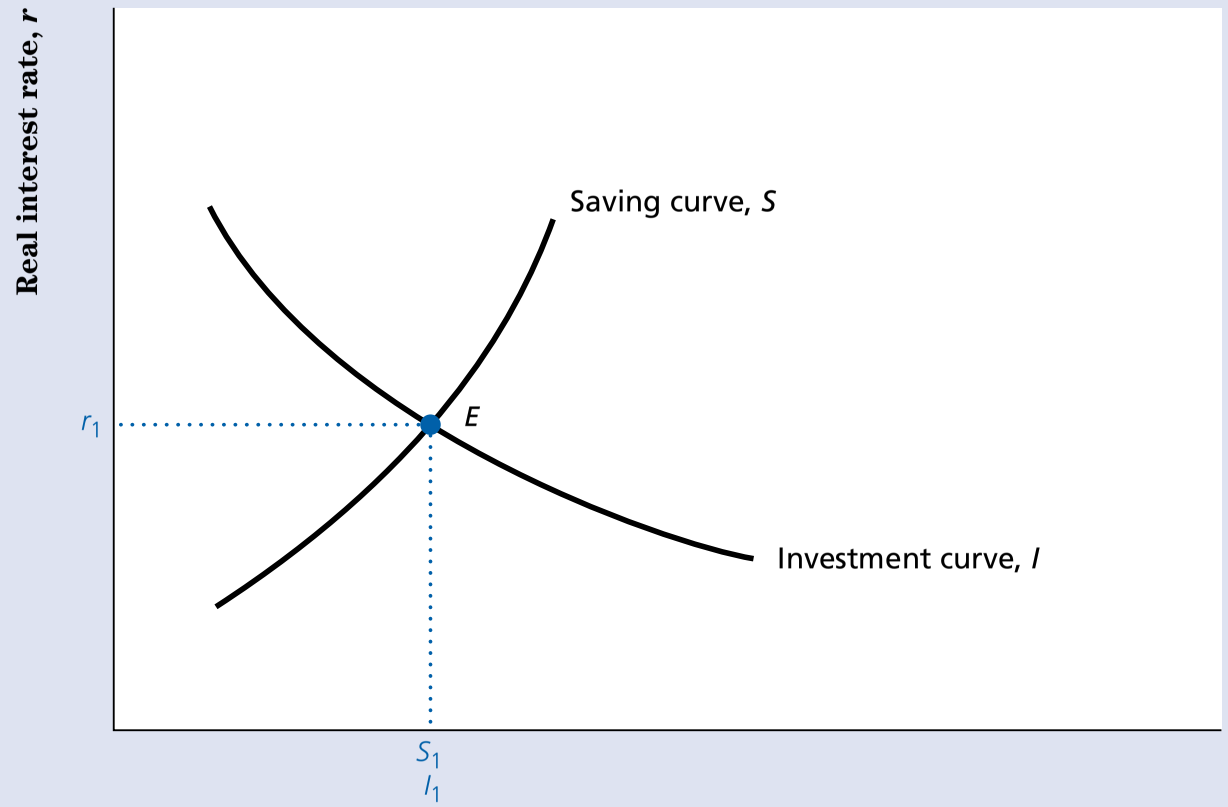


FIGURE 5.1

A SMALL OPEN ECONOMY THAT LENDS ABROAD

The graph shows the saving–investment diagram for a small open economy. The country faces a fixed world real interest rate of 6%. At this real interest rate national saving is $5 billion (point *B*) and investment is $1 billion (point *A*). The part of national saving not used for investment is lent abroad, so foreign lending is $4 billion (distance *AB*).

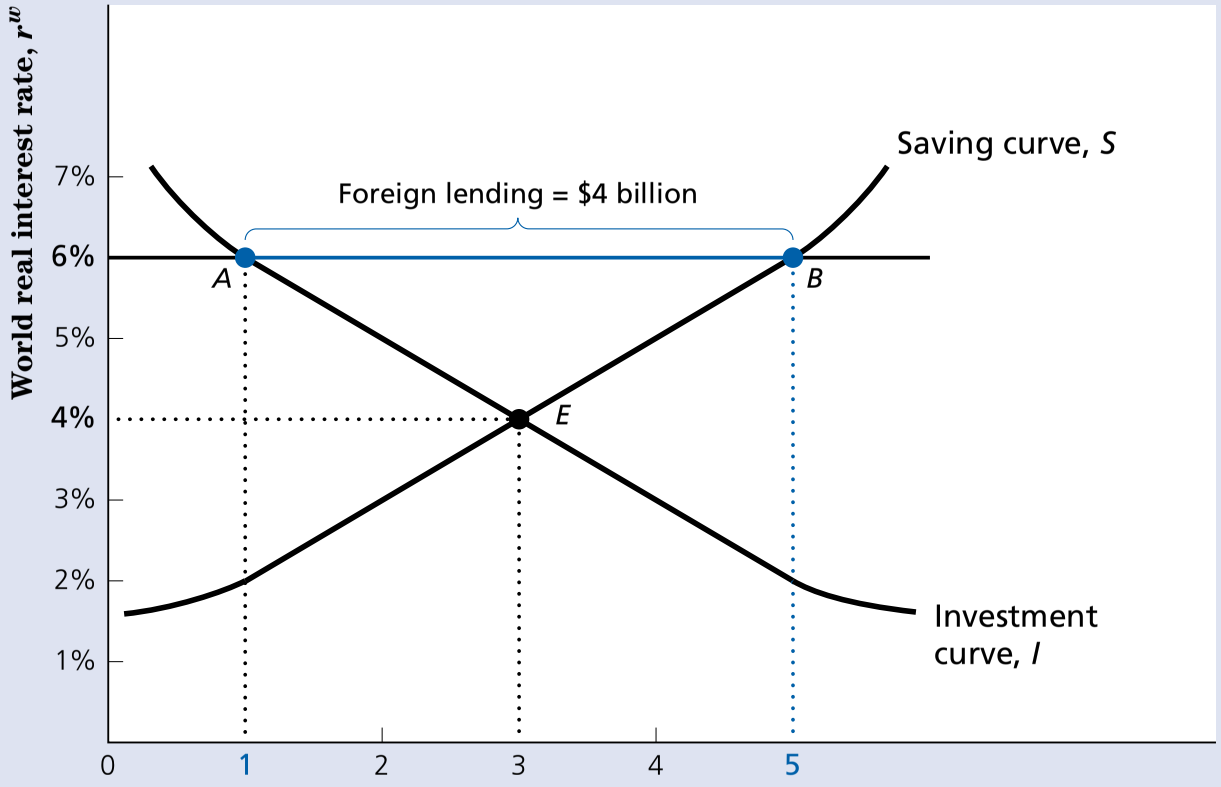


FIGURE 5.2

A SMALL OPEN ECONOMY THAT BORROWS ABROAD

The same small open economy shown in Figure 5.1 now faces a fixed world real interest rate of 2%. At this real interest rate national saving is $1 billion (point *C*) and investment is $5 billion (point *D*). Foreign borrowing of $4 billion (distance *CD*) makes up the difference between what investors want to borrow and what domestic savers want to lend.

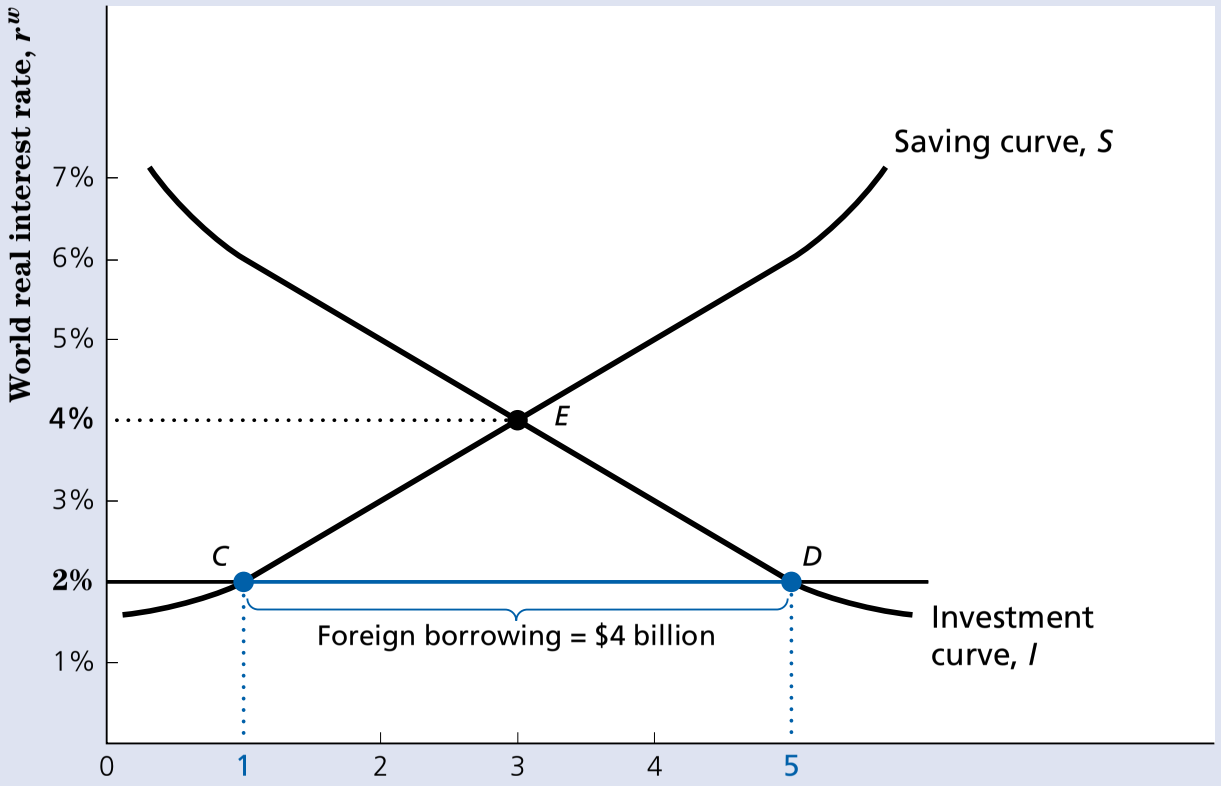


FIGURE 5.3

A TEMPORARY ADVERSE SUPPLY SHOCK IN A SMALL OPEN ECONOMY

Curve S^1 is the initial saving curve, and curve I^1 is the initial investment curve of a small open economy. With a fixed world real interest rate of r^w, national saving equals the distance *OB* and investment equals distance *OA*. The current account surplus (equivalently, net foreign lending) is the difference between national saving and investment, shown as distance *AB*. A temporary adverse supply shock lowers current output and causes consumers to save less at any real interest rate, which shifts the saving curve left, from S^1 to S^2. National saving decreases to distance *OD*, and the current account surplus decreases to distance *AD*.

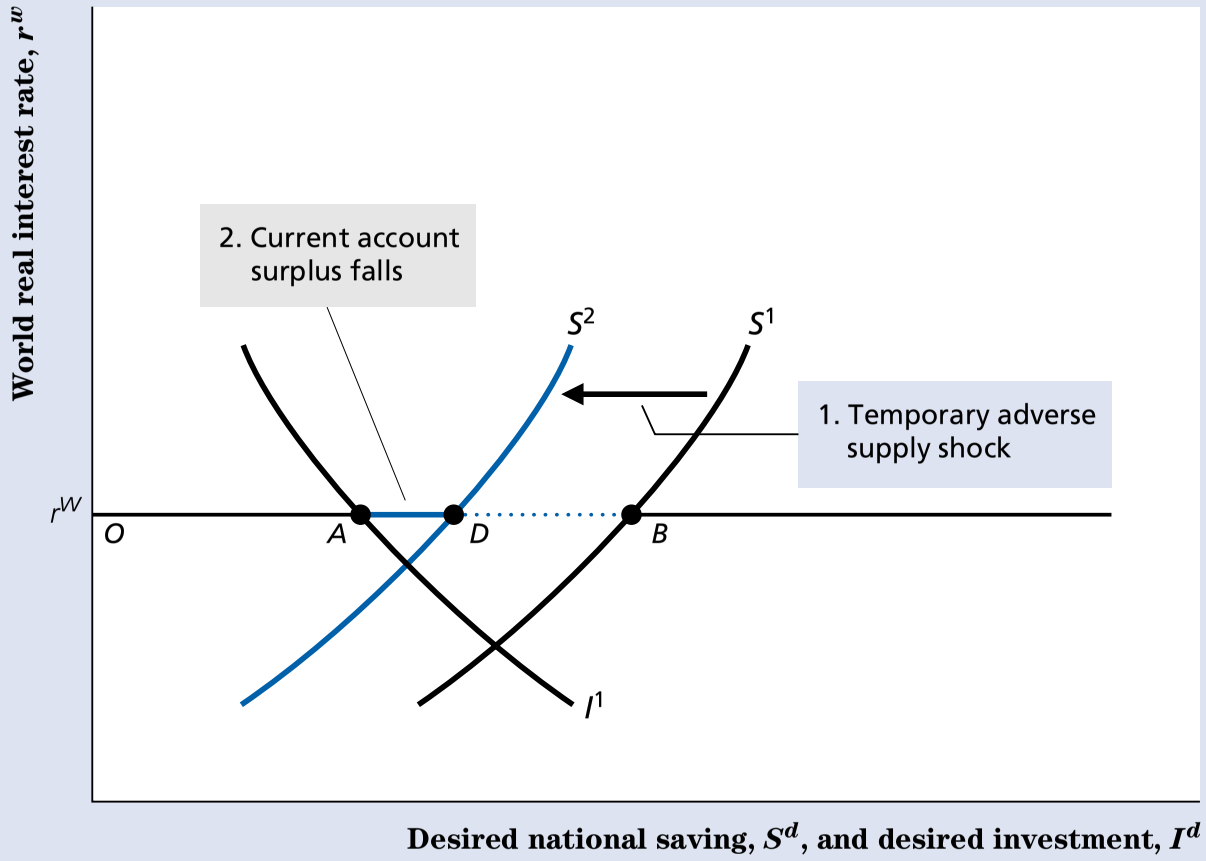


FIGURE 5.4

AN INCREASE IN THE EXPECTED FUTURE *MPK* IN A SMALL OPEN ECONOMY

As in Figure 5.3, the small open economy's initial national saving and investment curves are S^1 and I^1. At the fixed world real interest rate of r^w, there is an initial current account surplus equal to the distance *AB*. An increase in the expected future marginal product of capital (MPK^f) shifts the investment curve right, from I^1 to I^2, causing investment to increase from *OA* to distance *OF*. The current account surplus, which is national saving minus investment, decreases from distance *AB* to distance *FB*.

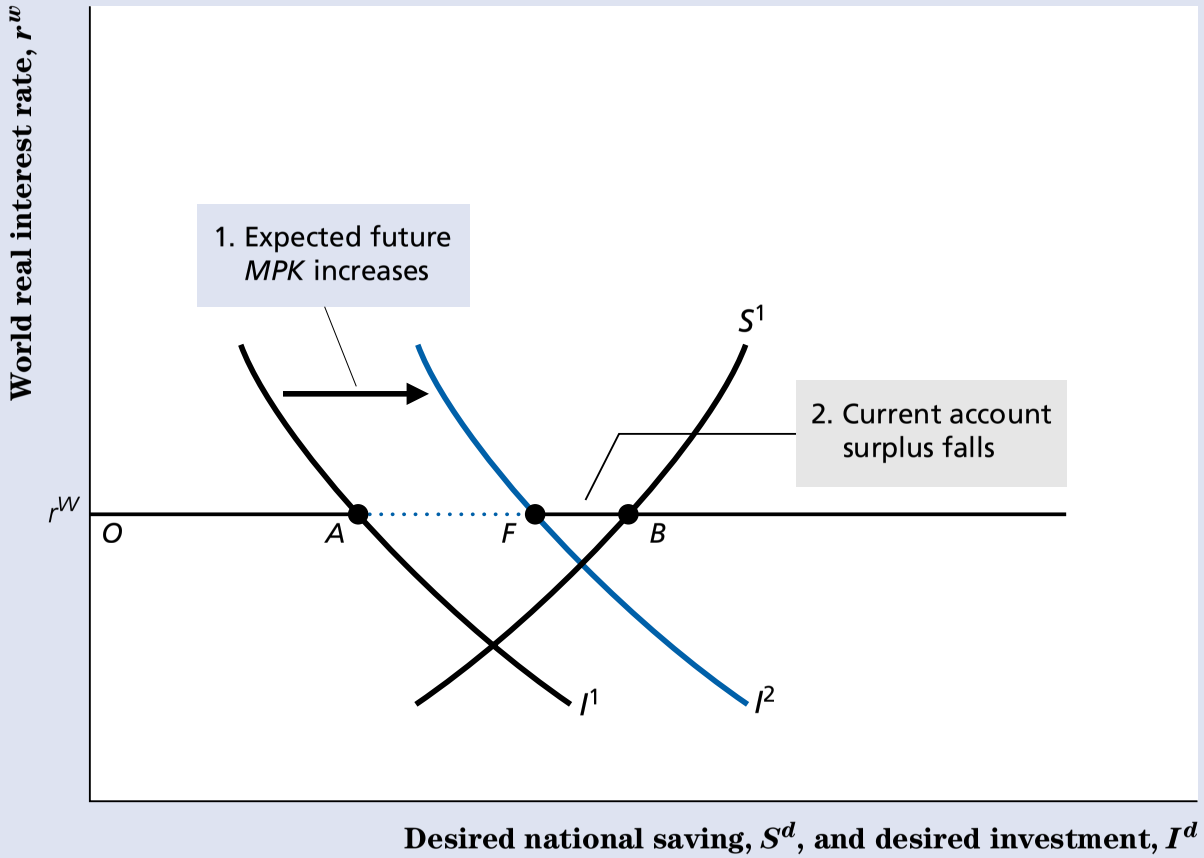
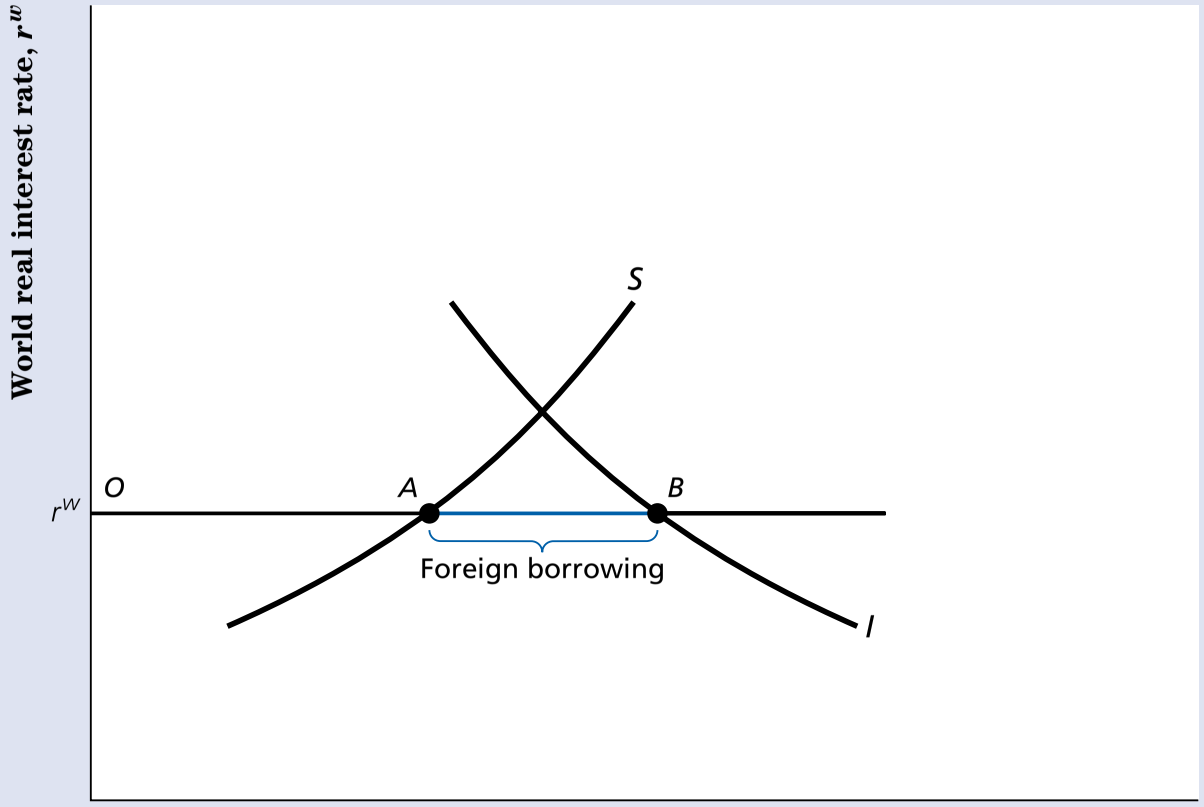
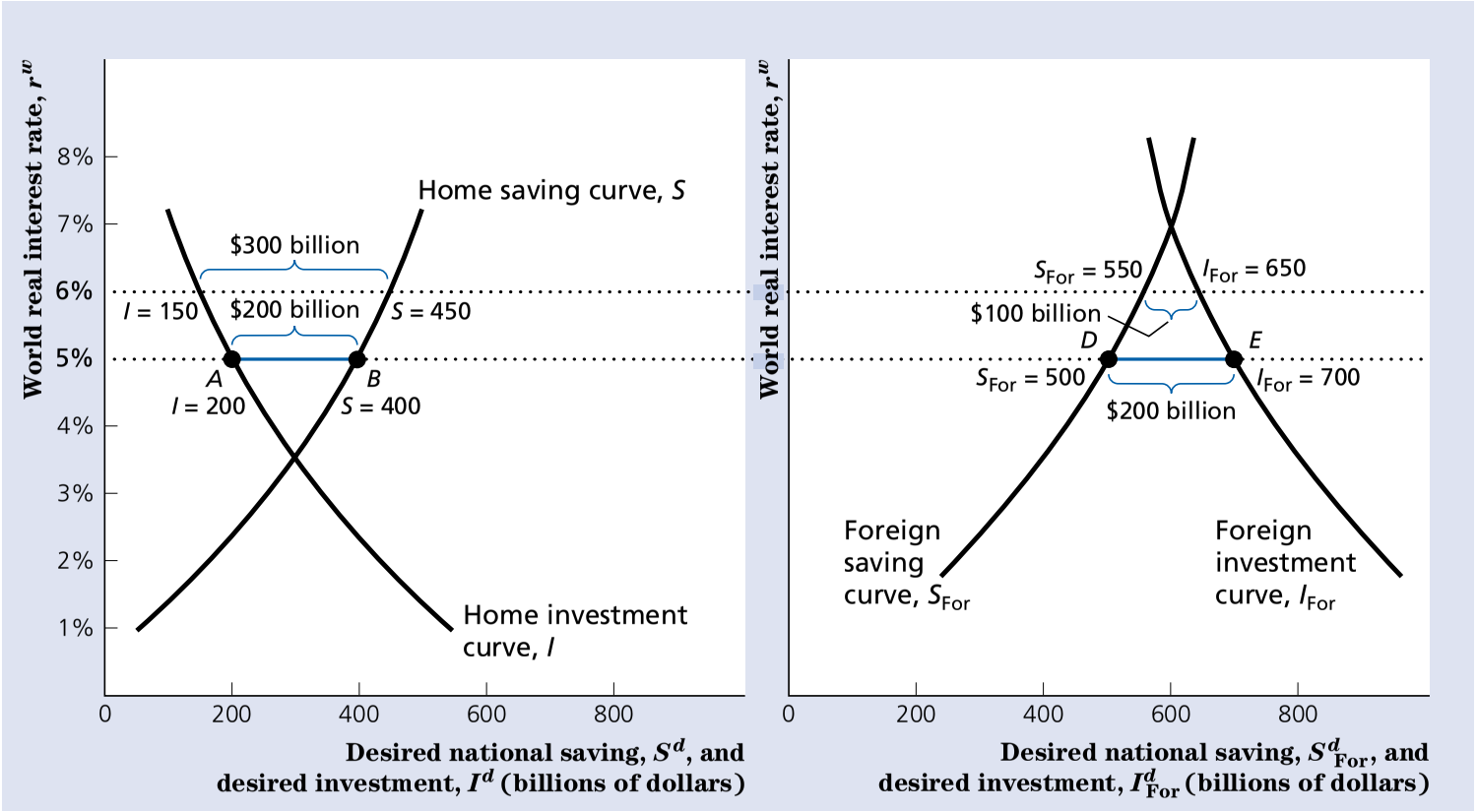


FIGURE 5.5

INTERNATIONAL BORROWING IN A DEVELOPING COUNTRY

In a small developing economy, income and national saving are low, so the saving curve *S* is far to the left. Investment opportunities are good (the expected future *MPK* is high), so the investment curve *I* is far to the right. At the world real interest rate of r^w, investment (distance *OB*) greatly exceeds national saving (distance *OA*). To fund its desired investment, the country must borrow abroad. Distance *AB* is the developing country's foreign borrowing or, equivalently, its current account deficit.



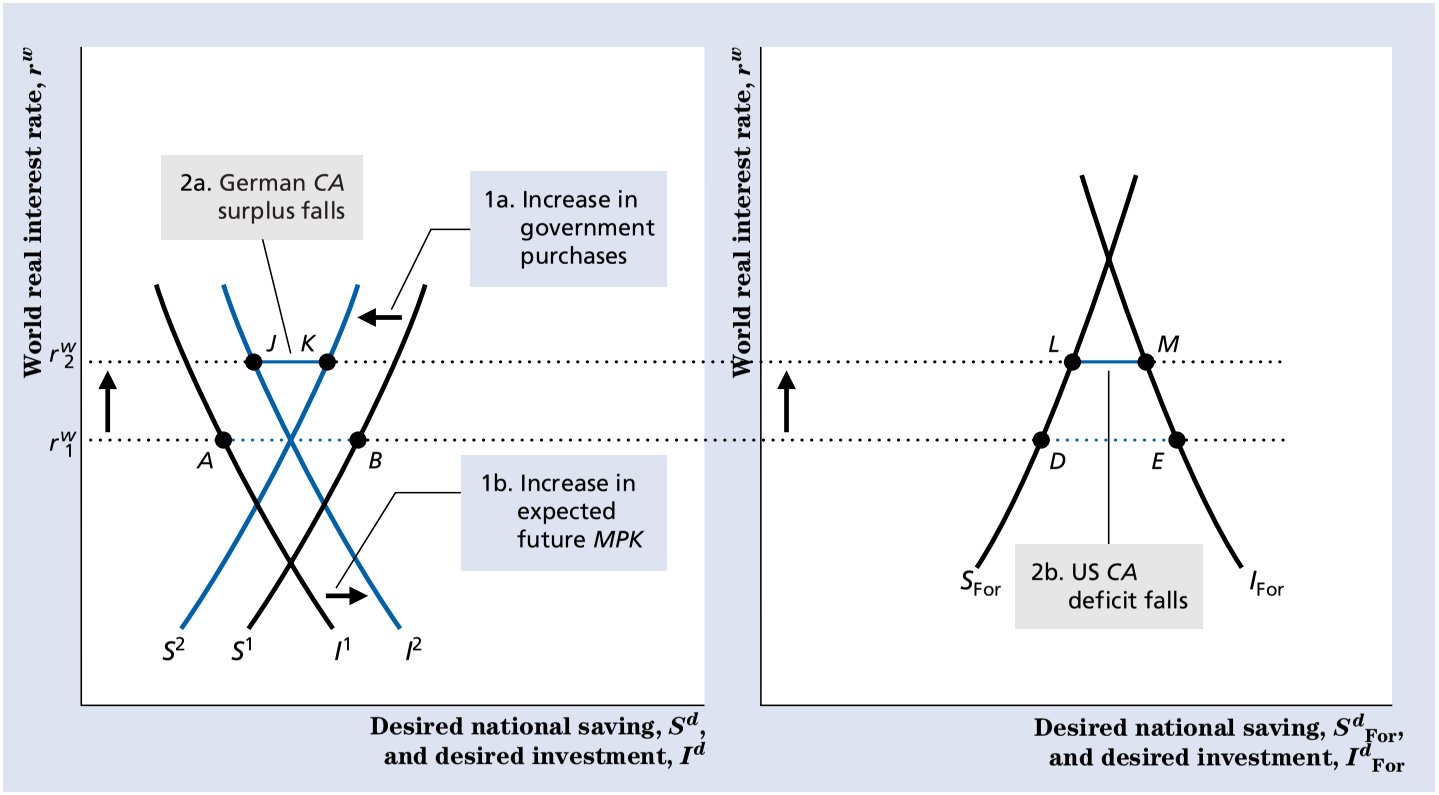


(a) Home country **(b) Foreign country**

FIGURE 5.6

THE DETERMINATION OF THE WORLD REAL INTEREST RATE WITH TWO LARGE OPEN ECONOMIES

The equilibrium world real interest rate is the real interest rate at which desired international lending by one country equals desired international borrowing by the other country. In the figure, when the world real interest rate is 5%, desired international lending by the home country is $200 billion ($400 billion desired national saving less $200 billion desired investment, or distance *AB*), which equals the foreign country's desired international borrowing of $200 billion ($700 billion desired investment less $500 billion desired national saving, or distance *DE*). Thus, 5% is the equilibrium world real interest rate. Equivalently, when the interest rate is 5%, the current account surplus of the home country equals the current account deficit of the foreign country (both are $200 billion).



(a) Home country (Germany) **(b) Foreign country (United States)**

FIGURE 5.7

GERMAN REUNIFICATION AND THE WORLD REAL INTEREST RATE

The figure represents two large open economies, Germany (the home economy) and the United States (the foreign economy). Before reunification, the German saving and investment curves are S^1 and I^1. The equilibrium world real interest rate, r_1^w, is the real interest rate at which the German current account surplus *AB* just equals the US current account deficit *DE*. Reunification raises government purchases in Germany, which shifts the German saving curve left from S^1 to S^2, and also improves investment opportunities in Germany, which shifts the German investment curve right from I^1 to I^2. The US saving and investment curves do not shift. The new world real interest rate is r_2^w, where the German current account surplus *JK* again equals the US current account deficit *LM*. Reunification raises the world real interest rate, lowers the German current account surplus, and lowers the US current account deficit.

FIGURE 5.8

THE GOVERNMENT BUDGET DEFICIT AND THE CURRENT ACCOUNT IN A SMALL OPEN ECONOMY

An increase in the government budget deficit affects the current account only if the increased budget deficit reduces national saving. Initially, the saving curve is S^1 and the current account surplus is distance *AB*. If an increase in the government deficit reduces national saving, the saving curve shifts left, from S^1 to S^2. With no change in the effective tax rate on capital, the investment curve *I* does not move. Thus, the increase in the budget deficit causes the current account surplus to decrease from distance *AB* to distance *AC*. In contrast, if the increase in the budget deficit has no effect on national saving, the current account is also unaffected and remains equal to distance *AB*.

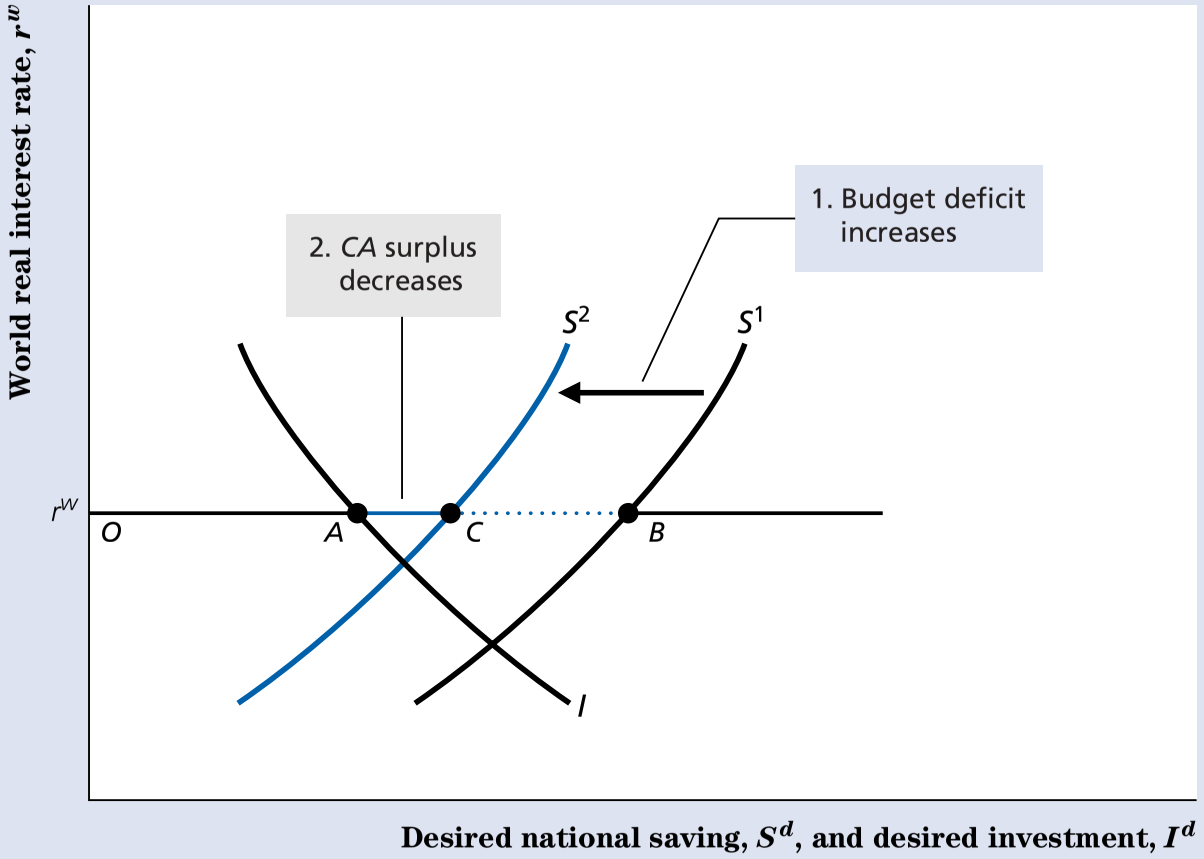
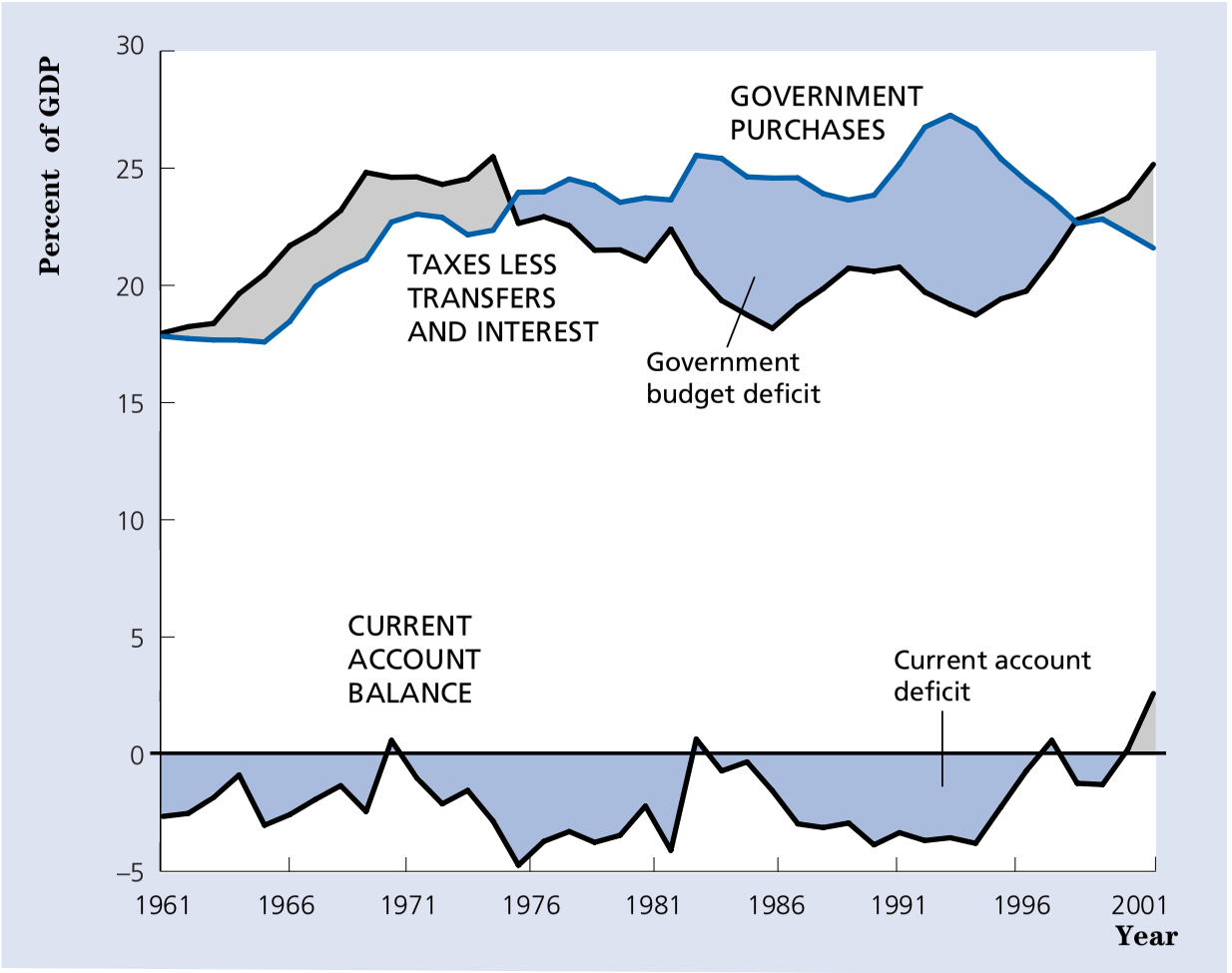


FIGURE 5.9

THE GOVERNMENT BUDGET BALANCE AND THE CURRENT ACCOUNT BALANCE IN CANADA, 1961–2001

The figure shows government purchases, net government income (taxes less transfers and interest), and the current account balance for Canada for the period 1961–2001. Government data are for federal, provincial, territorial, and municipal governments, and each series is measured as a percentage of GDP. The government deficit (shaded area) is the difference between government purchases and net receipts. The expansion of both the government deficit and the current account deficit in the late 1980s and early 1990s is the twin-deficits phenomenon. Canada currently has twin surpluses.

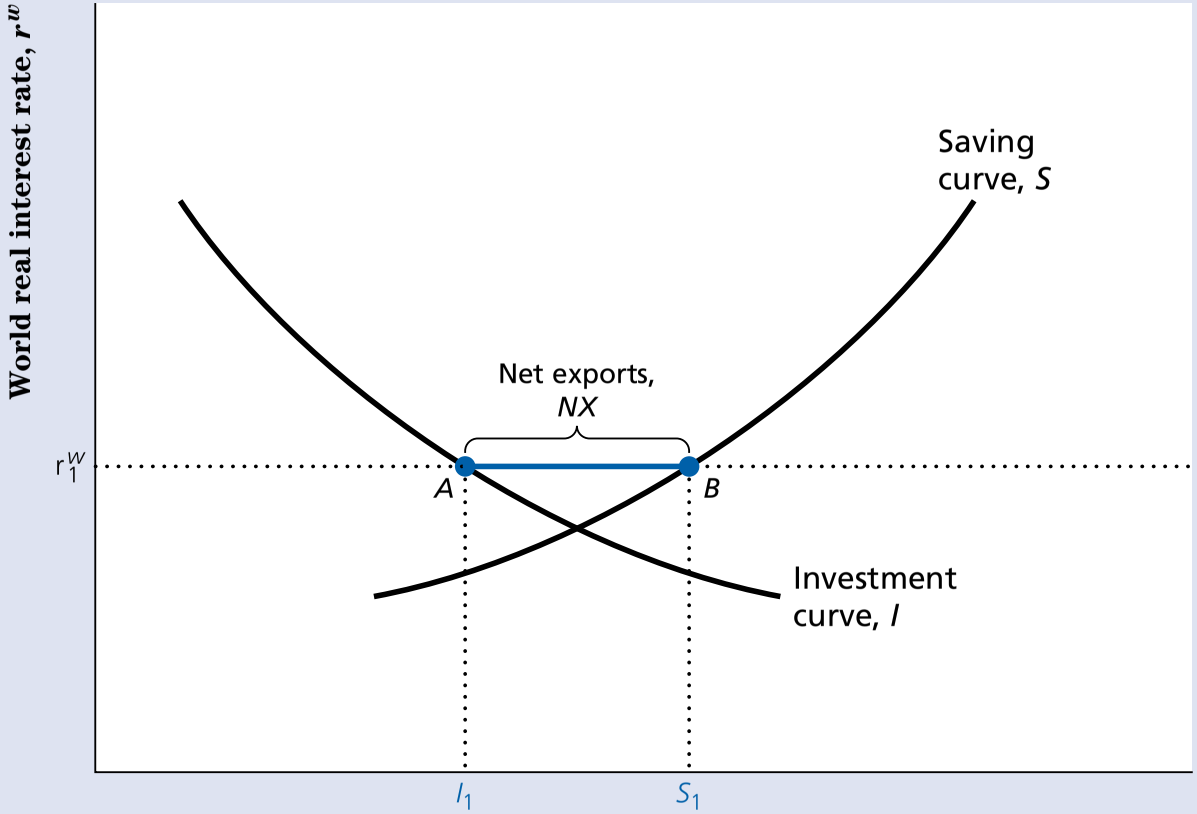
Source: *Canadian Economic Observer, Historical Statistical Supplement,* Tables 1, 3, and 19, or Statistics Canada, CANSIM Series D15665, D58032, D15886, and D15892.



KEY DIAGRAM 4

NATIONAL SAVING AND INVESTMENT IN A SMALL OPEN ECONOMY

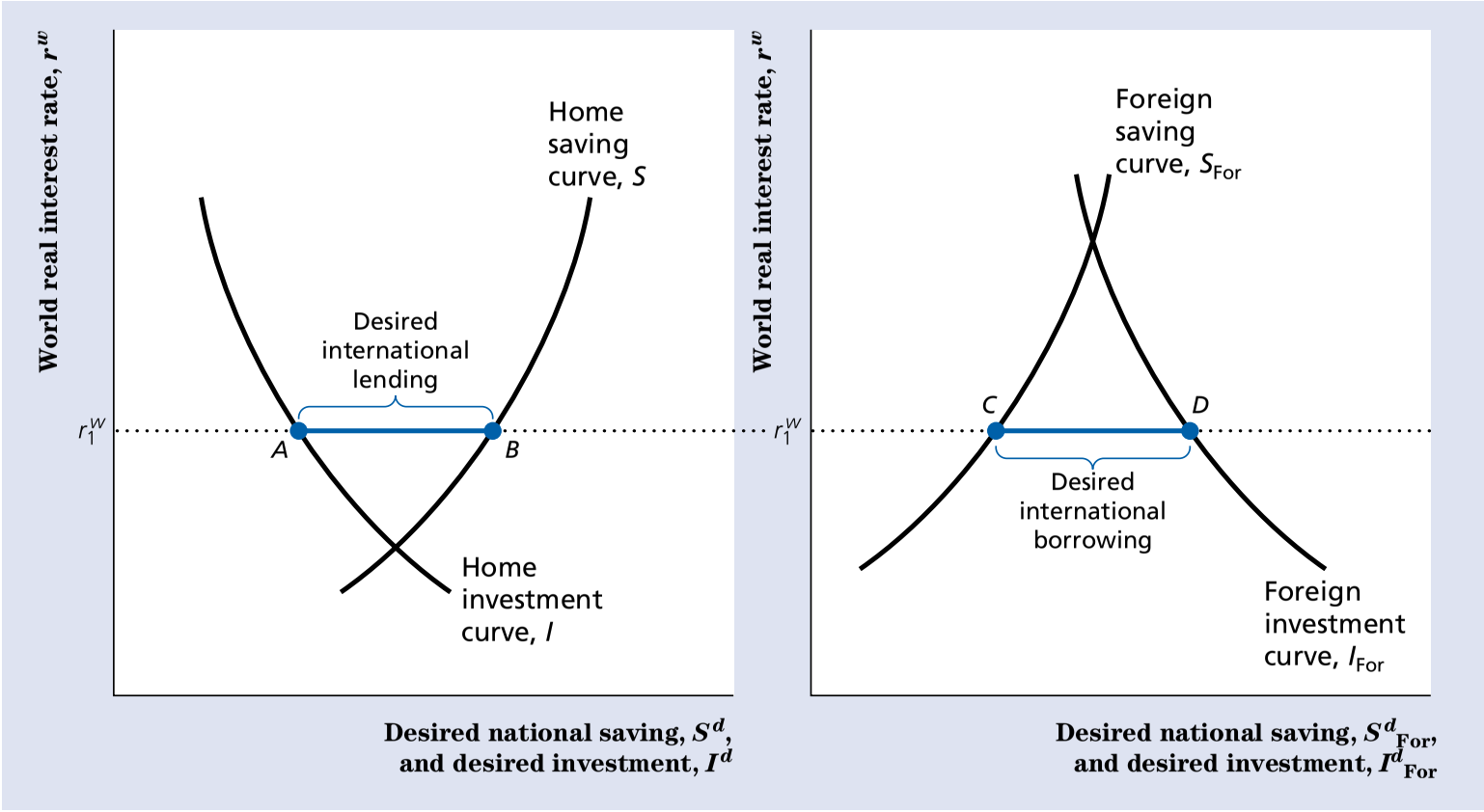
This open-economy version of the saving–investment diagram shows the determination of national saving, investment, and the current account balance in a small open economy that takes the world real interest rate as given.



KEY DIAGRAM 5

NATIONAL SAVING AND INVESTMENT IN LARGE OPEN ECONOMIES

This diagram shows the determination of national saving, investment, and the current account balance in large open economies, economies large enough to affect the world real interest rate.



(a) Home country **(b) Foreign country**

FIGURE 6.1

THE PER-WORKER PRODUCTION FUNCTION

The per-worker production function, $y_t = f(k_t)$, relates the amount of output produced per worker, y_t, to the capital–labour ratio, k_t. For example, when the capital–labour ratio is k_1, output per worker is y_1. The per-worker production function slopes upward from left to right because an increase in the capital–labour ratio raises the amount of output produced per worker. The bowed shape of the production function reflects the diminishing marginal productivity of capital.

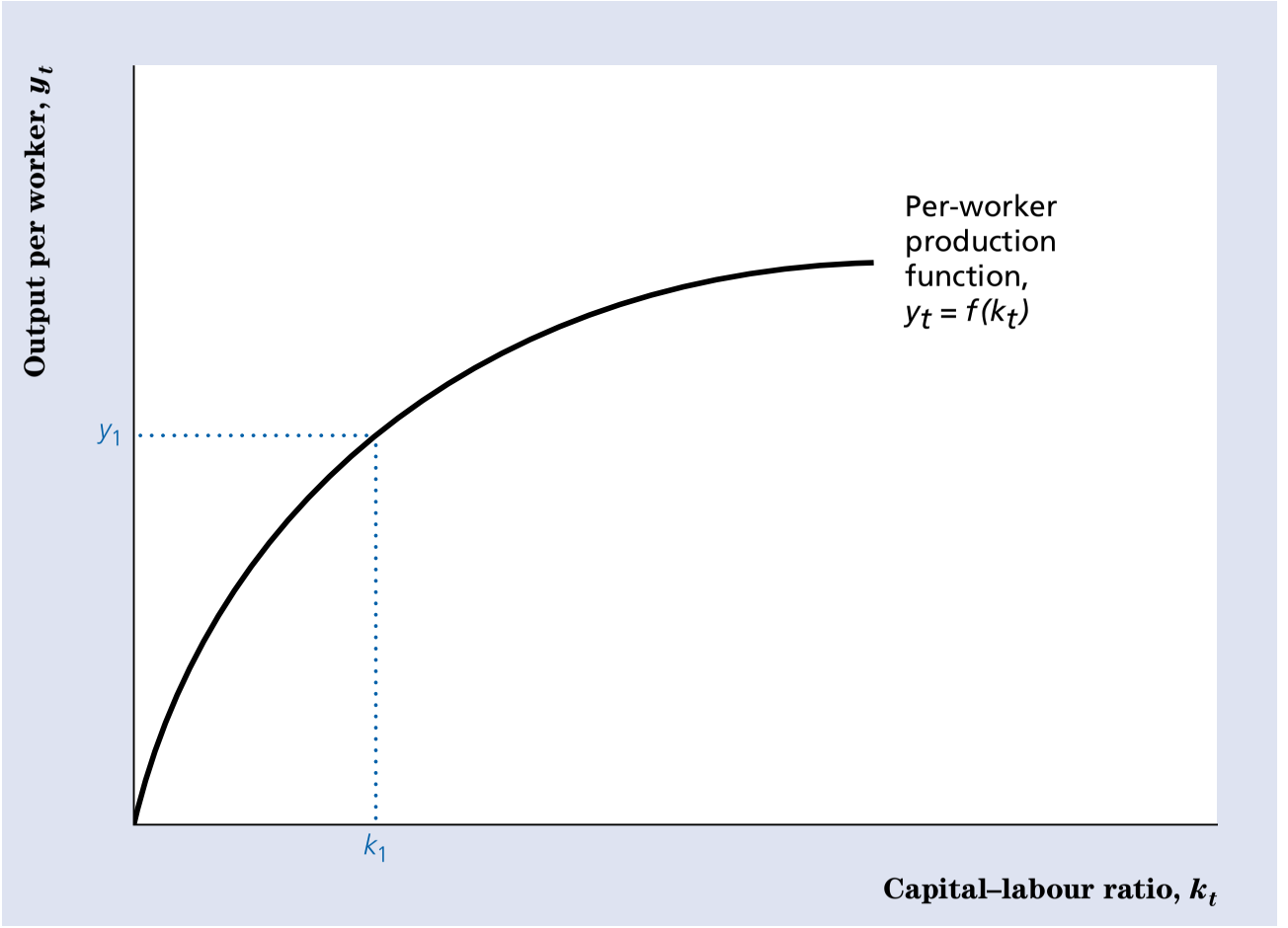


FIGURE 6.2

THE RELATIONSHIP OF CONSUMPTION PER WORKER TO THE CAPITAL–LABOUR RATIO IN THE STEADY STATE

(a) For each value of the capital–labour ratio, k, steady-state output per worker, y, is given by the per-worker production function, $f(k)$. Steady-state investment per worker, $(n + d)k$, is a straight line with slope $n + d$. Steady-state consumption per worker, c, is the difference between output per worker and investment per worker (the shaded area). For example, if the capital–labour ratio is k_1, steady-state consumption per worker is c_1.
(b) For each value of the steady-state capital–labour ratio, k, steady-state consumption per worker, c, is derived in (a) as the difference between output per worker and investment per worker. Thus, the shaded area in (b) corresponds to the shaded area in (a). Note that starting from a low value of the capital–labour ratio, an increase in the capital–labour ratio raises steady-state consumption per worker. However, starting from a capital–labour ratio greater than k_1, an increase in the capital–labour ratio actually lowers consumption per worker. When the capital–labour ratio equals k_{max}, all output is devoted to investment, and steady-state consumption per worker is zero.

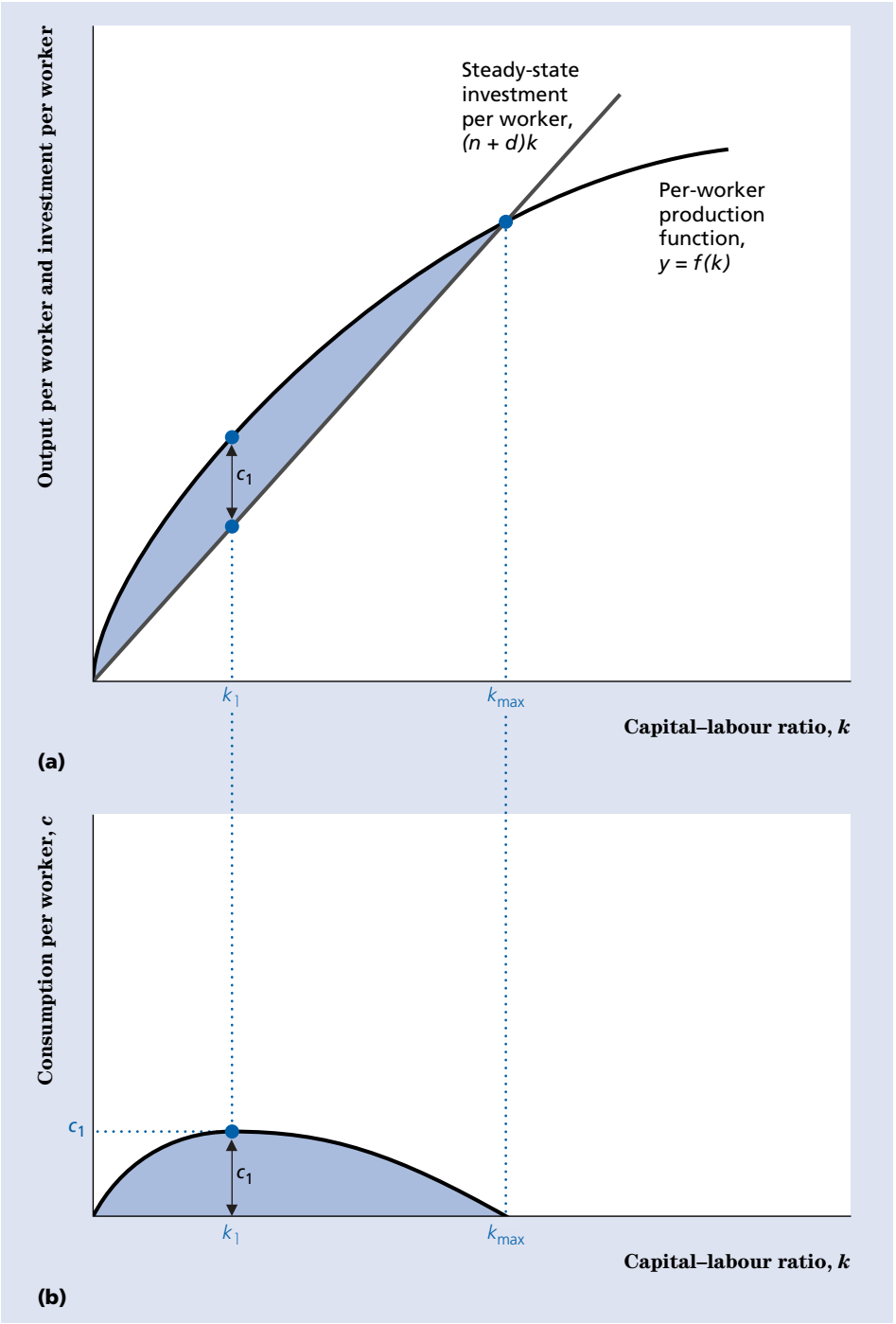


FIGURE 6.3

DETERMINING THE CAPITAL–LABOUR RATIO IN THE STEADY STATE

The steady-state capital–labour ratio, k^*, is determined by the condition that saving per worker, $sf(k)$, equals steady-state investment per worker, $(n + d)k$. The steady-state capital–labour ratio k^* corresponds to point A, where the saving curve and the steady-state investment line cross. From any starting point, eventually the capital–labour ratio reaches k^*. If the capital–labour ratio happens to be below k^*, say, at k_1, saving per worker, $sf(k_1)$, exceeds the investment per worker, $(n + d)k_1$, needed to maintain the capital–labour ratio at k_1. As this extra saving is converted into capital, the capital–labour ratio will rise, as indicated by the arrows. Similarly, if the capital–labour ratio is greater than k^*, say, at k_2, saving is too low to maintain the capital–labour ratio, and it will fall over time.

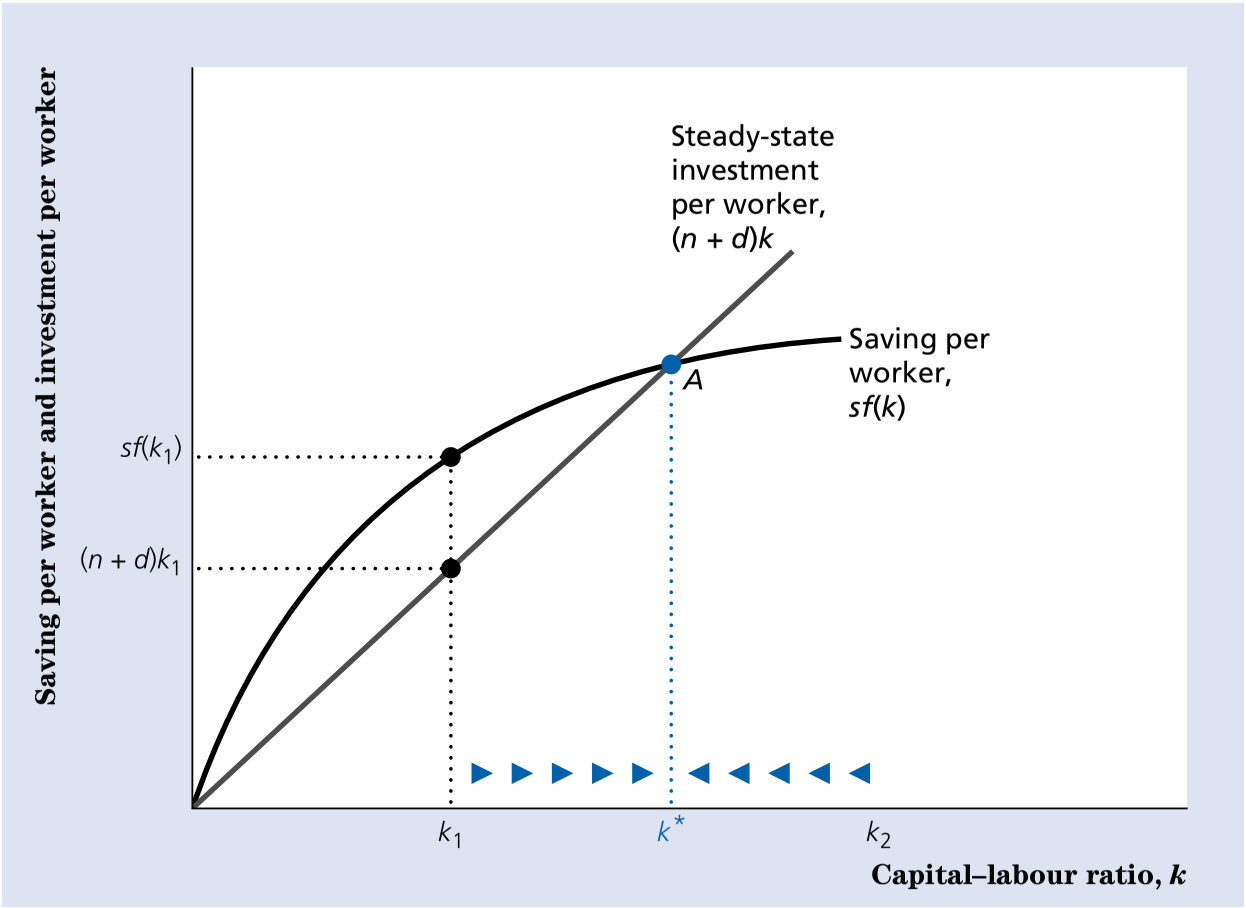


FIGURE 6.4

THE EFFECT OF AN INCREASED SAVING RATE ON THE STEADY-STATE CAPITAL–LABOUR RATIO

An increase in the saving rate from s_1 to s_2 raises the saving curve from $s_1 f(k)$ to $s_2 f(k)$. The point where saving per worker equals steady-state investment per worker moves from point A to point B, and the corresponding capital–labour ratio rises from k_1^* to k_2^*. Thus, a higher saving rate raises the steady-state capital–labour ratio.

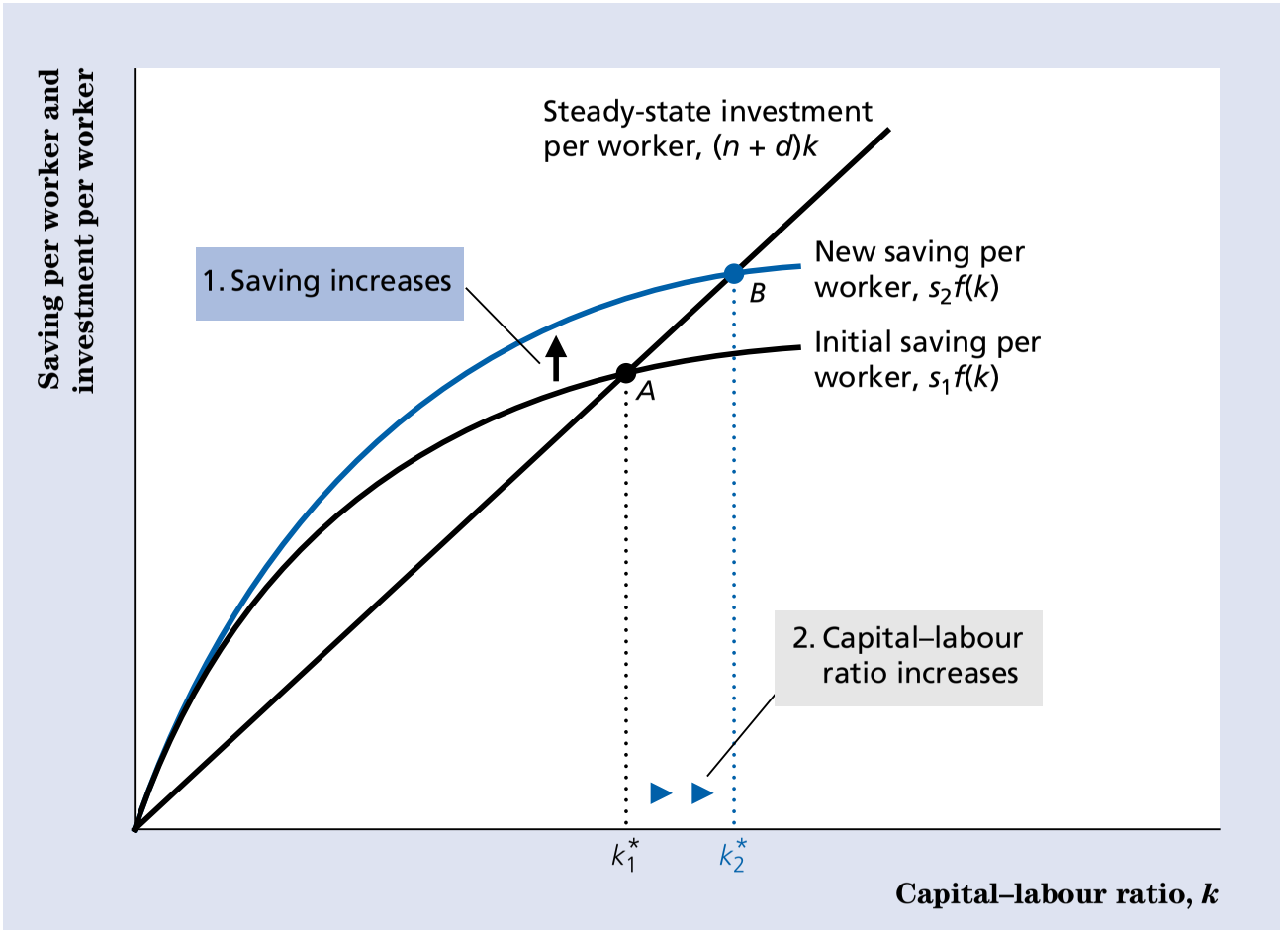


FIGURE 6.5

THE EFFECT OF A HIGHER POPULATION GROWTH RATE ON THE STEADY-STATE CAPITAL–LABOUR RATIO

An increase in the population growth rate from n_1 to n_2 increases steady-state investment per worker from $(n_1 + d)k$ to $(n_2 + d)k$. The steady-state investment line pivots up and to the left as its slope rises from $n_1 + d$ to $n_2 + d$. The point where saving per worker equals steady-state investment per worker shifts from point A to point B, and the corresponding capital–labour ratio falls from k_1^* to k_2^*. A higher population growth rate therefore causes the steady-state capital–labour ratio to fall.

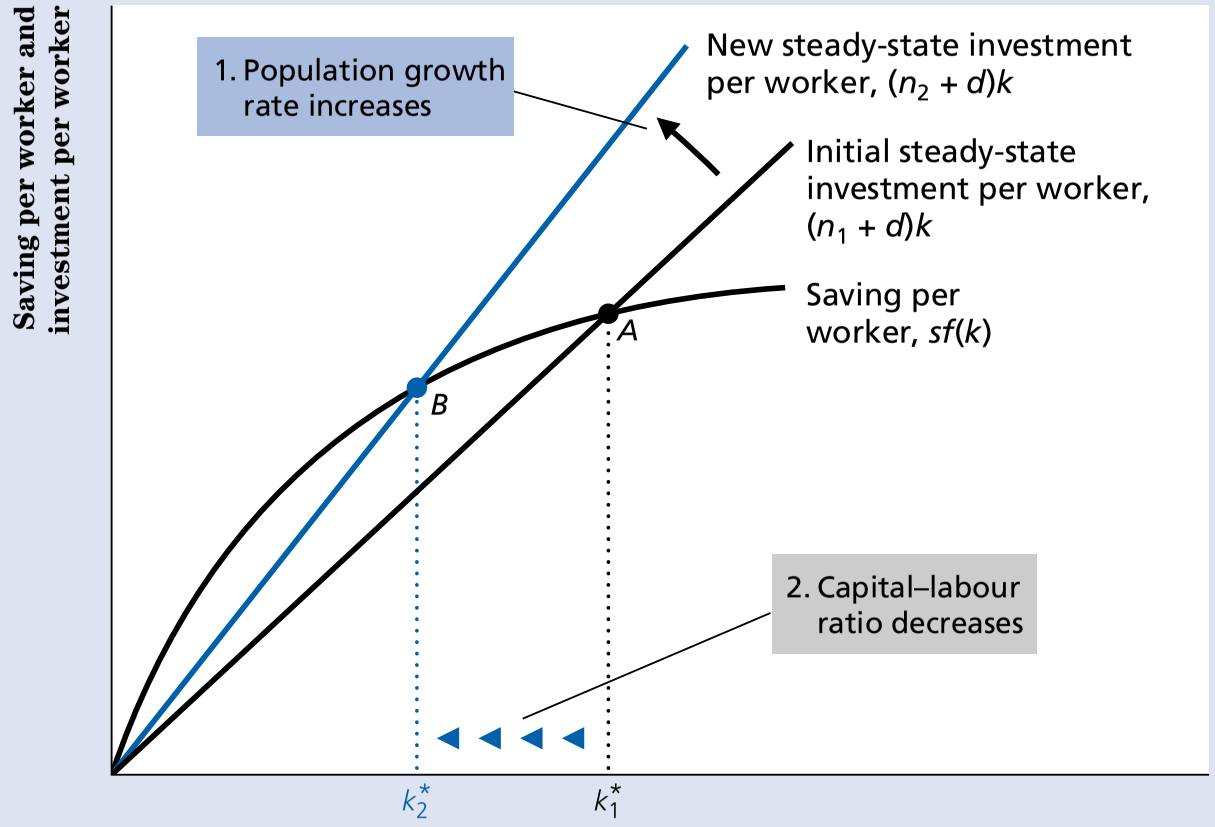


FIGURE 6.6

AN IMPROVEMENT IN PRODUCTIVITY

An improvement in productivity shifts the per-worker production function upward from the initial production function $y = f_1(k)$ to the new production function $y = f_2(k)$. After the productivity improvement, more output per worker y can be produced at any capital–labour ratio k.

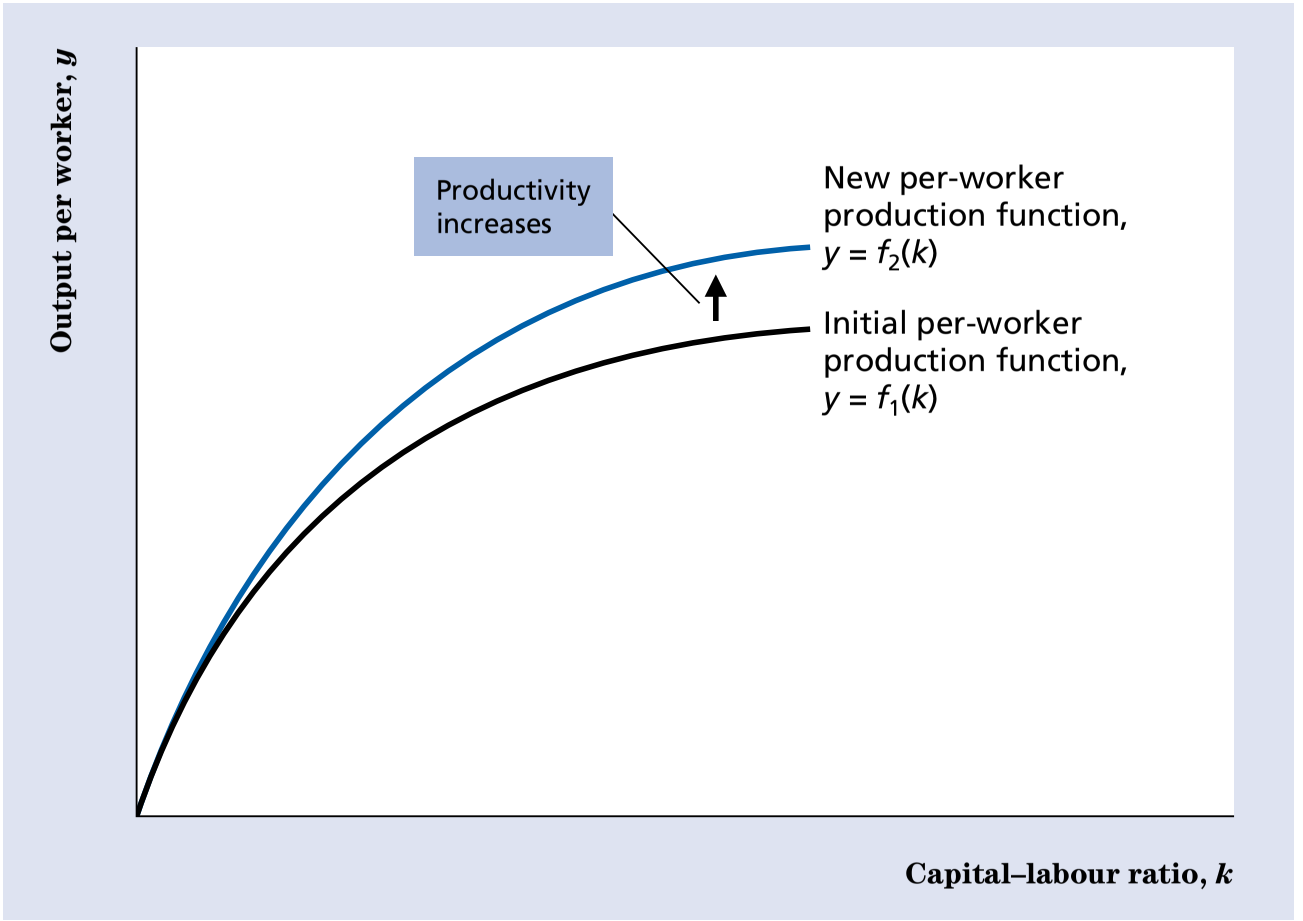


FIGURE 6.7

THE EFFECT OF A PRODUCTIVITY IMPROVEMENT ON THE STEADY-STATE CAPITAL–LABOUR RATIO

A productivity improvement shifts the production function upward from $f_1(k)$ to $f_2(k)$, raising output per worker for any capital–labour ratio. Because saving is proportional to output, saving per worker also rises, from $sf_1(k)$ to $sf_2(k)$. The point where saving per worker equals steady-state investment per worker shifts from point *A* to point *B*, and the corresponding steady-state capital–labour ratio rises from k_1^* to k_2^*. Thus, a productivity improvement raises the steady-state capital–labour ratio.

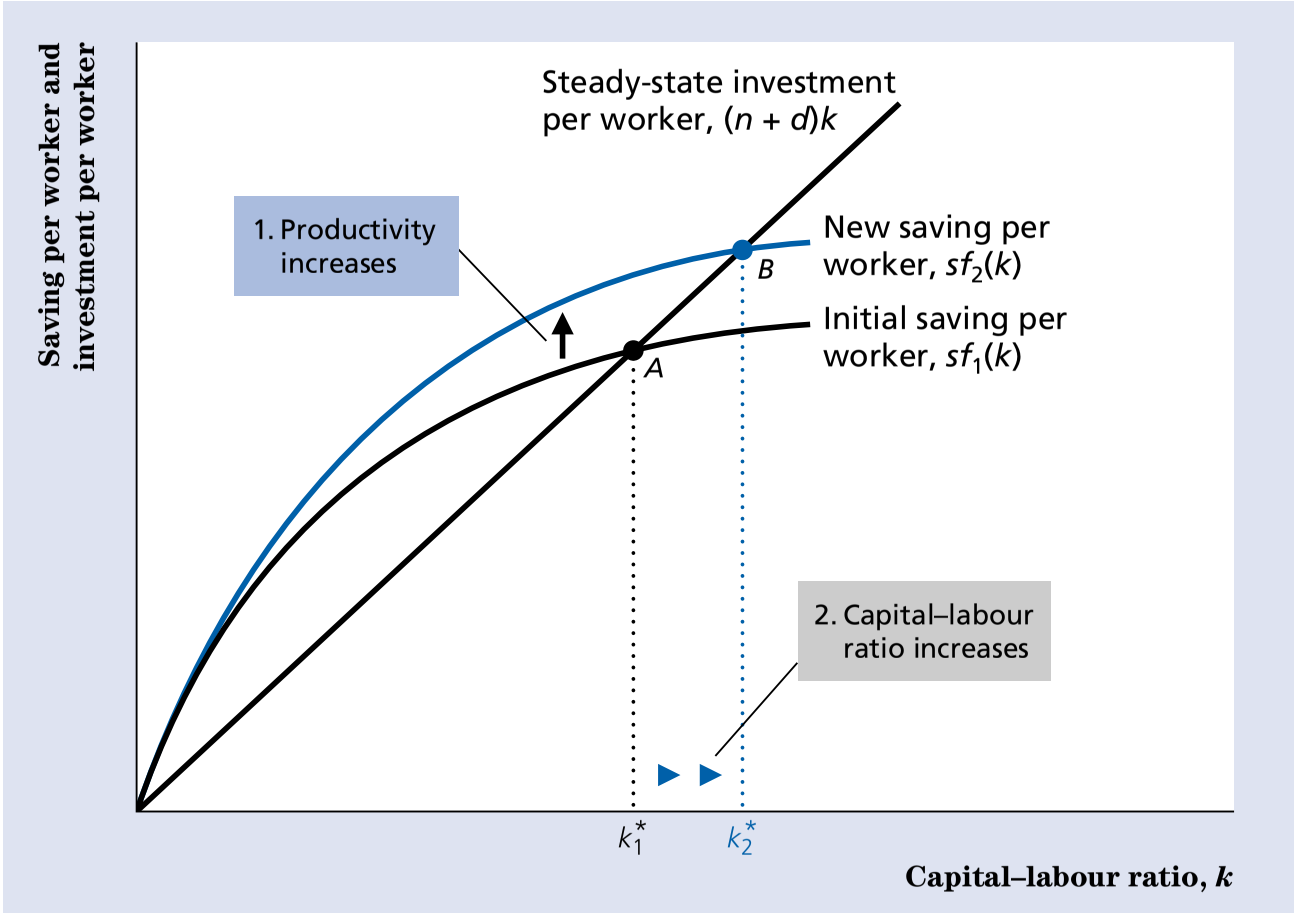


FIGURE 7.1

VELOCITY OF M1 AND M2, 1968–2001

M1 velocity is nominal GDP divided by M1, and M2 velocity is nominal GDP divided by M2. M1 velocity rose through the 1970s, then became more erratic in the 1980s, before falling in the 1990s. M2 velocity, while declining steadily, has been more stable than M1 velocity, but it has been unpredictable over some short time periods.

Source: Statistics Canada, CANSIM Series B1627 (M1), B1630 (M2), D14816 (GDP). Series are in millions of dollars, quarterly, and seasonally adjusted.

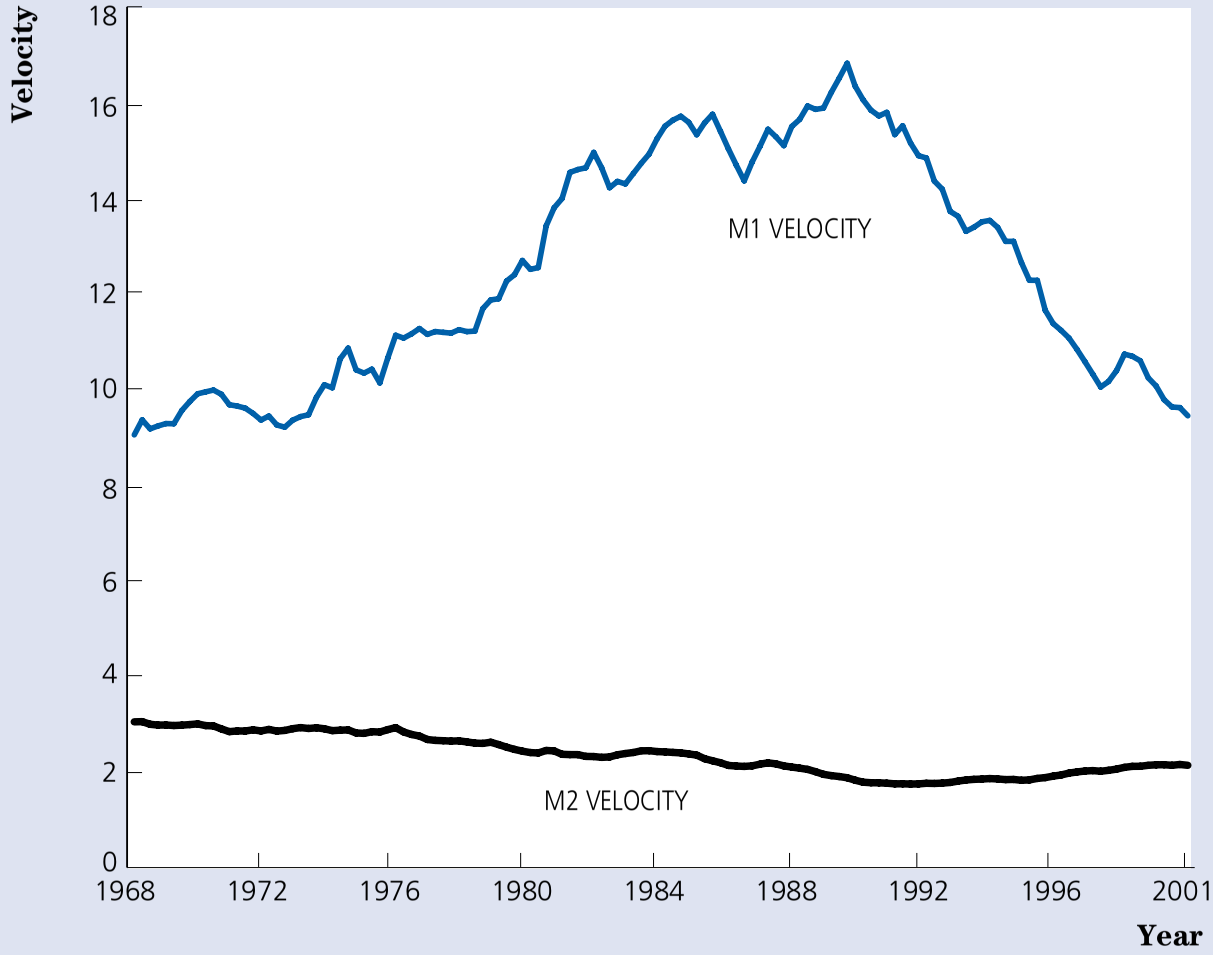


FIGURE 7.2

THE RELATIONSHIP BETWEEN MONEY GROWTH AND INFLATION

Nominal money growth and inflation during the period 1998–2000 are plotted for the European countries in transition. There is a strong relationship between money growth rates and inflation rates, with countries having double-digit inflation rates also having double-digit money growth rates.

Source: Money growth rates and consumer price inflation from *International Financial Statistics,* August 2001, pp. 60–61.

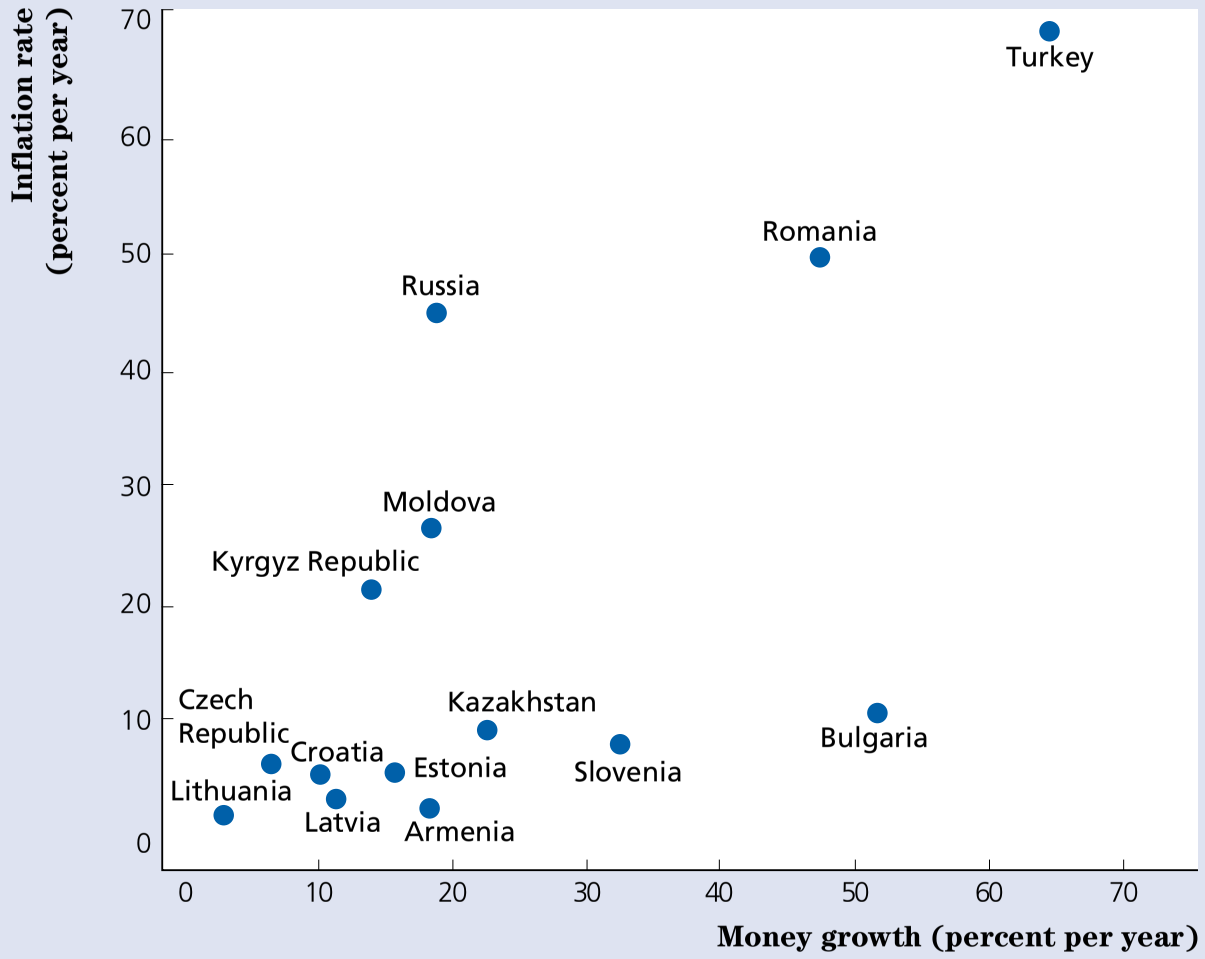


FIGURE 7.3

INFLATION AND THE NOMINAL INTEREST RATE IN CANADA, 1949–2001

The figure shows the nominal interest rate on one- to three-year government bonds and the annual rate of inflation as measured by the CPI. The nominal interest rate tends to move together with inflation, although there are periods, such as the early 1980s and mid-1990s, when the two variables diverge.

Source: Nominal interest rate is the annual average yield on one- to three-year Government of Canada bonds from the *Bank of Canada Review,* Table F1 (reprinted with permission of the Bank of Canada) or Statistics Canada, CANSIM Series B14009. Inflation is the rate of change of the consumer price index from *Canadian Economic Observer, Historical Statistical Summary,* Table 12 or CANSIM P100000.

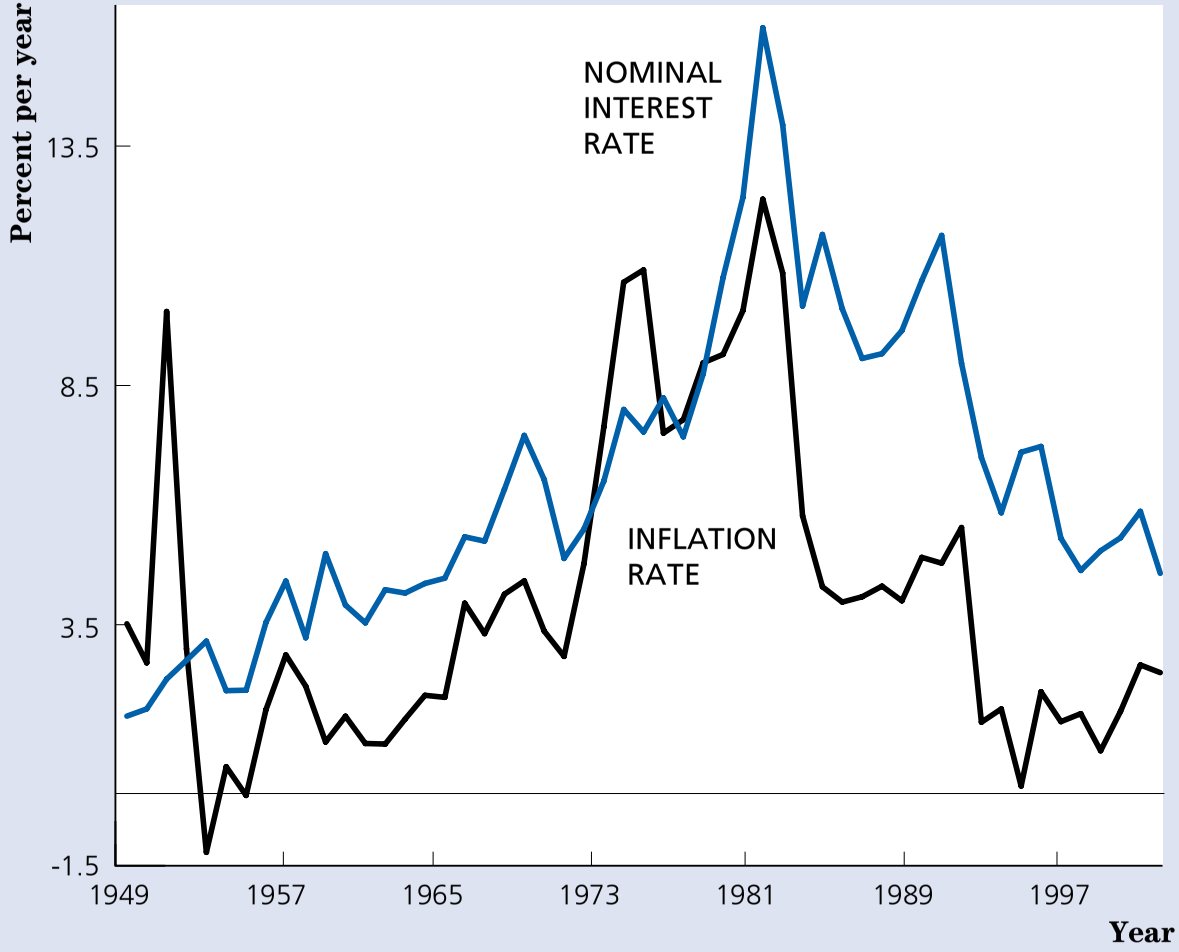


FIGURE 8.1

A BUSINESS CYCLE

The solid curve graphs the behaviour of aggregate economic activity over a typical business cycle. The dashed line shows the economy's normal growth path. During a contraction, aggregate economic activity falls until it reaches a trough, *T*. The trough is followed by an expansion during which economic activity increases until it reaches a peak, *P*. A complete cycle is measured from peak to peak or trough to trough.

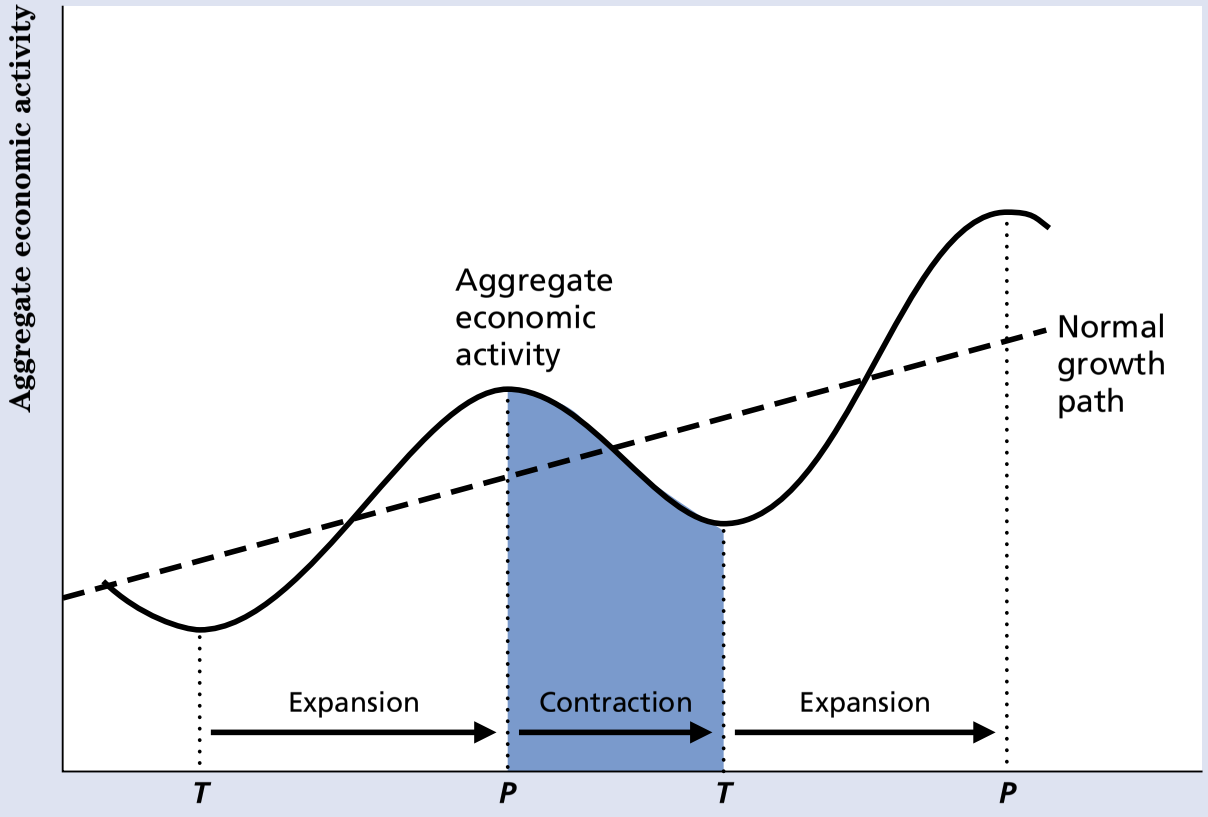


FIGURE 8.2

PERMANENT COMPONENTS OF THE BUSINESS CYCLE

The figure shows actual Canadian GDP (measured quarterly) and a trend line based on real GDP growth from 1947 to 1981. The economy did not return to the earlier trend line after the 1981–1982 recession. Hence much of the output loss of the 1981–1982 recession was permanent.

Source: Real GDP quarterly, seasonally adjusted: *Canadian Economic Observer, Statistical Summary* or CANSIM D100-126; data prior to 1981 have been rescaled.

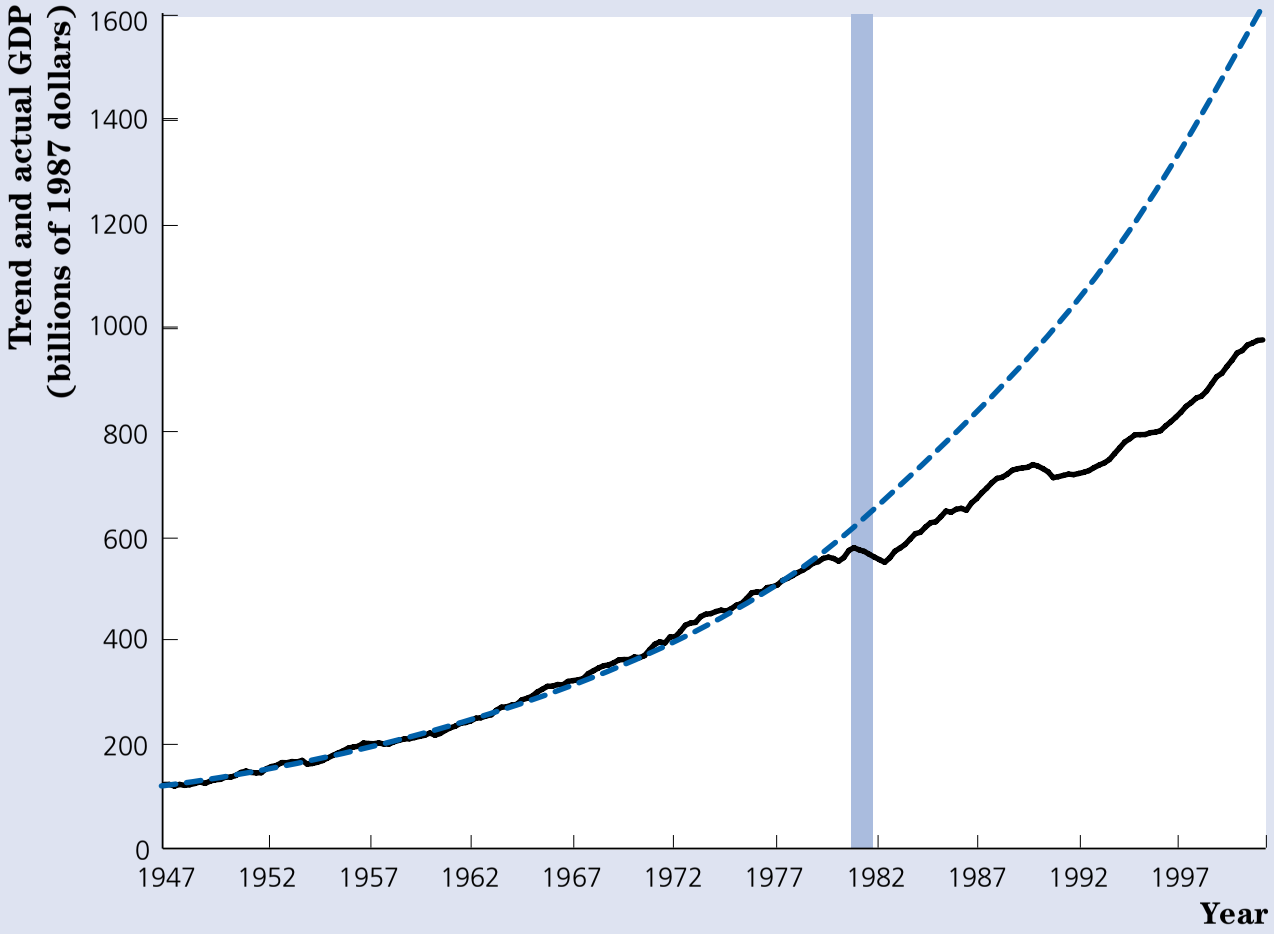


FIGURE 8.3

REAL GDP IN G–7 COUNTRIES

The worldwide effect of business cycles is reflected in the similar behaviour of real GDP in each of the seven countries shown. But individual countries also have fluctuations not shared with other countries.

Note: The scales for output differ by country; for example, the figure does not imply that Canada's output is the highest of the seven countries.

Source: Real GDP, quarterly, seasonally adjusted: International Monetary Fund, *International Financial Statistics*.

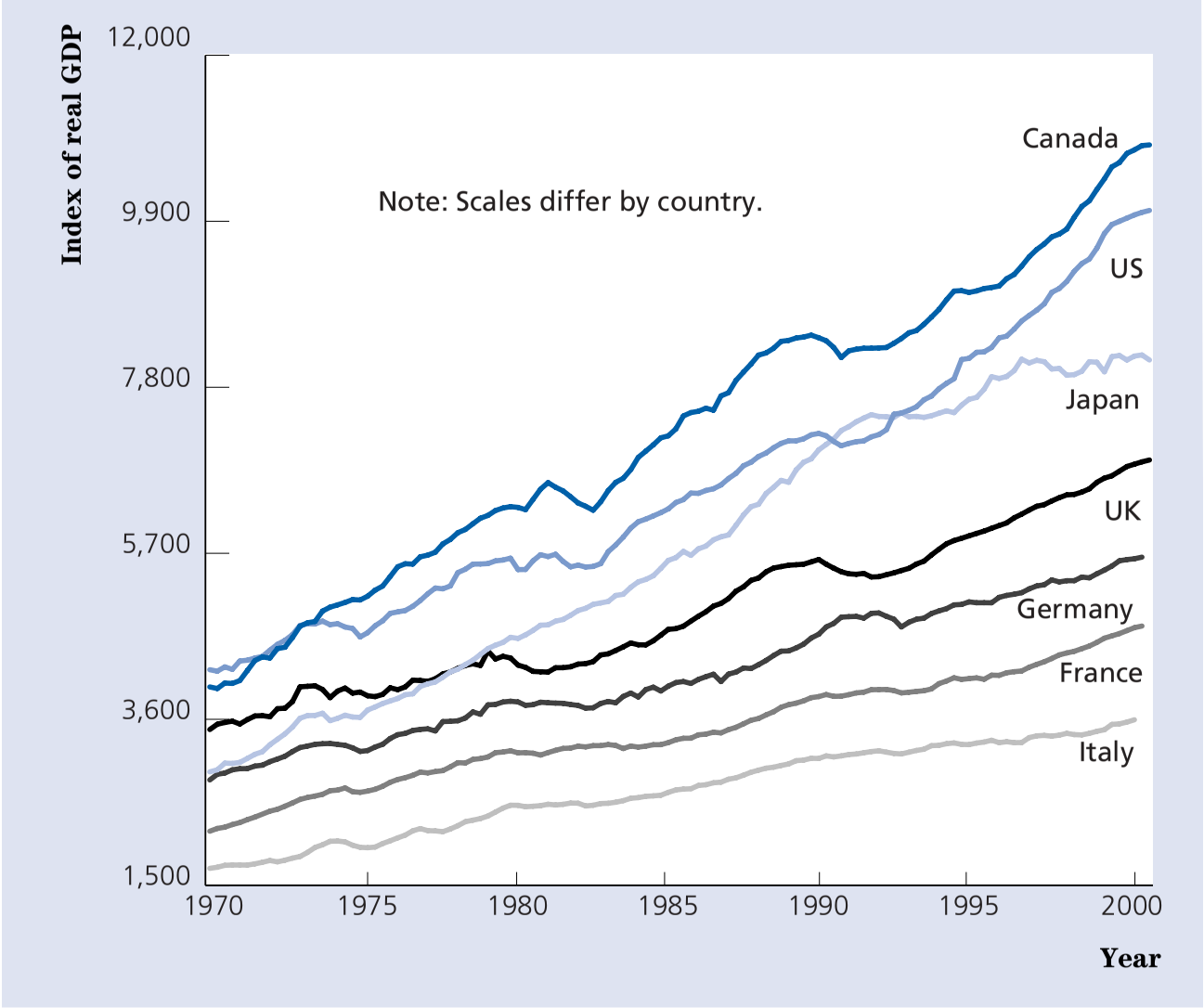


FIGURE 8.4

THE INDEX OF LEADING INDICATORS

Used for forecasting, the index of leading indicators is a weighted average of 10 economic variables that typically lead the business cycle. The index turns down in advance of business cycle peaks, signalling the onset of recession. Shaded areas represent recessions.

Source: *Canadian Economic Observer, Statistical Summary*, Table 5 (unsmoothed) or CANSIM D100052.

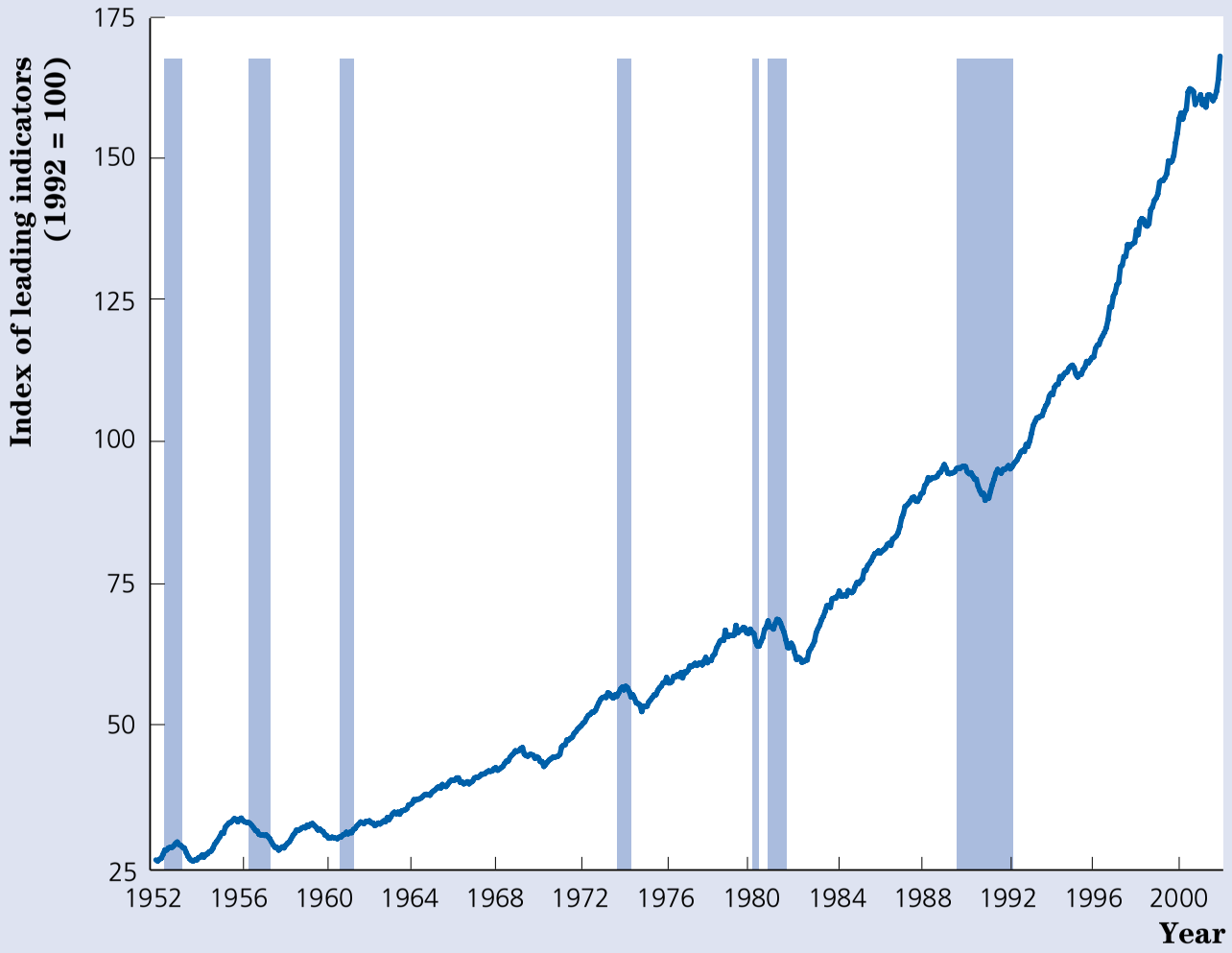


FIGURE 8.5

CYCLICAL BEHAVIOUR OF INDUSTRIAL PRODUCTION

Industrial production, an aggregate of production in all industries, is procyclical and coincident with the business cycle. The peaks and troughs of the business cycle are shown by the vertical lines *P* and *T*. The shaded areas represent recessions.

Source: Monthly industrial production, seasonally adjusted: *Canadian Economic Observer, Statistical Summary* or CANSIM I56010.

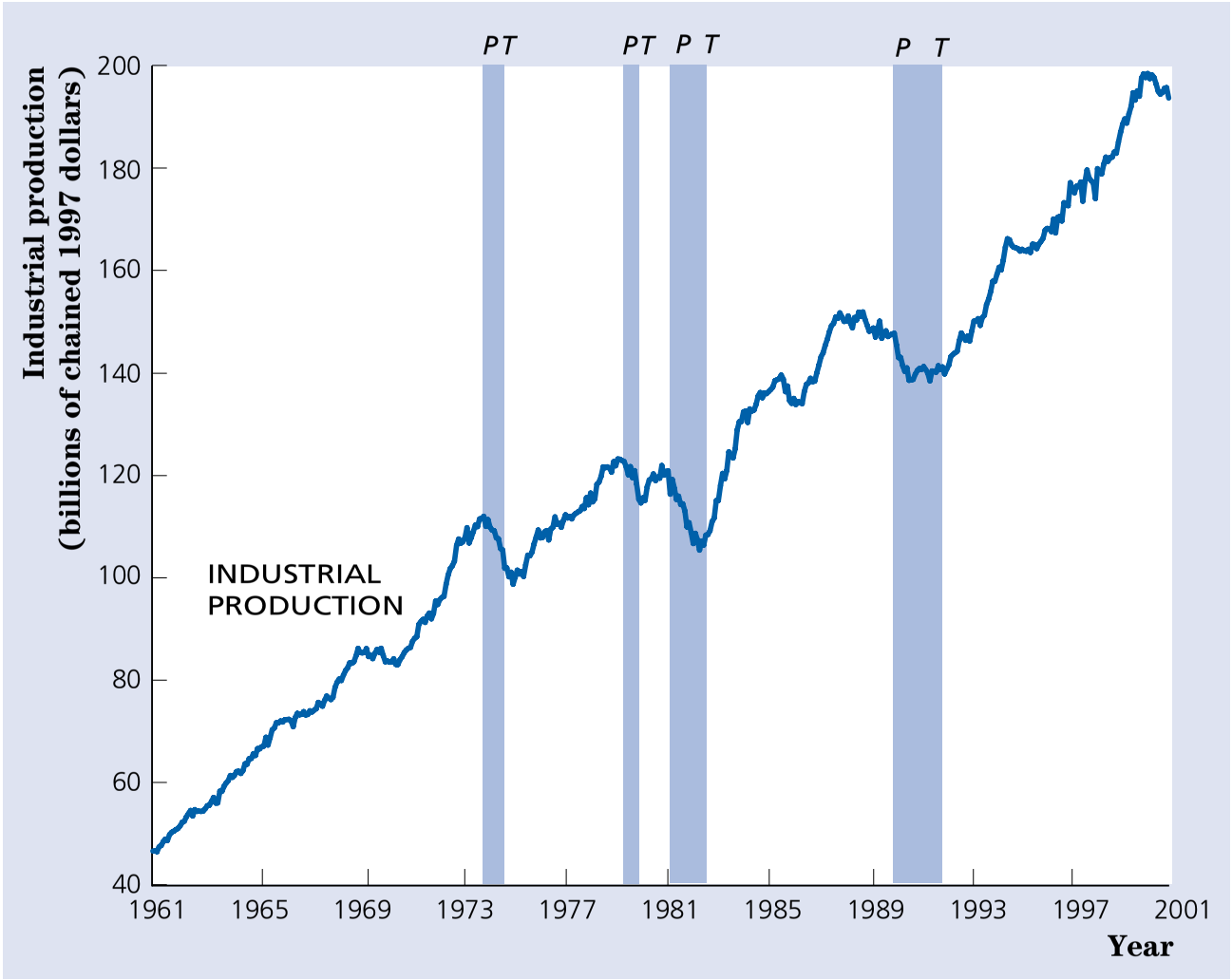


FIGURE 8.6

CYCLICAL BEHAVIOUR OF CONSUMPTION AND INVESTMENT

Both consumption and investment are procyclical. However, investment is more sensitive than consumption to the business cycle, reflecting the fact that durable goods are a larger part of investment spending than they are of consumption spending.

Source: Consumption and business fixed investment, real, quarterly, and seasonally adjusted: 1946–1980 Statistics Canada, CANSIM D15372 and D14851; 1981–2001 CANSIM D100103 and D100111. Data prior to 1981 are not chain-weighted and have been rescaled.

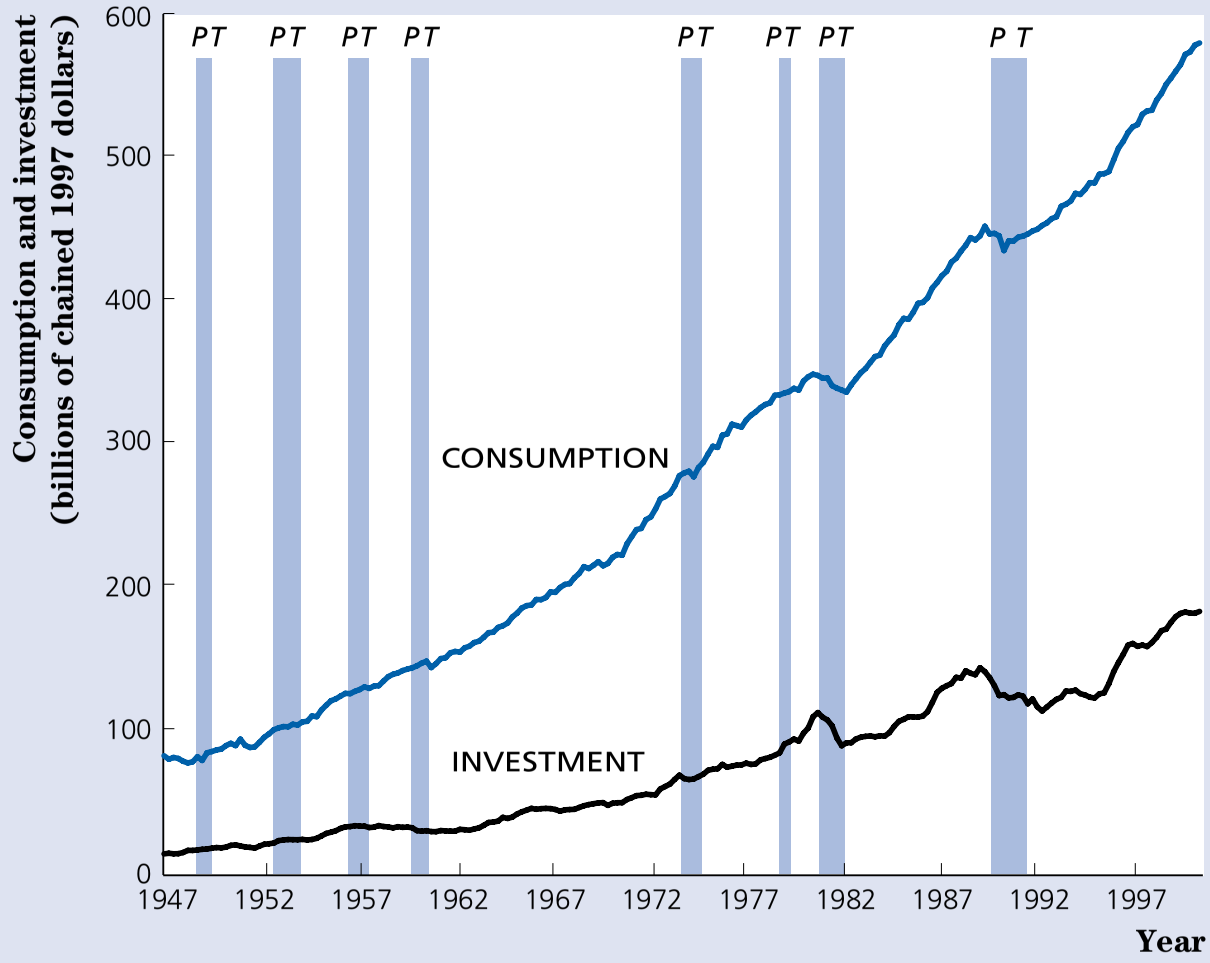


FIGURE 8.7

CYCLICAL BEHAVIOUR OF CHANGES IN BUSINESS INVENTORIES

Inventory investment, or changes in business inventories, is procyclical and leading but also extremely volatile. For example, between 1992 and 2000, inventory investment fluctuated sharply despite the fact that the economy was continually in expansion.

Source: Real, quarterly inventory investment, seasonally adjusted: 1947–1980 Statistics Canada, CANSIM D14858; 1981–2001 CANSIM D100116. Data prior to 1981 are not chain-weighted and have been rescaled.

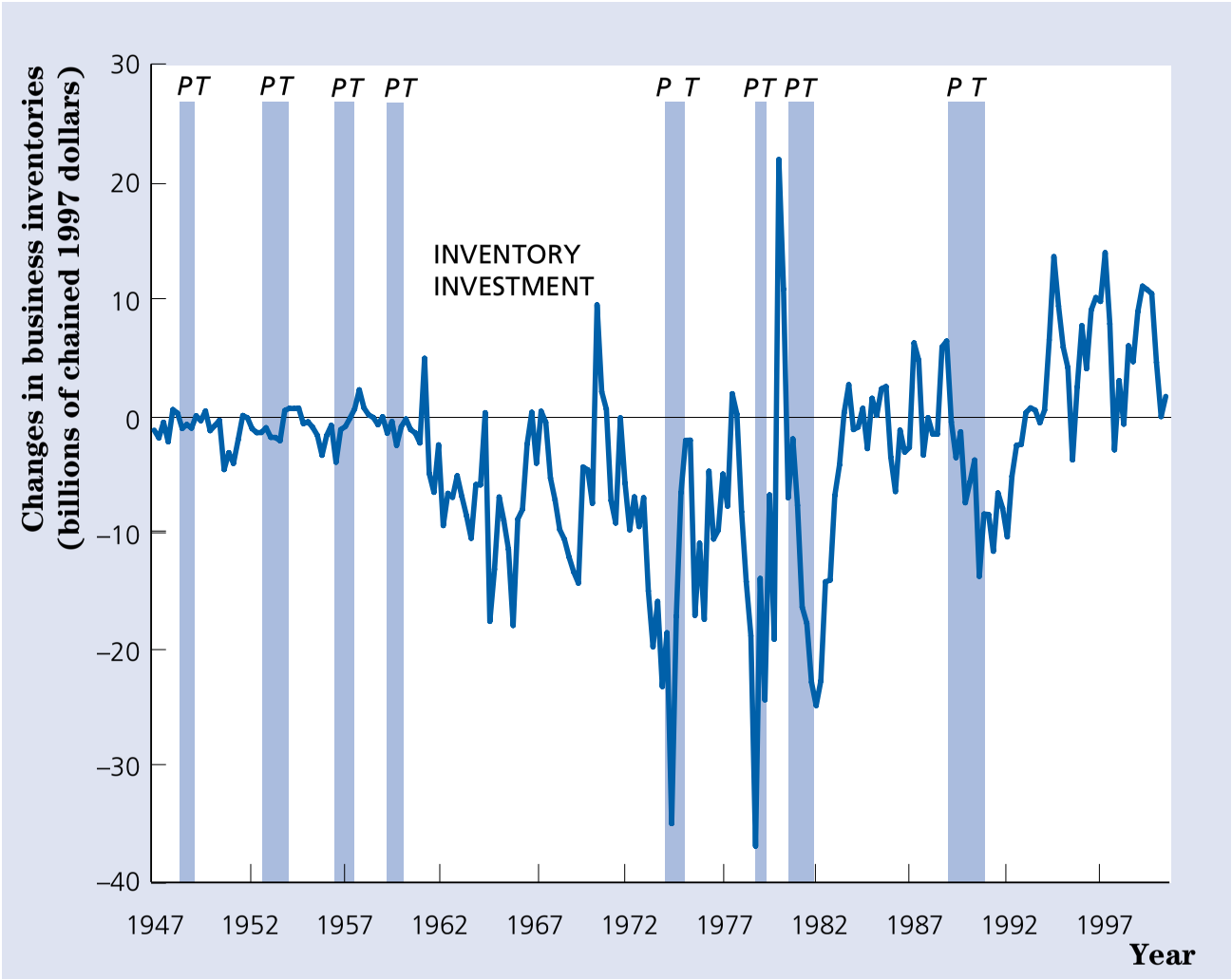


FIGURE 8.8

CYCLICAL BEHAVIOUR OF THE TRADE BALANCE

The trade balance (the difference between exports and imports) tends to be procyclical and leading, falling prior to recessions.

Source: Real, quarterly exports and imports, seasonally adjusted: 1947–1980 Statistics Canada, CANSIM D14862-D14866; 1981–2001 CANSIM D100119-D1001422. Data prior to 1981 are not chain-weighted and have been rescaled.

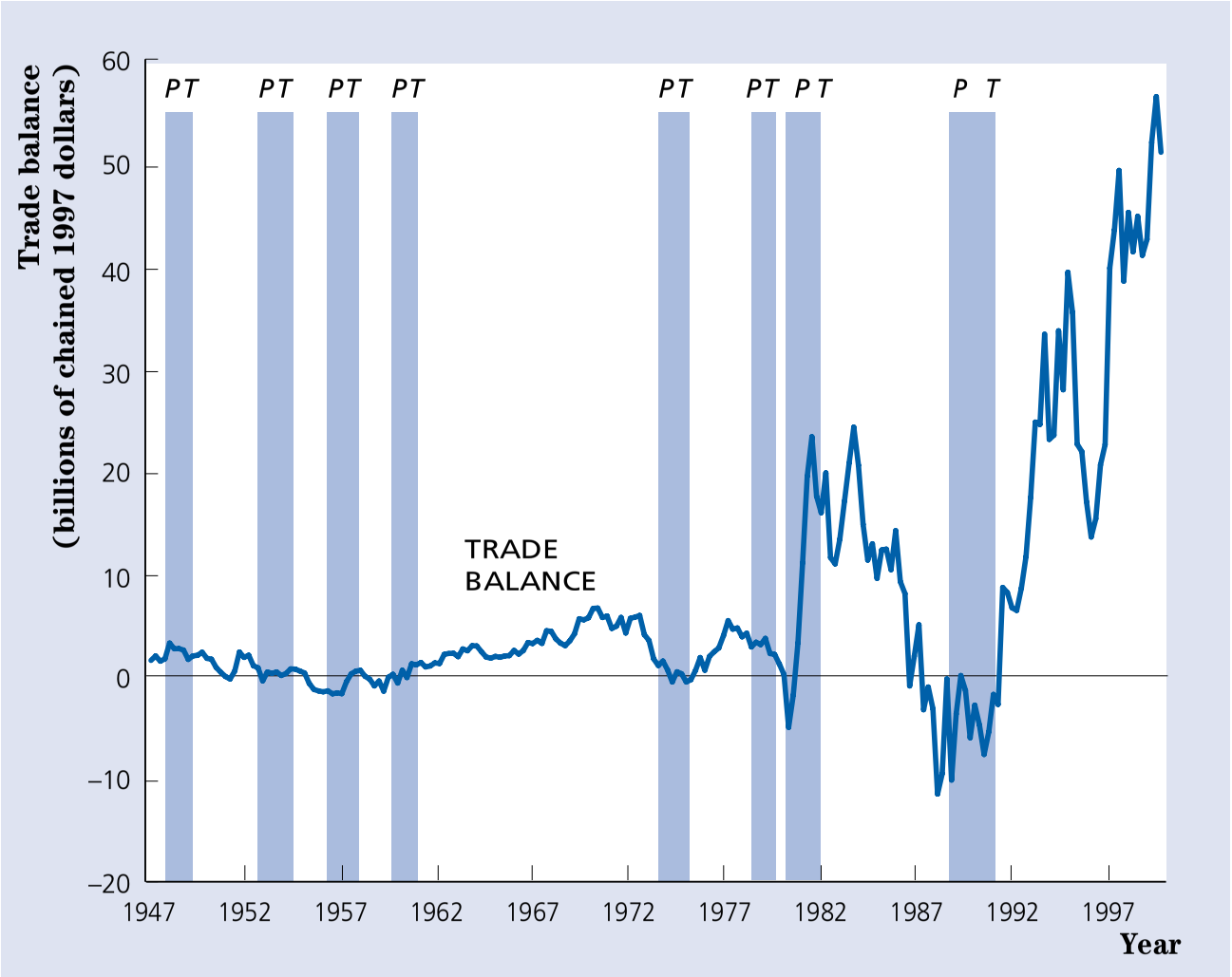


FIGURE 8.9

CYCLICAL BEHAVIOUR OF EMPLOYMENT

Employment is procyclical and coincident with the business cycle.

Source: Total employment, monthly, seasonally adjusted: *Canadian Economic Observer, Statistical Summary* or CANSIM D980595.

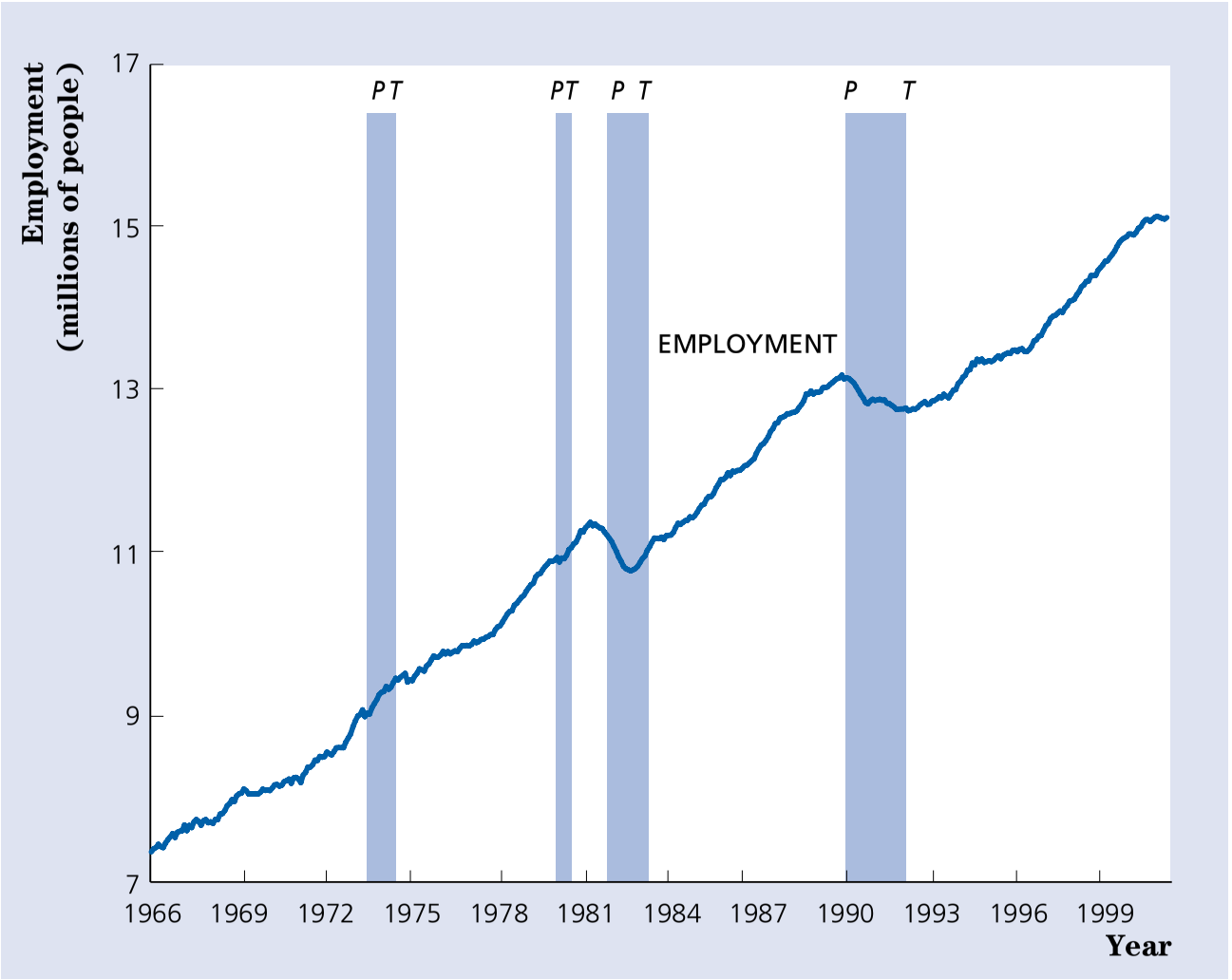


FIGURE 8.10

CYCLICAL BEHAVIOUR OF THE UNEMPLOYMENT RATE

The unemployment rate is countercyclical and very sensitive to the business cycle. It rises rapidly in contractions but falls more slowly in expansions.

Source: Monthly unemployment rate, seasonally adjusted: *Canadian Economic Observer, Statistical Summary* or CANSIM D980745.

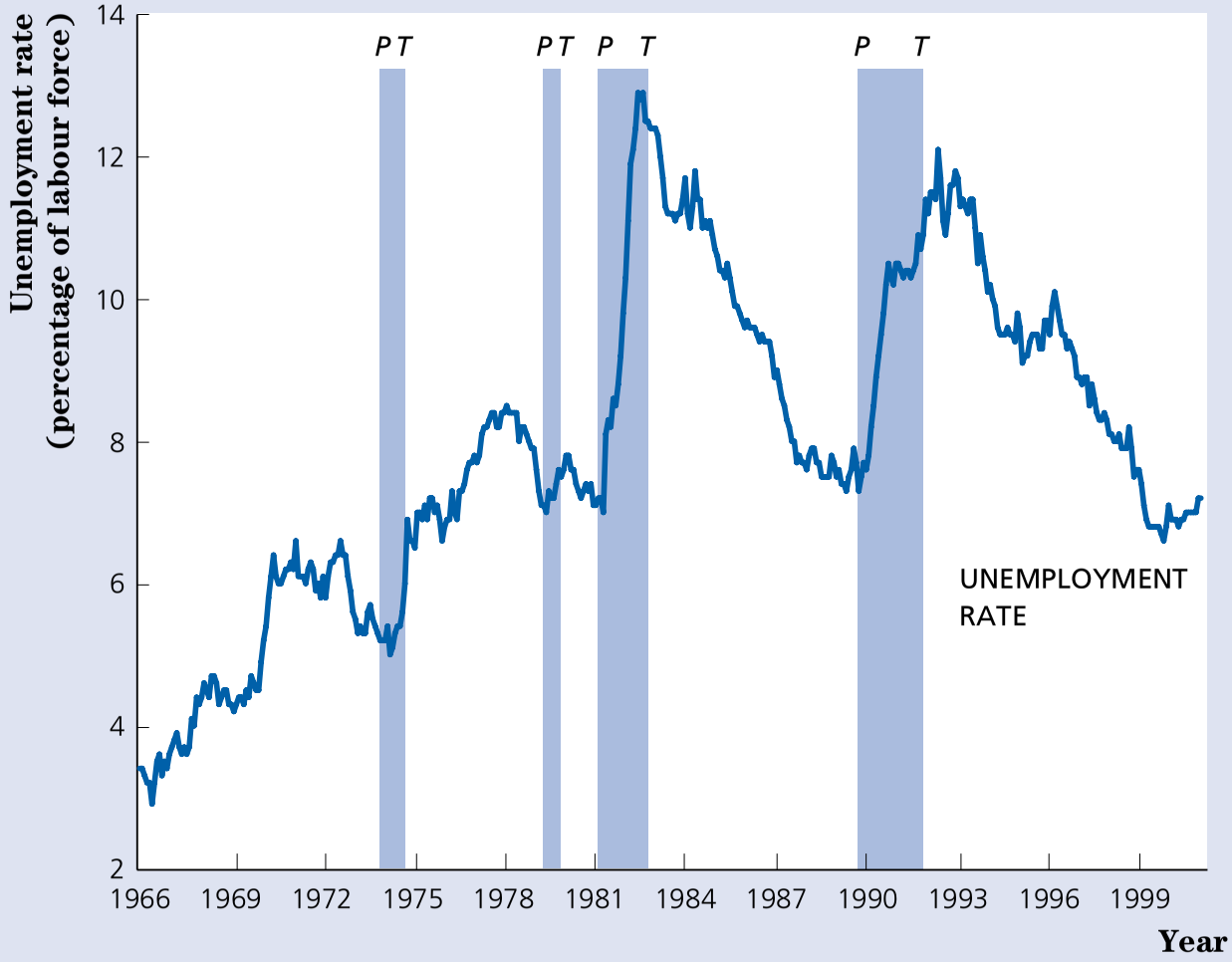


FIGURE 8.11

CYCLICAL BEHAVIOUR OF AVERAGE LABOUR PRODUCTIVITY

Average labour productivity, measured as real output per person employed, is pro-cyclical and leading.

Source: Monthly GDP at factor cost and monthly employment, both seasonally adjusted: *Canadian Economic Observer, Statistical Summary* or CANSIM I56001 and D980595.

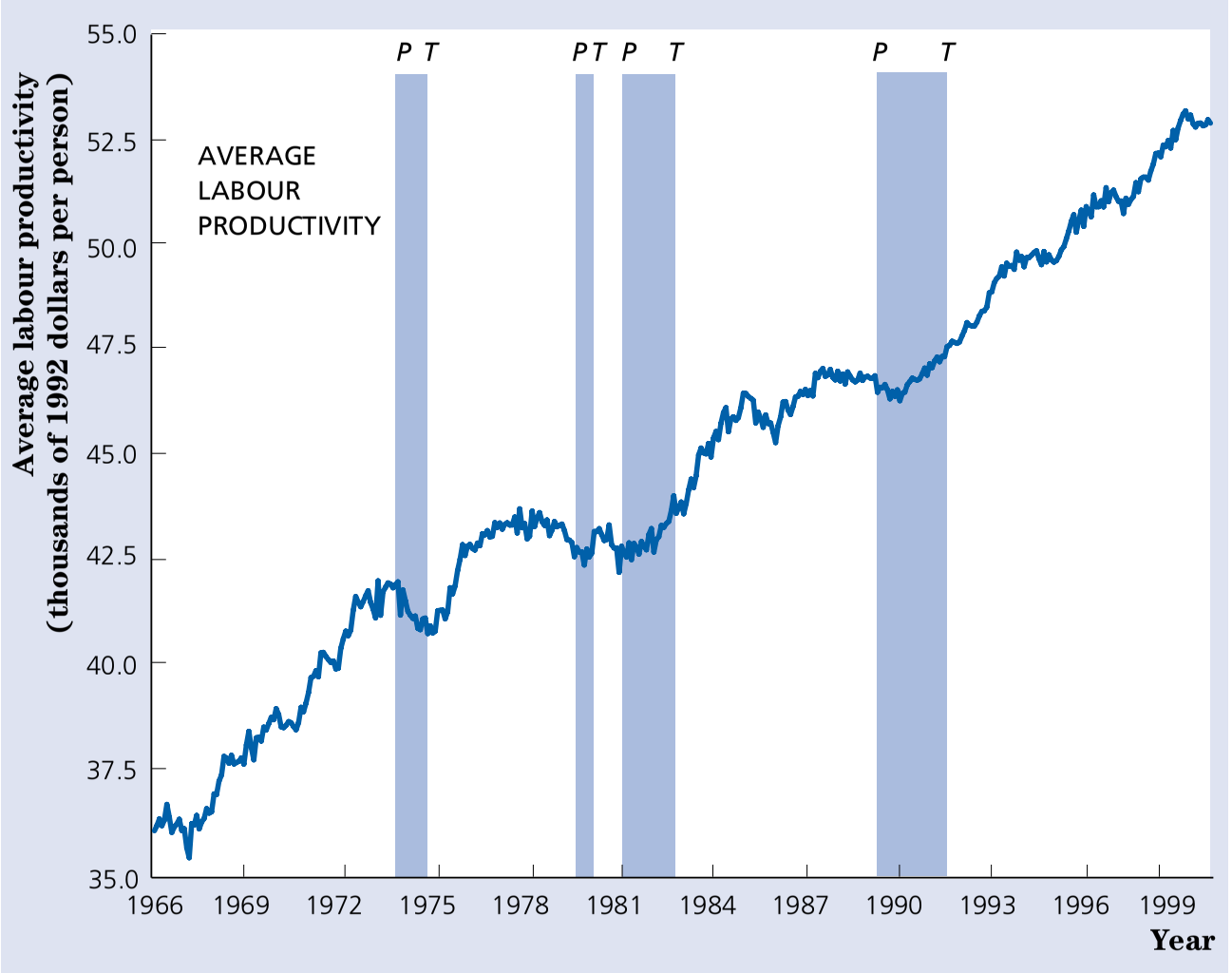


FIGURE 8.12

CYCLICAL BEHAVIOUR OF NOMINAL MONEY GROWTH AND INFLATION

Nominal money growth, here measured as the six-month moving average of monthly growth rates in M1 (expressed in annual rates) is volatile. However, the figure shows that money growth often falls at or just before a cyclical peak. Generally, money growth is procyclical and leading.

Inflation, here measured as the six-month moving average of monthly growth rates of the CPI (expressed in annual rates), is procyclical and lags the business cycle. A typical pattern is for inflation to build up during the expansion and then to fall after the cyclical peak.

Source: M1 monthly, seasonally adjusted: *Bank of Canada Review*, Table E1, reprinted with permission of the Bank of Canada, or CANSIM B1627; monthly CPI, all items: *Canadian Economic Observer, Statistical Summary* or CANSIM P100000.

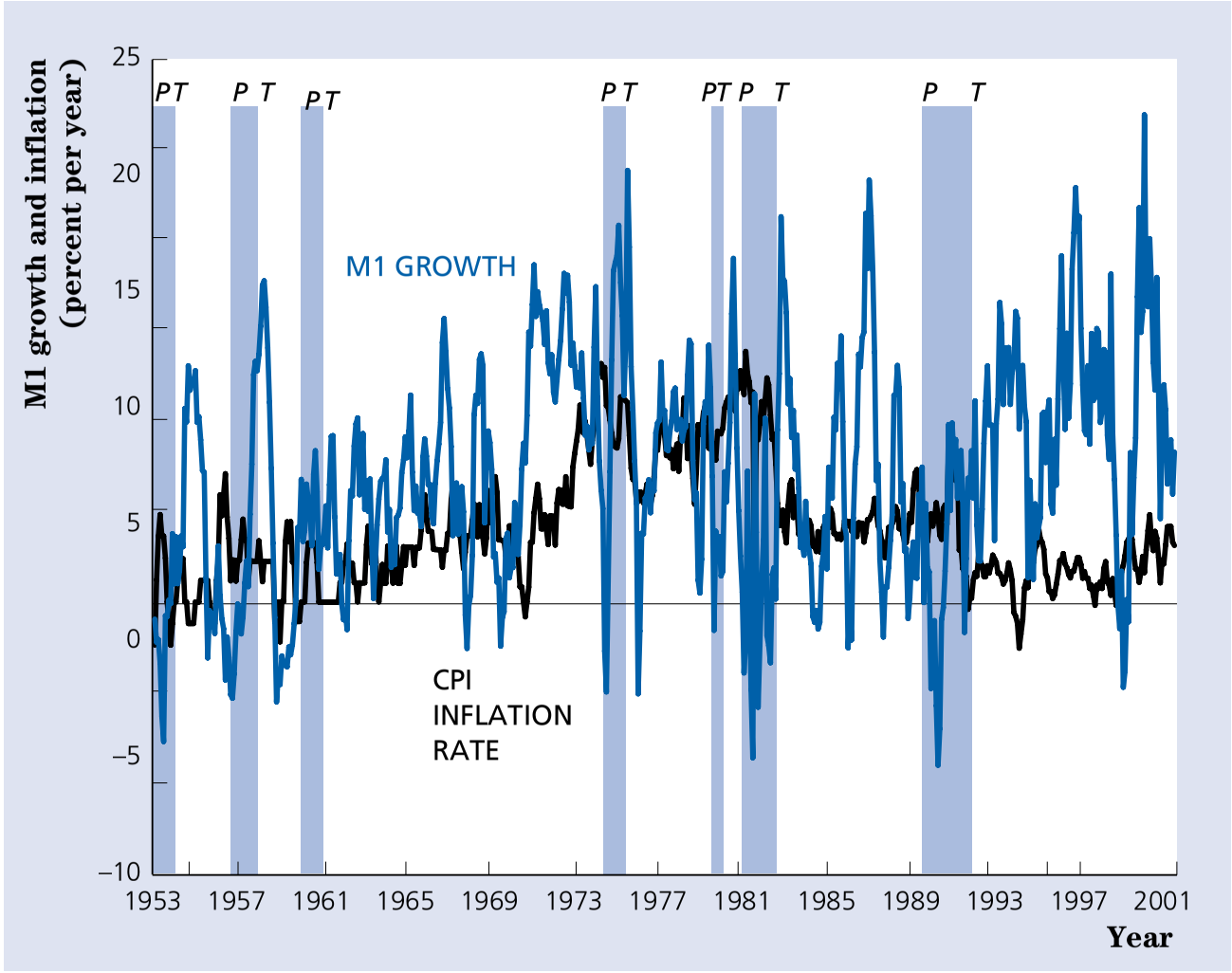


FIGURE 8.13

CYCLICAL BEHAVIOUR OF THE NOMINAL INTEREST RATE

The nominal interest rate, measured here as the interest rate on 90-day corporate paper, is procyclical and recently has lagged the business cycle.

Source: Monthly average, 90-day corporate paper rate: *Bank of Canada Review*, Table F1 reprinted with permission of the Bank of Canada, or CANSIM B14017.

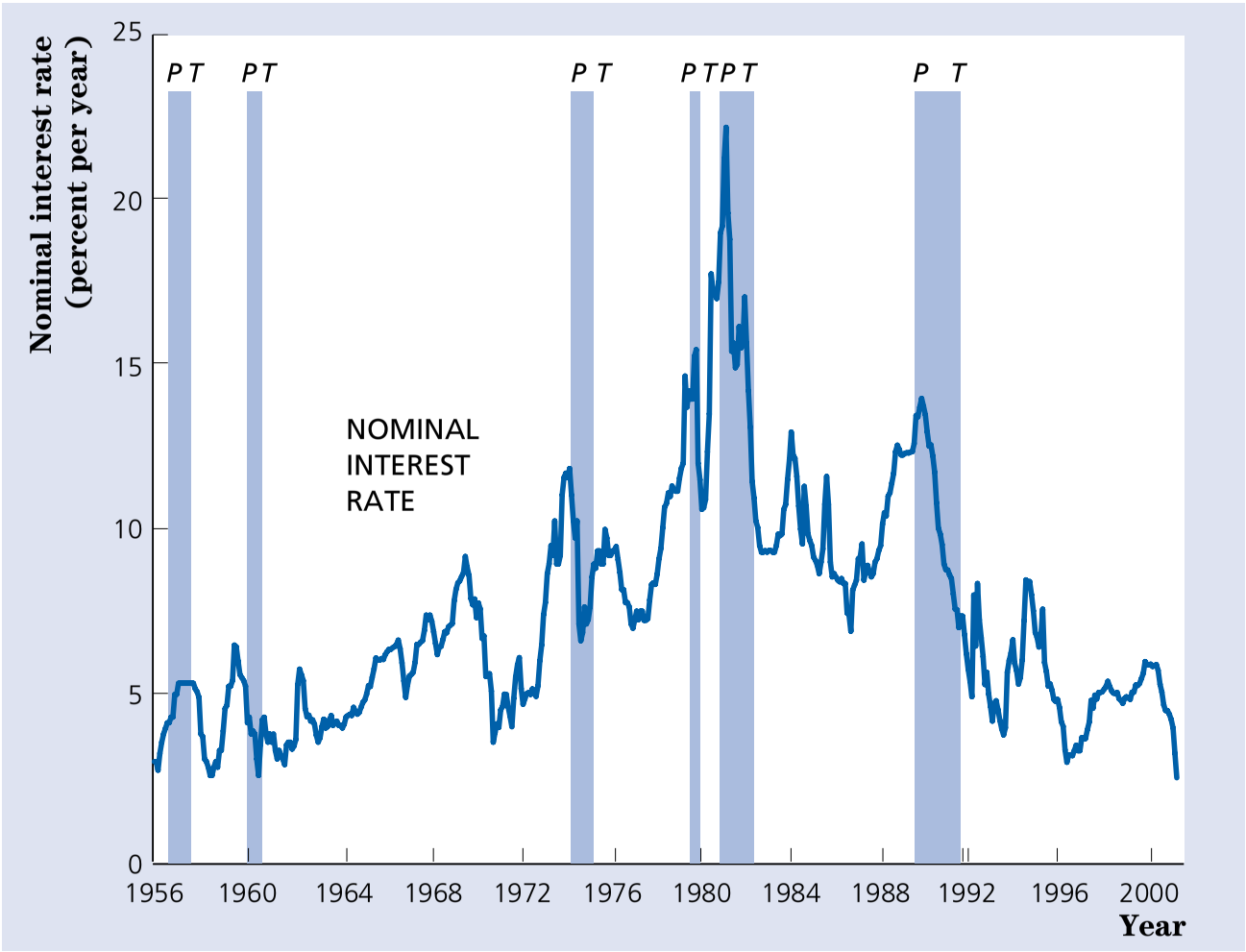


FIGURE 8.14

THE AGGREGATE DEMAND–AGGREGATE SUPPLY MODEL

The aggregate demand (*AD*) curve slopes downward, reflecting the fact that the aggregate quantity of goods and services demanded, *Y*, falls when the price level, *P*, rises. The short-run aggregate supply (*SRAS*) curve is horizontal, reflecting the assumption that in the short run, prices are fixed and firms simply produce whatever quantity is demanded. In the long run, firms produce their normal levels of output, so the long-run aggregate supply (*LRAS*) curve is vertical at the full-employment level of output, $\bar{Y}$. The economy's short-run equilibrium is at the point where the *AD* and *SRAS* curves intersect, and its long-run equilibrium is where the *AD* and *LRAS* curves intersect. In this example, the economy is in both short-run and long-run equilibrium at point *E*.

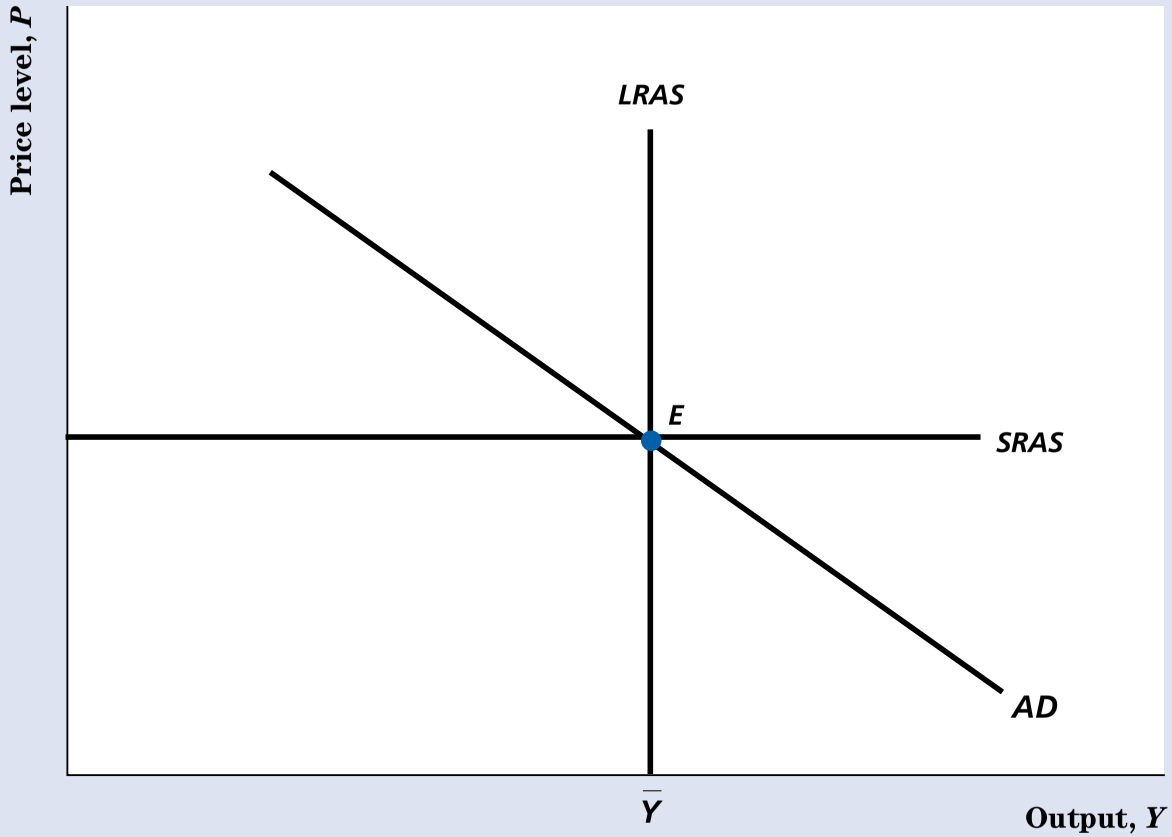


FIGURE 8.15

AN ADVERSE AGGREGATE DEMAND SHOCK

An adverse aggregate demand shock reduces the aggregate quantity of goods and services demanded at a given price level; an example is that consumers become more pessimistic and, thus, reduce their spending. This shock is represented by a shift to the left of the aggregate demand curve from AD^1 to AD^2. In the short run, the economy moves to point *F*. At this short-run equilibrium, output has fallen to Y_2 and the price level is unchanged. Eventually, price adjustment causes the economy to move to the new long-run equilibrium at point *H*, where output returns to its full-employment level, $\overline{Y}$, and the price level falls to P_2. In the strict classical view, the economy moves almost immediately to point *H*, so the adverse aggregate demand shock essentially has no effect on output in both the short run and the long run. Keynesians argue that the adjustment process takes longer so that the adverse aggregate demand shock may lead to a sustained decline in output.

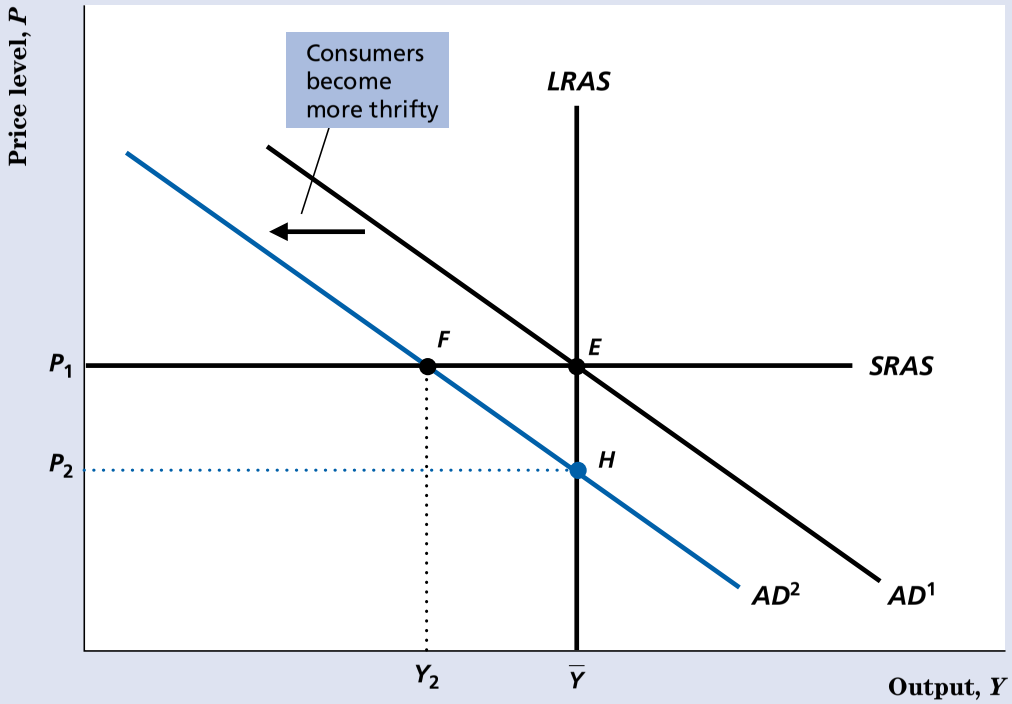


FIGURE 8.16

AN ADVERSE AGGREGATE SUPPLY SHOCK

An adverse aggregate supply shock, such as a drought, reduces the full-employment level of output from $\overline{Y}_1$ to $\overline{Y}_2$. Equivalently, the shock shifts the long-run aggregate supply curve from the left, from $LRAS^1$ to $LRAS^2$. As a result of the adverse supply shock, the long-run equilibrium moves from point E to point F. In the new long-run equilibrium, output has fallen from $\overline{Y}_1$ to $\overline{Y}_2$ and the price level has increased from P_1 to P_2.

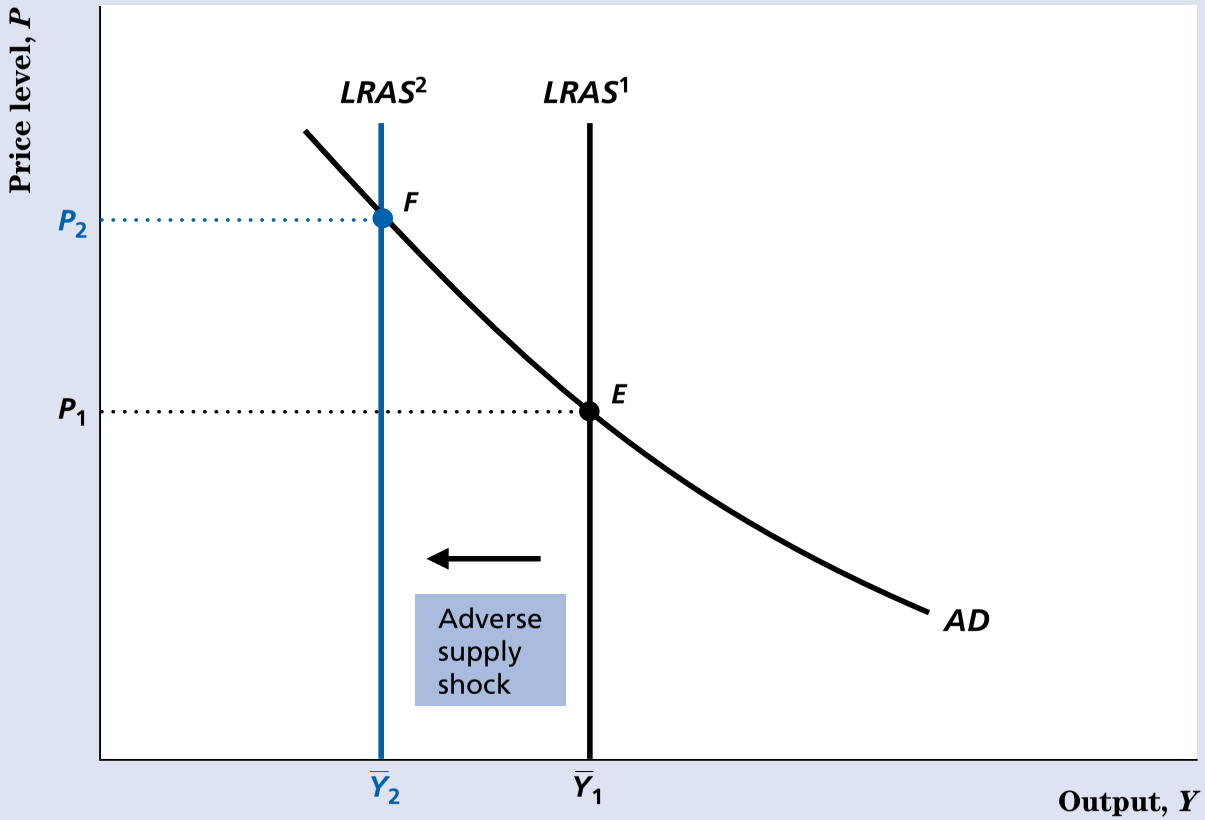
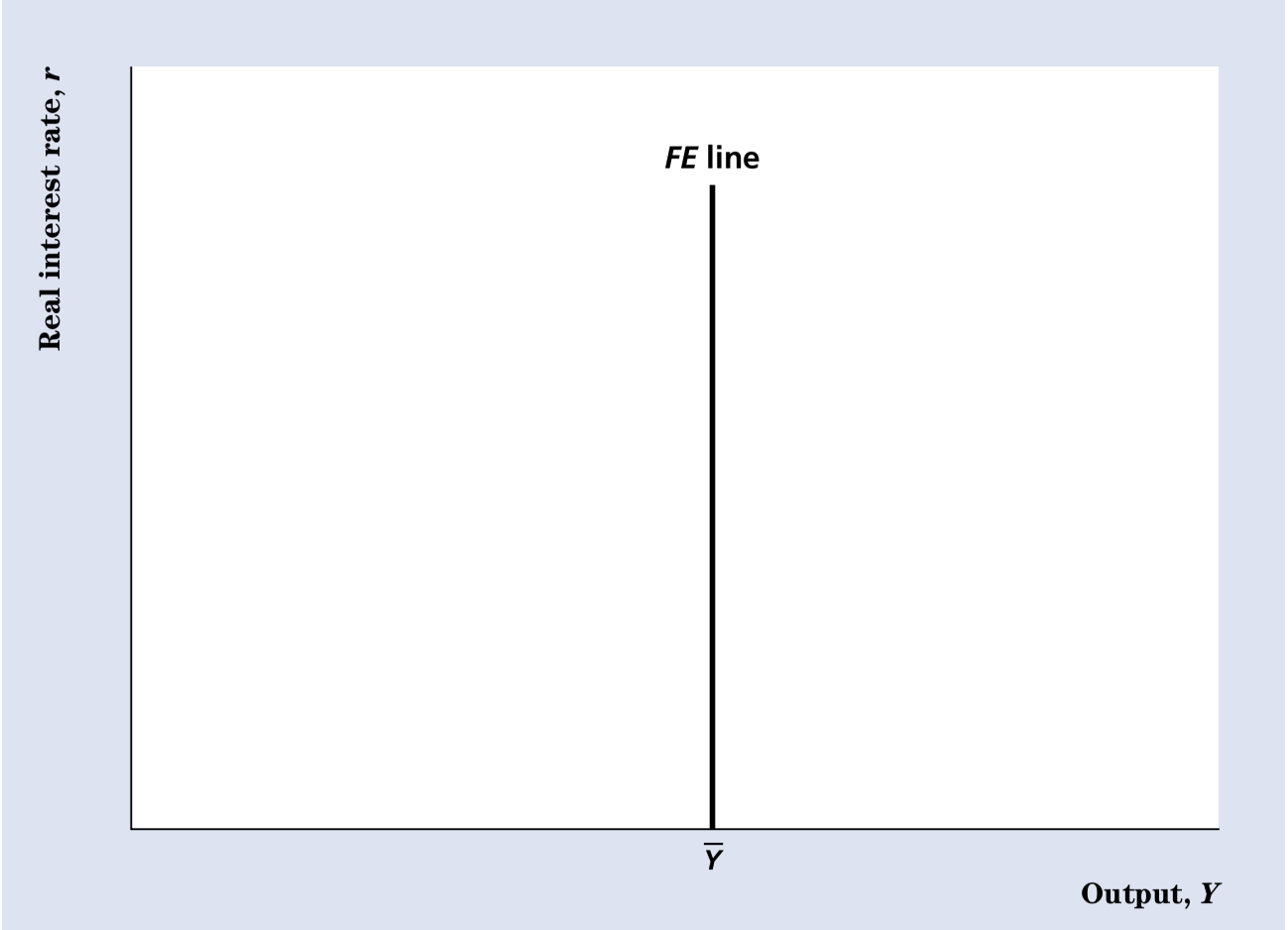


FIGURE 9.1

THE *FE* LINE

The full-employment (*FE*) line represents labour market equilibrium. When the labour market is in equilibrium, employment equals its full-employment level $\overline{N}$ and output equals its full-employment level $\overline{Y}$, regardless of the value of the real interest rate. Thus, the *FE* line is vertical at $Y = \overline{Y}$.



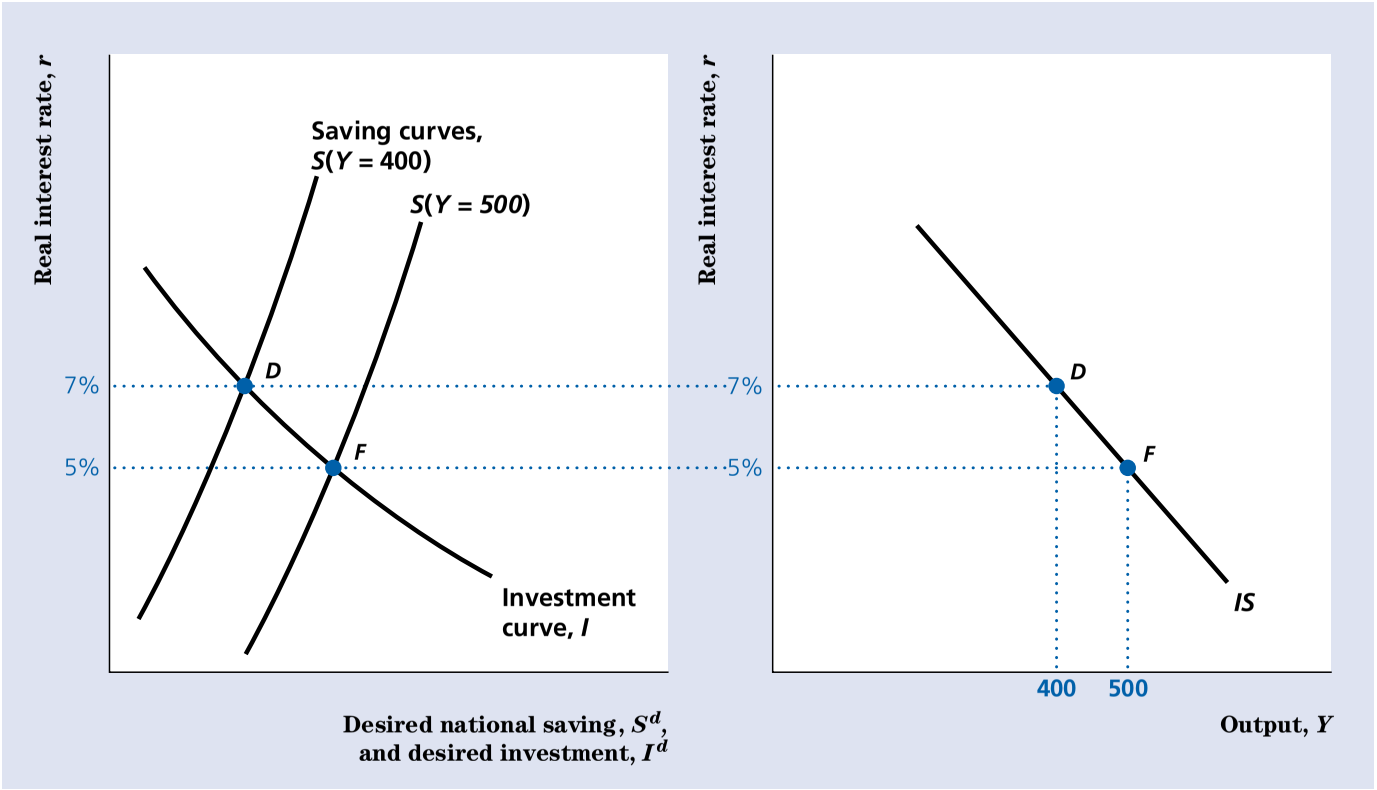


FIGURE 9.2

DERIVING THE *IS* CURVE

(a) The graph shows the goods market equilibrium for two different levels of output: 400 and 500 (the output corresponding to each saving curve is indicated in parentheses next to the curve). Higher levels of output (income) increase desired national saving and shift the saving curve to the right. When output is 400, the real interest rate that clears the goods market is 7% (point *D*). When output is 500, the market-clearing interest rate is 5% (point *F*).

(b) For each level of output the *IS* curve shows the corresponding real interest rate that clears the goods market. Thus, each point on the *IS* curve corresponds to an equilibrium point in the goods market. As in (a), when output is 400, the real interest rate that clears the goods market is 7% (point *D*); when output is 500, the market-clearing interest rate is 5% (point *F*). Because higher output raises saving and leads to a lower market-clearing interest rate, the *IS* curve slopes downward.

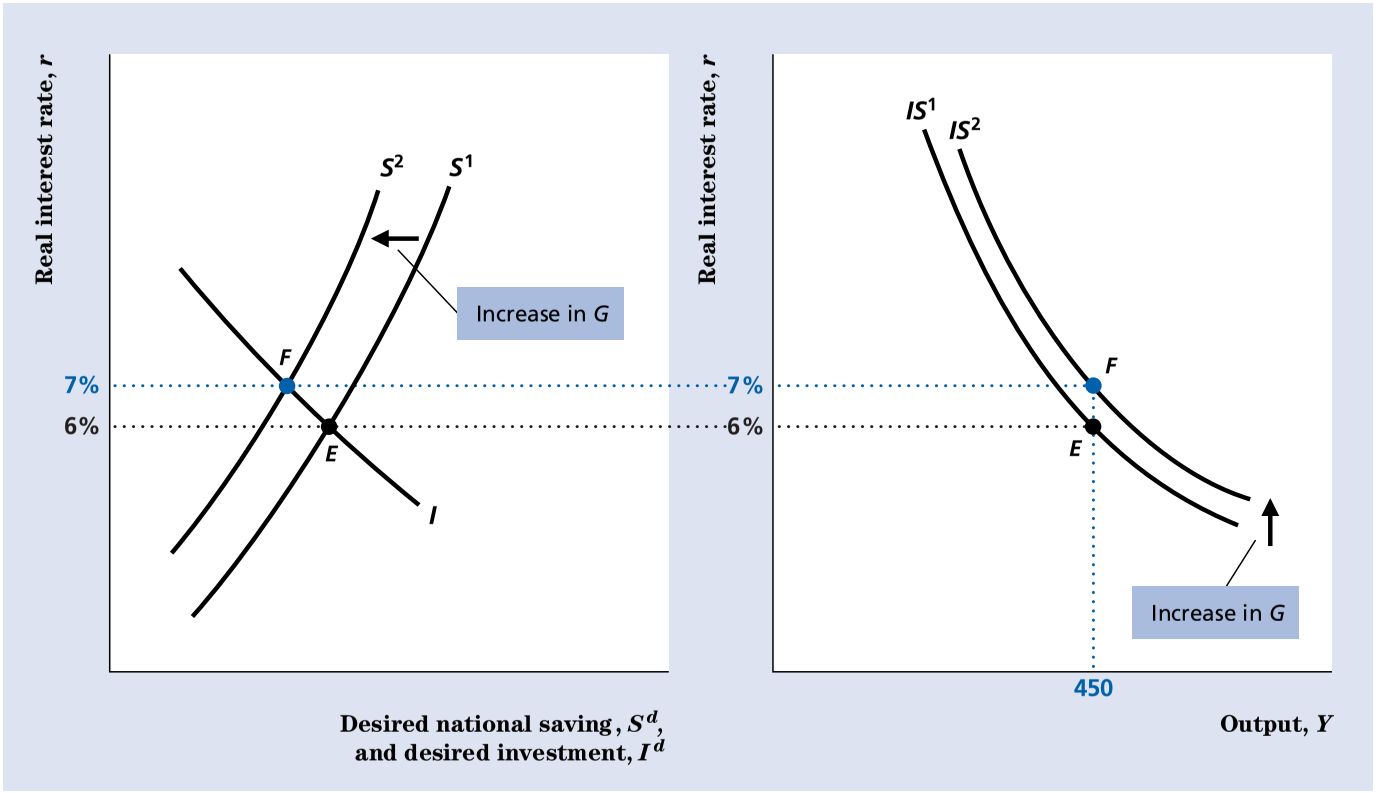


FIGURE 9.3

EFFECT ON THE *IS* CURVE OF A TEMPORARY INCREASE IN GOVERNMENT PURCHASES

(a) The saving–investment diagram shows the effects of a temporary increase in government purchases, G, with output Y constant at 450. The increase in G reduces desired national saving and shifts the saving curve to the left, from S^1 to S^2. The goods market equilibrium point moves from point E to point F, and the real interest rate rises from 6% to 7%.

(b) The increase in G raises the real interest rate that clears the goods market for any level of output. Thus, the IS curve shifts upward from IS^1 to IS^2. In this example, with output held constant at 450, an increase in government purchases raises the real interest rate that clears the goods market from 6% (point E) to 7% (point F).

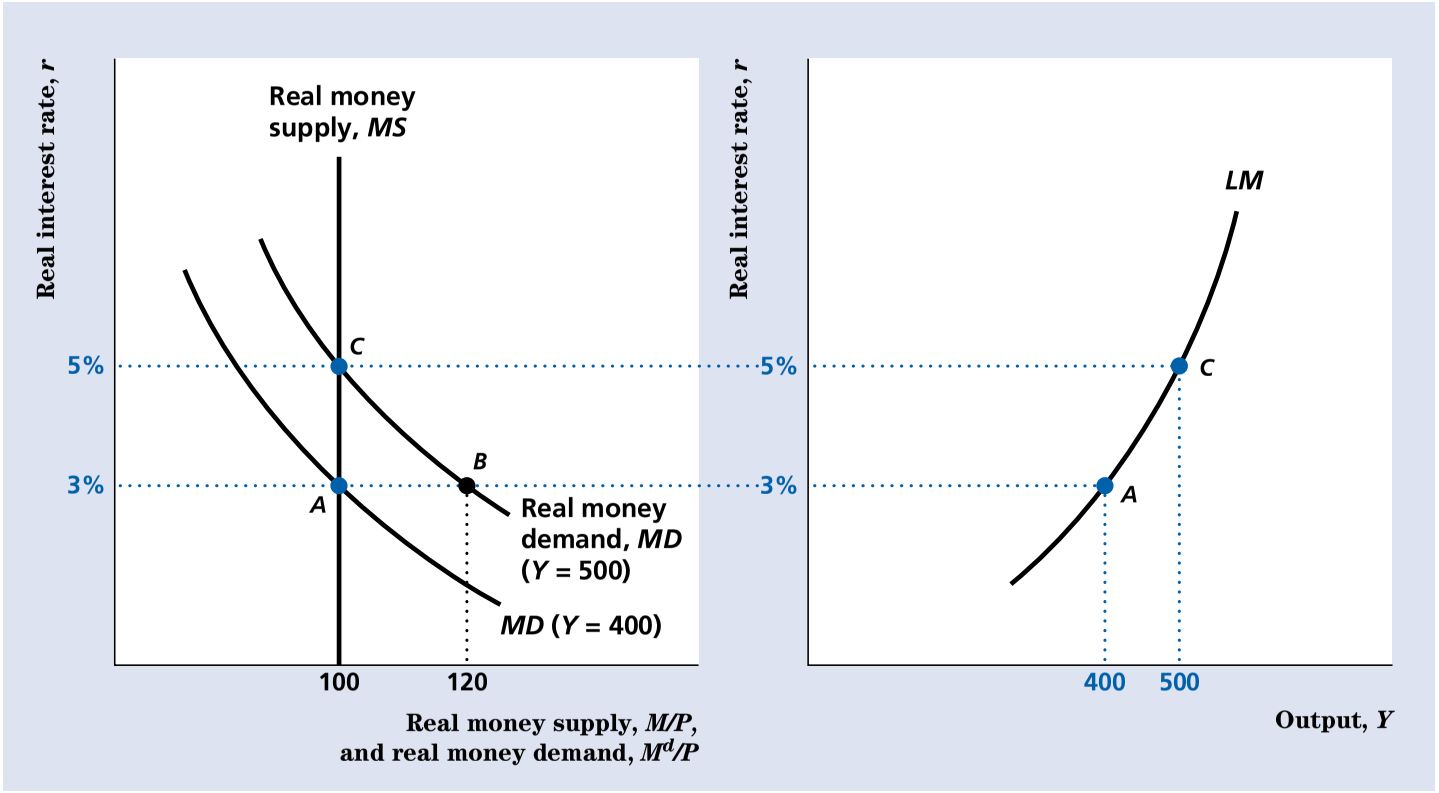


FIGURE 9.4

DERIVING THE *LM* CURVE

(a) The curves show real money demand and real money supply. Real money supply is fixed at 100. When output is 400, the real money demand curve is *MD* (*Y* = 400); the real interest rate that clears the asset market is 3% (point *A*). When output is 500, more money is demanded at the same real interest rate, so the real money demand curve shifts to the right to *MD* (*Y* = 500). In this case, the real interest rate that clears the asset market is 5% (point *C*).

(b) The graph shows the corresponding *LM* curve. For each level of output, the *LM* curve shows the real interest rate that clears the asset market. Thus, when output is 400, the *LM* curve shows that the real interest rate that clears the goods market is 3% (point *A*). When output is 500, the *LM* curve shows a market-clearing real interest rate of 5% (point *C*). Because higher output raises money demand, and thus raises the real interest rate that clears the asset market, the *LM* curve slopes upward.

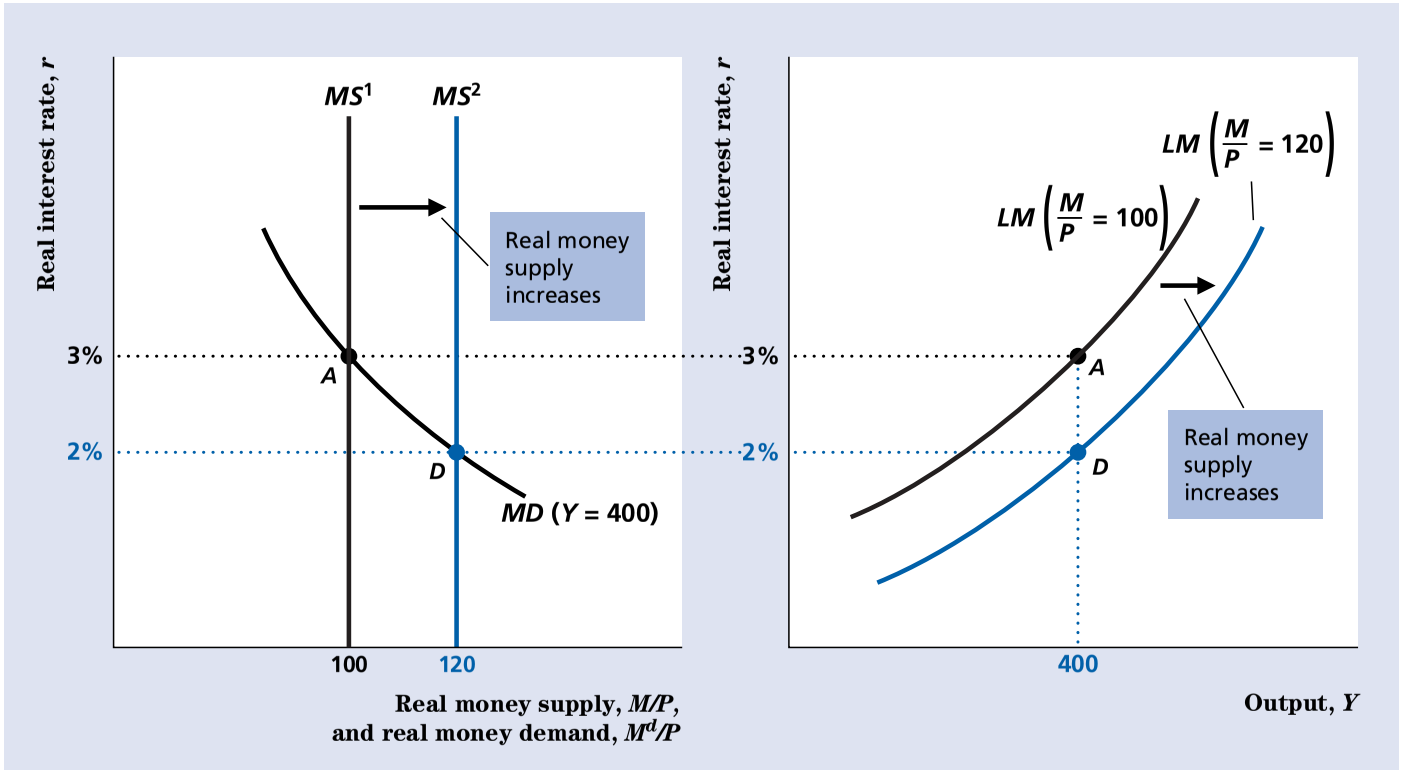


FIGURE 9.5

AN INCREASE IN THE REAL MONEY SUPPLY SHIFTS THE *LM* CURVE DOWN

(a) An increase in the real supply of money shifts the money supply curve to the right, from MS^1 to MS^2. For a constant level of output, the real interest rate that clears the asset market falls. If output is fixed at 400, for example, the money demand curve is MD (Y = 400) and the real interest rate that clears the asset market falls from 3% (point *A*) to 2% (point *D*).

(b) The graph shows the effect of the increase in real money supply on the *LM* curve. For any level of output, the increase in the real money supply causes the real interest rate that clears the asset market to fall. So, for example, when output is 400, the increase in the real money supply causes the real interest rate that clears the asset market to fall from 3% (point *A*) to 2% (point *D*). Thus, the *LM* curve shifts down, from *LM* for M/P = 100 to *LM* for M/P = 120.

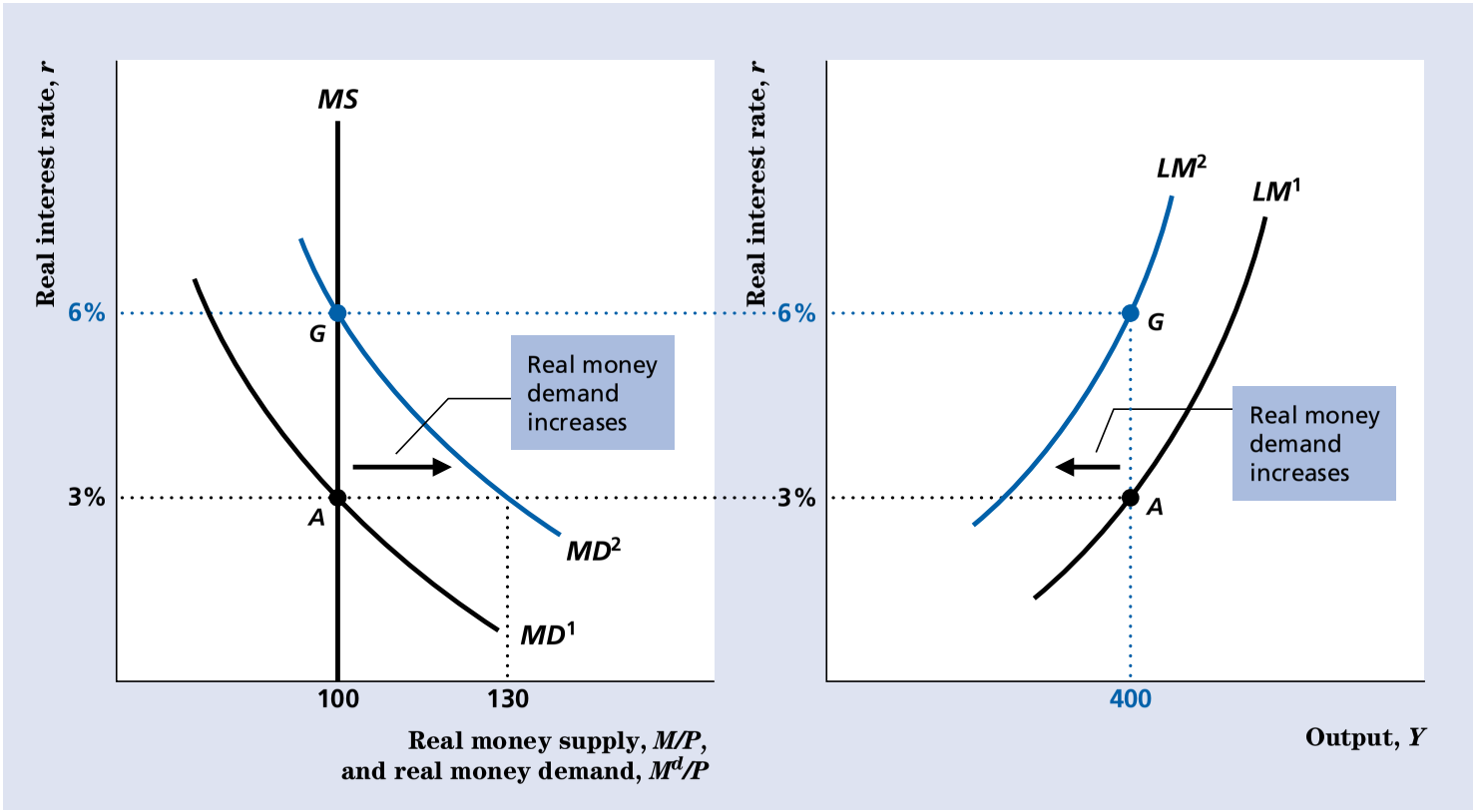


FIGURE 9.6

AN INCREASE IN REAL MONEY DEMAND SHIFTS THE *LM* CURVE UP

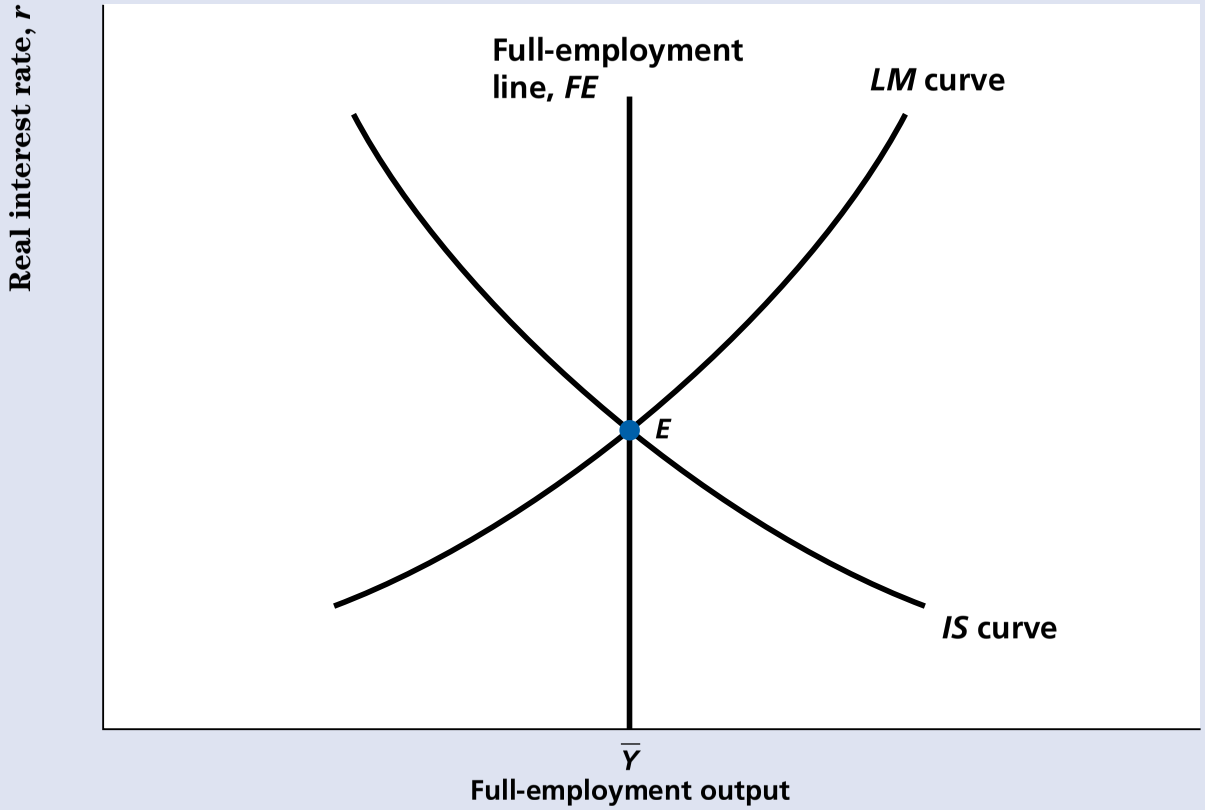
(a) With output constant at 400 and the real money supply at 100, an increase in the interest rate paid on money raises real money demand. The money demand curve shifts to the right, from MD^1 to MD^2, and the real interest rate that clears the asset market rises from 3% (point *A*) to 6% (point *G*).

(b) The graph shows the effect of the increase in real money demand on the *LM* curve. When output is 400, the increase in real money demand raises the real interest rate that clears the asset market from 3% (point *A*) to 6% (point *G*). More generally, for any level of output, the increase in real money demand raises the real interest rate that clears the asset market. Thus, the *LM* curve shifts up, from LM^1 to LM^2.

FIGURE 9.7

GENERAL EQUILIBRIUM IN THE *IS–LM* MODEL

The economy is in general equilibrium when quantities supplied equal quantities demanded in every market. The general equilibrium point, *E*, lies on the *IS* curve, the *LM* curve, and the *FE* line. Thus, at *E*, and only at *E*, the goods market, the asset market, and the labour market are simultaneously in equilibrium.



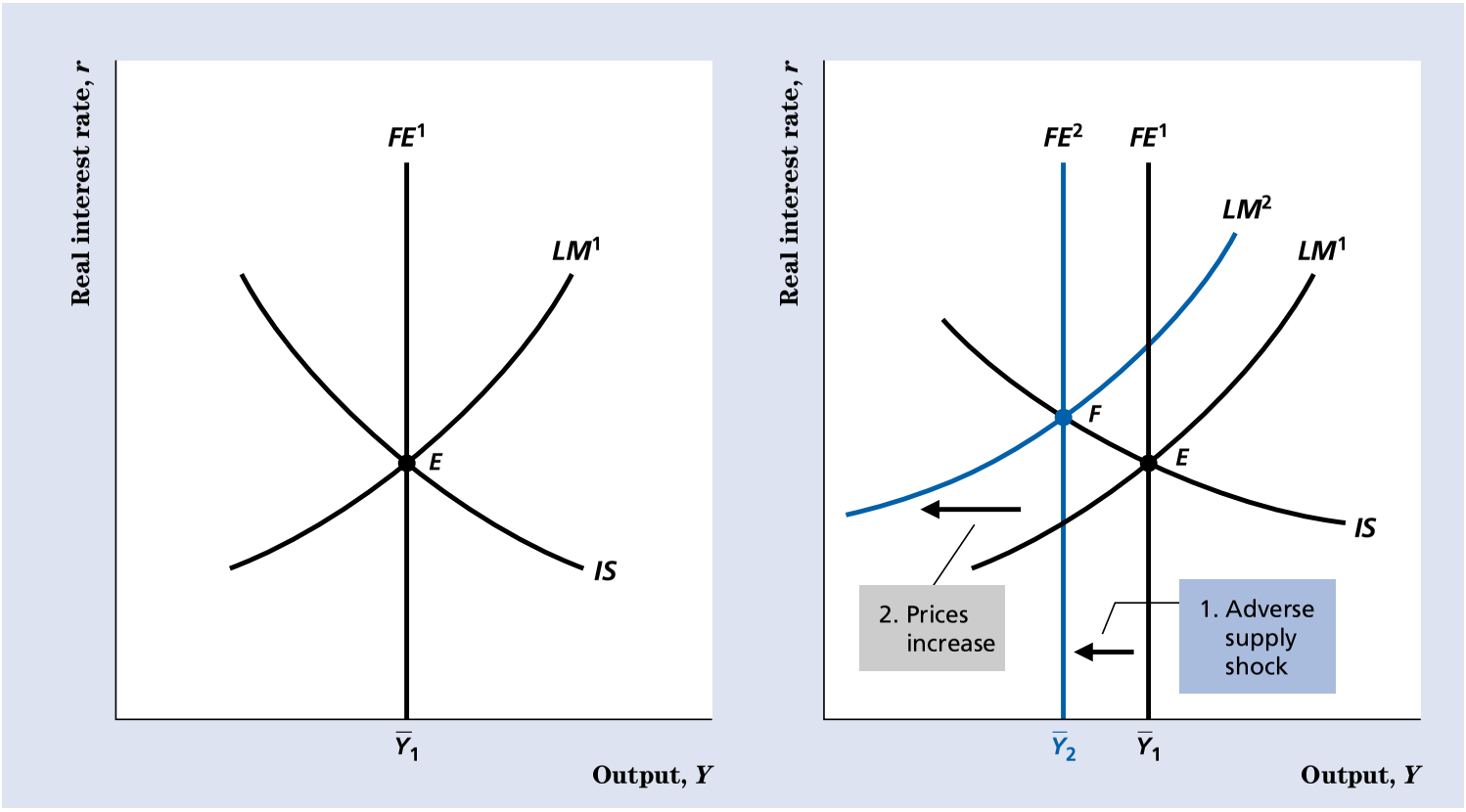


FIGURE 9.8

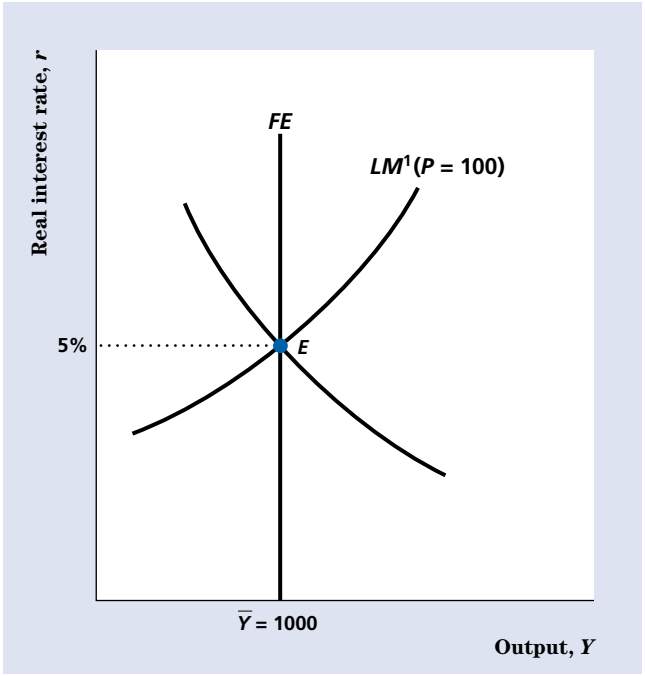
EFFECTS OF A TEMPORARY ADVERSE SUPPLY SHOCK

(a) Initially, the economy is in general equilibrium at point *E*, with output at its full-employment level $\bar{Y}_1$.
(b) A temporary adverse supply shock reduces full-employment output from $\bar{Y}_1$ to $\bar{Y}_2$ and shifts the *FE* line to the left from FE^1 to FE^2. The new general equilibrium is represented by point *F*, where FE^2 intersects the unchanged *IS* curve. The price level increases and shifts the *LM* curve up and to the left, from LM^1 to LM^2, until it passes through *F*. At the new general equilibrium point, *F*, output is lower, the real interest rate is higher, and the price level is higher than at the original general equilibrium point, *E*.

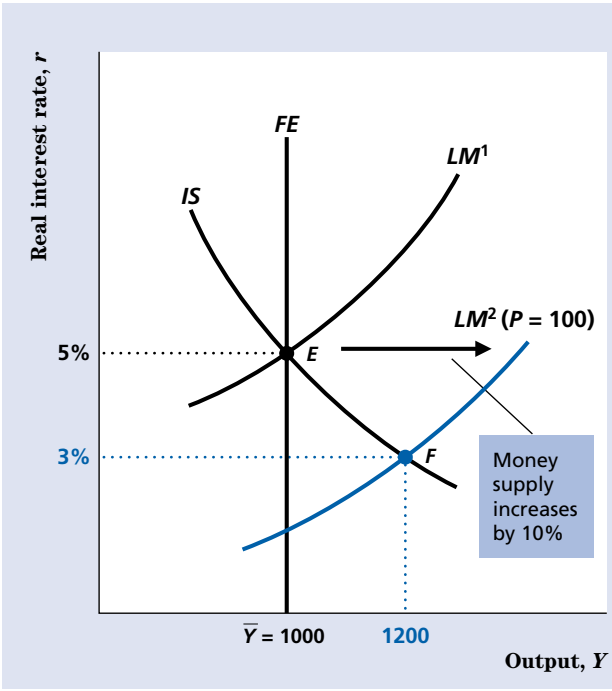
FIGURE 9.9

EFFECTS OF A MONETARY EXPANSION

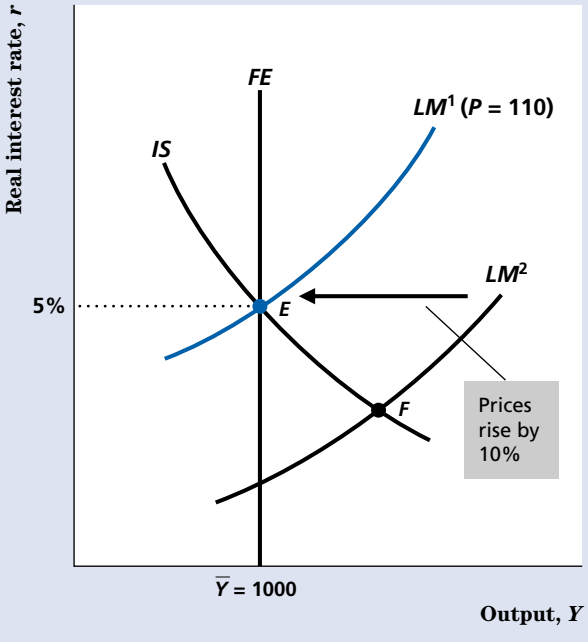
(a) The economy is in general equilibrium at point *E*. Output equals the full-employment level of 1,000, the real interest rate is 5%, and the price level is 100.
(b) With the price level fixed, a 10% increase in the nominal money supply *M* raises the real money supply *M/P* and shifts the *LM* curve down from LM^1 to LM^2. At point *F*, the intersection of the *IS* curve and the new *LM* curve, LM^2, the real interest rate has fallen to 3%, which raises the aggregate demand for goods. If firms produce extra output to meet the increase in aggregate demand, output rises to 1,200 (higher than full-employment output of 1,000).
(c) Because aggregate demand exceeds full-employment output at point *F*, firms raise prices. A 10% rise in *P*, from 100 to 110, restores the real money supply to its original level and shifts the *LM* curve back to its original position at LM^1. This returns the economy to point *E*, where output again is at its full-employment level of 1,000, but the price level has risen 10% from 100 to 110.



(a)



(b)



(c)

FIGURE 9.10

DERIVATION OF THE AGGREGATE DEMAND CURVE

For a given price level, the aggregate quantity of output demanded is determined where the *IS* and *LM* curves intersect. If the price level, *P*, is P_1 and the initial *LM* curve is LM^1, the initial aggregate quantity of output demanded is Y_1, corresponding to point *E* in both (a) and (b). To derive the aggregate demand curve, we examine what happens to the quantity of output demanded when the price level changes. **(a)** An increase in the price level from P_1 to P_2 reduces the real money supply and shifts the *LM* curve up and to the left, from LM^1 to LM^2. Therefore, the aggregate quantity of output demanded, represented by the intersection of the *IS* and *LM* curves, falls from Y_1 to Y_2. **(b)** The increase in the price level from P_1 to P_2 reduces the aggregate quantity of output demanded from Y_1 to Y_2, so the aggregate demand curve slopes downward.

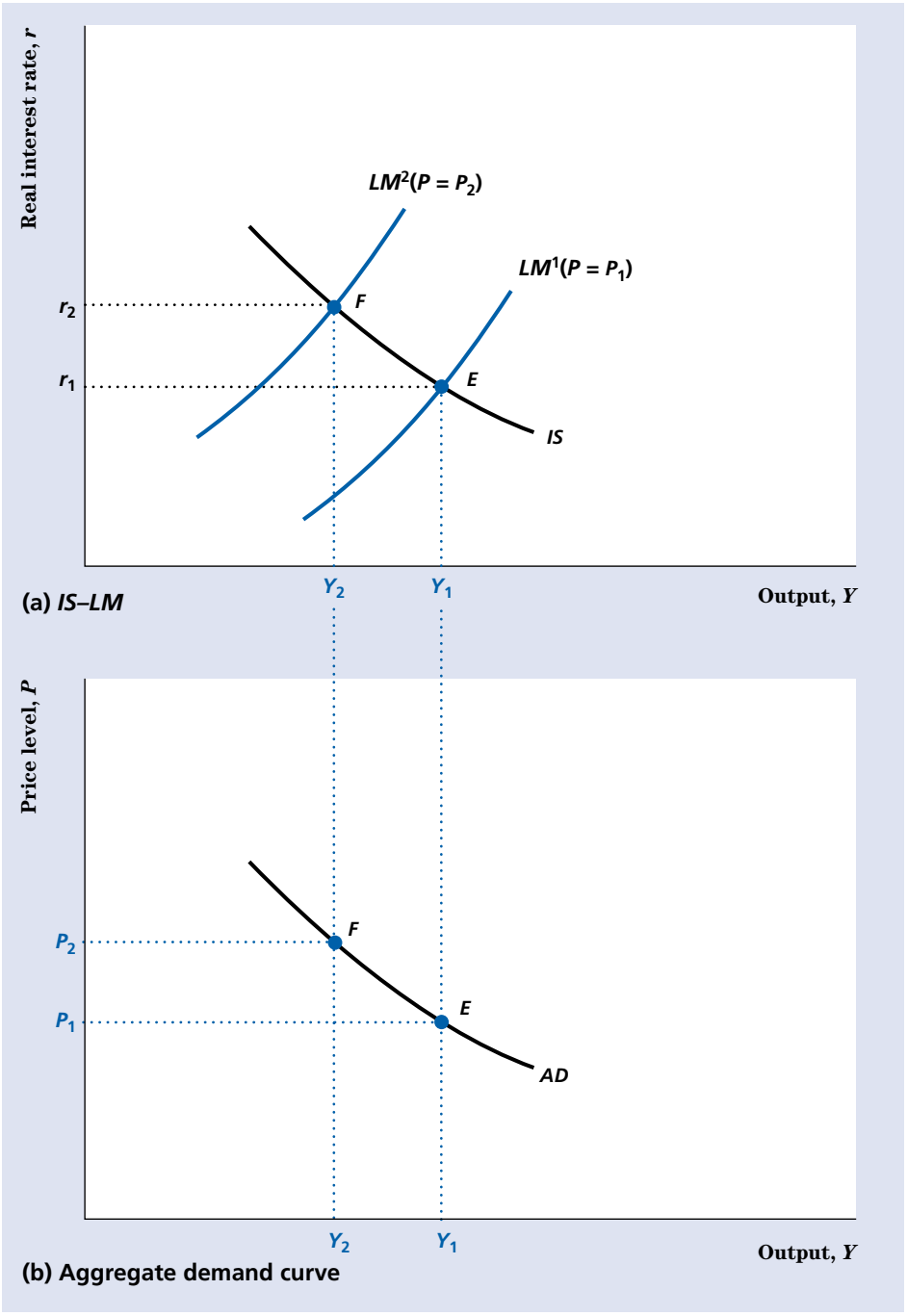


FIGURE 9.11

THE EFFECT OF AN INCREASE IN GOVERNMENT PURCHASES ON THE AGGREGATE DEMAND CURVE

(a) An increase in government purchases shifts the *IS* curve up and to the right, from IS^1 to IS^2. At price level P_1, the aggregate quantity of output demanded increases from Y_1 to Y_2, as shown by the shift of the *IS–LM* intersection from point *E* to point *F*.
(b) Because the aggregate quantity of output demanded rises at any price level, the *AD* curve shifts to the right. Points *E* and *F* in part (b) correspond to points *E* and *F* in part (a).

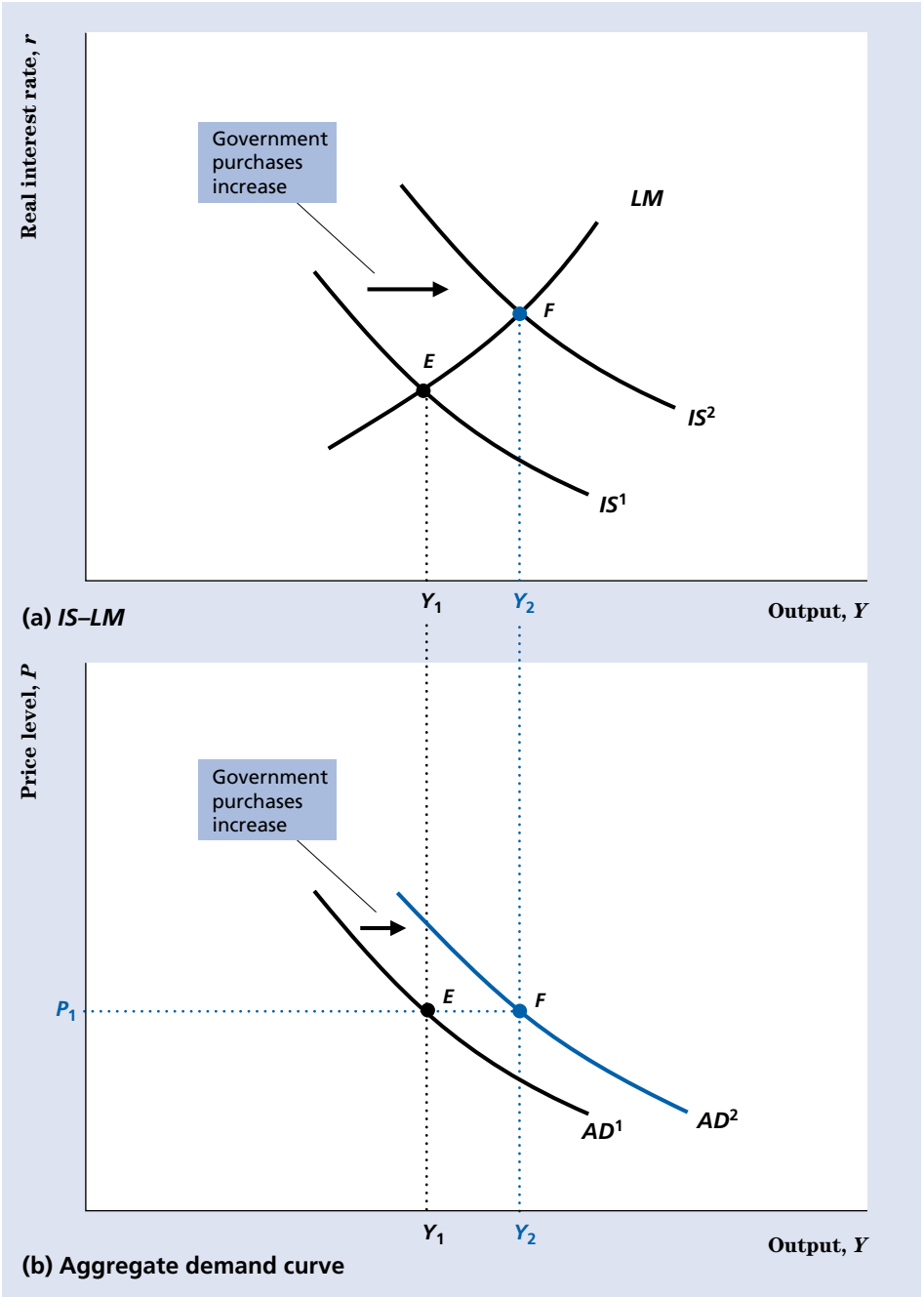


FIGURE 9.12

THE SHORT-RUN AND LONG-RUN AGGREGATE SUPPLY CURVES

In the short run, firms supply the amount of output demanded at the fixed price, so the short-run aggregate supply (*SRAS*) curve is a horizontal line. In the long run, when the labour market clears, firms supply the full-employment level of output, $\overline{Y}$, regardless of the price level. Thus, the long-run aggregate supply (*LRAS*) curve is a vertical line at $Y = \overline{Y}$.

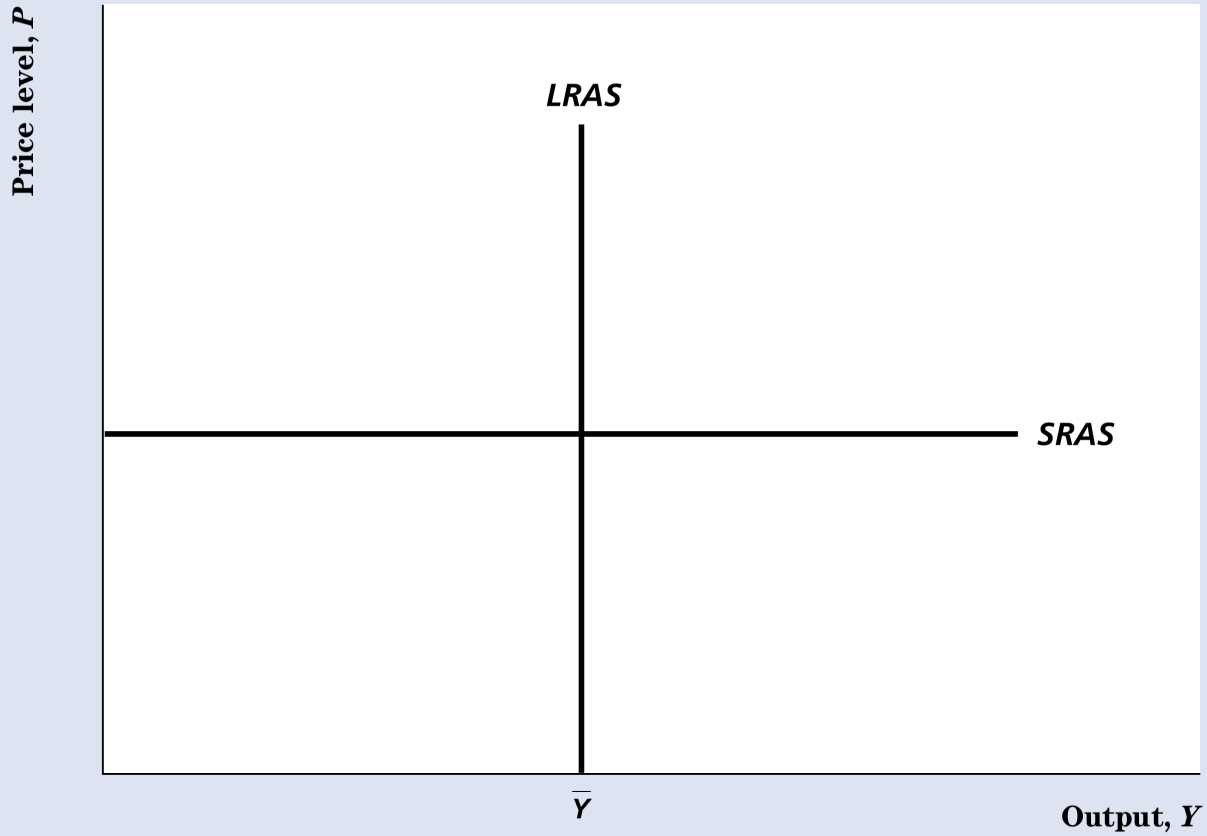


FIGURE 9.13

EQUILIBRIUM IN THE *AD–AS* MODEL

Short-run equilibrium is represented by the intersection of the *AD* and *SRAS* curves at point *E*. At short-run equilibrium, prices are fixed and firms meet demand at those prices. Long-run equilibrium, which occurs after prices have fully adjusted, is represented by the intersection of the *AD* and *LRAS* curves, also at point *E*. Long-run equilibrium is the same as general equilibrium because in long-run equilibrium all markets clear.

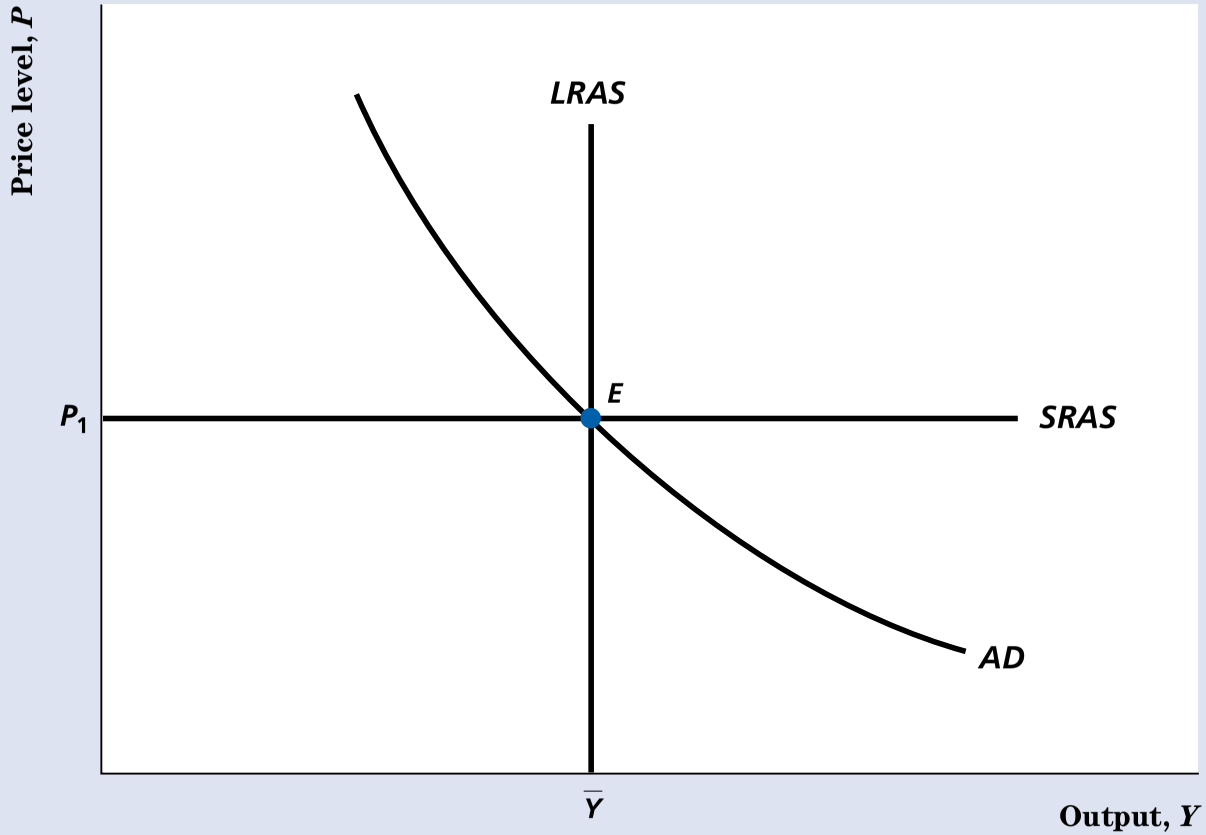
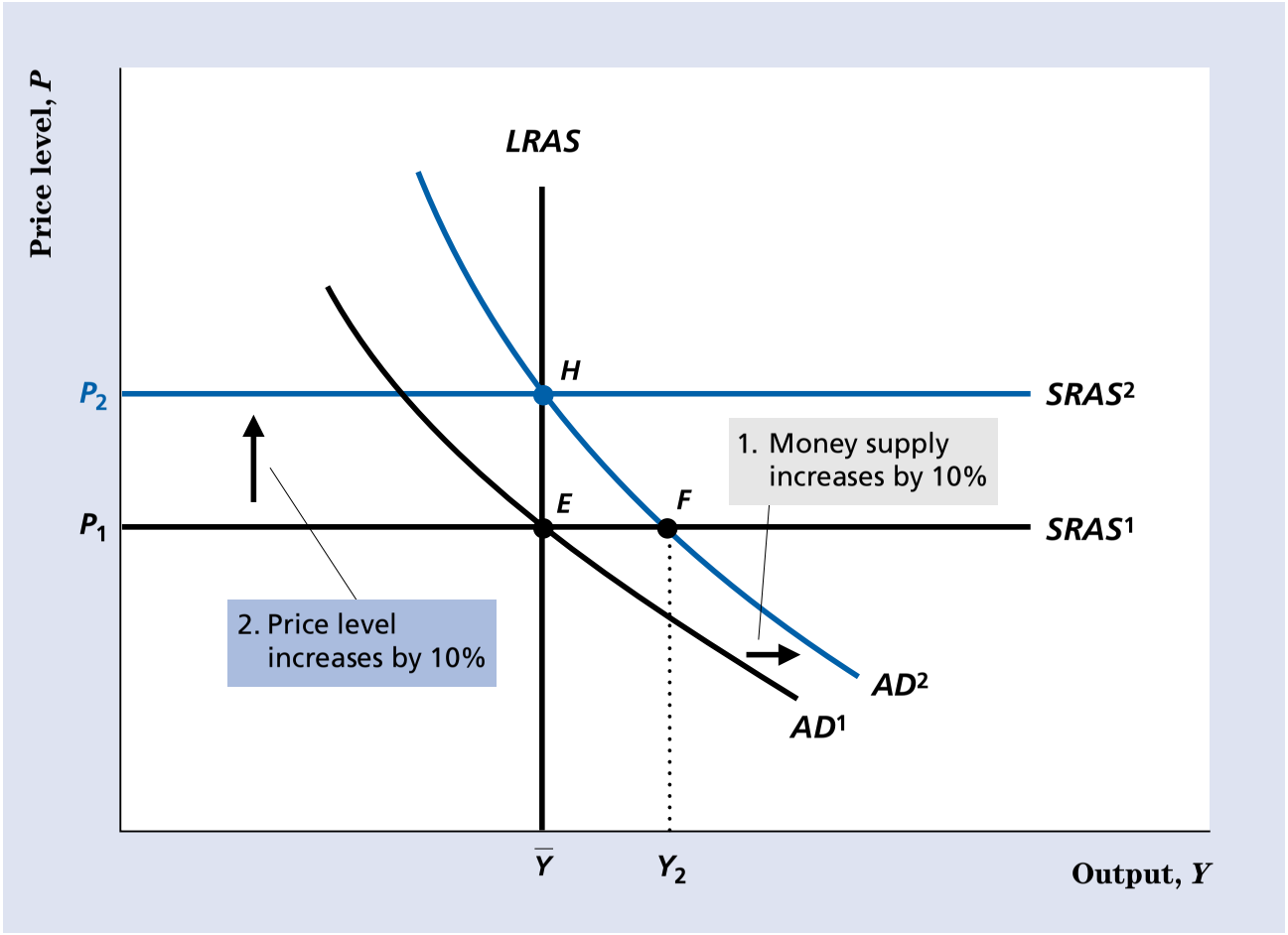


FIGURE 9.14

MONETARY NEUTRALITY IN THE *AD–AS* FRAMEWORK

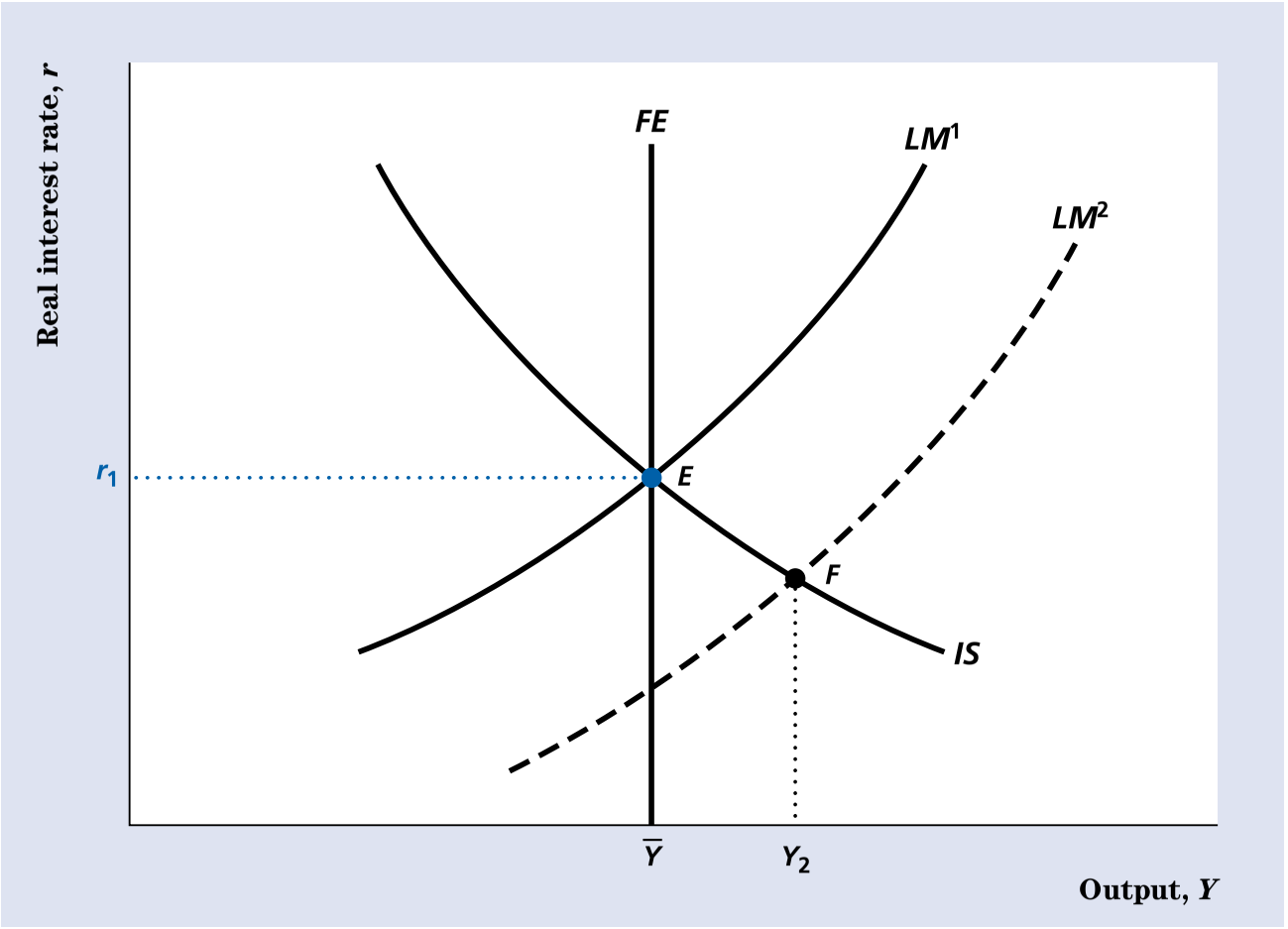
If we start from general equilibrium at point *E*, a 10% increase in the nominal money supply shifts the *AD* curve up by 10% at each level of output, from AD^1 to AD^2. The *AD* curve shifts up by 10% because at any given level of output, a 10% increase in the price level is needed to keep the real money supply, and, thus, the aggregate quantity of output demanded, unchanged. In the new short-run equilibrium at point *F*, the price level is unchanged, and output is higher than its full-employment level. In the new long-run equilibrium at point *H*, output is unchanged at $\overline{Y}$, and the price level P_2 is 10% higher than the initial price level P_1. Thus, money is neutral in the long run.



KEY DIAGRAM 6

THE *IS–LM* MODEL

The *IS–LM* model shows general equilibrium in the goods, asset, and labour markets. It can be used to analyze the effects of economic shocks on output, the real interest rate, the price level, and other macroeconomic variables.



KEY DIAGRAM 7

THE AGGREGATE DEMAND–AGGREGATE SUPPLY MODEL

The *AD–AS* model shows the determination of the price level and output. In the short run, before prices adjust, equilibrium occurs at the intersection of the *AD* and *SRAS* curves. In the long run, equilibrium occurs at the intersection of the *AD* and *LRAS* curves.

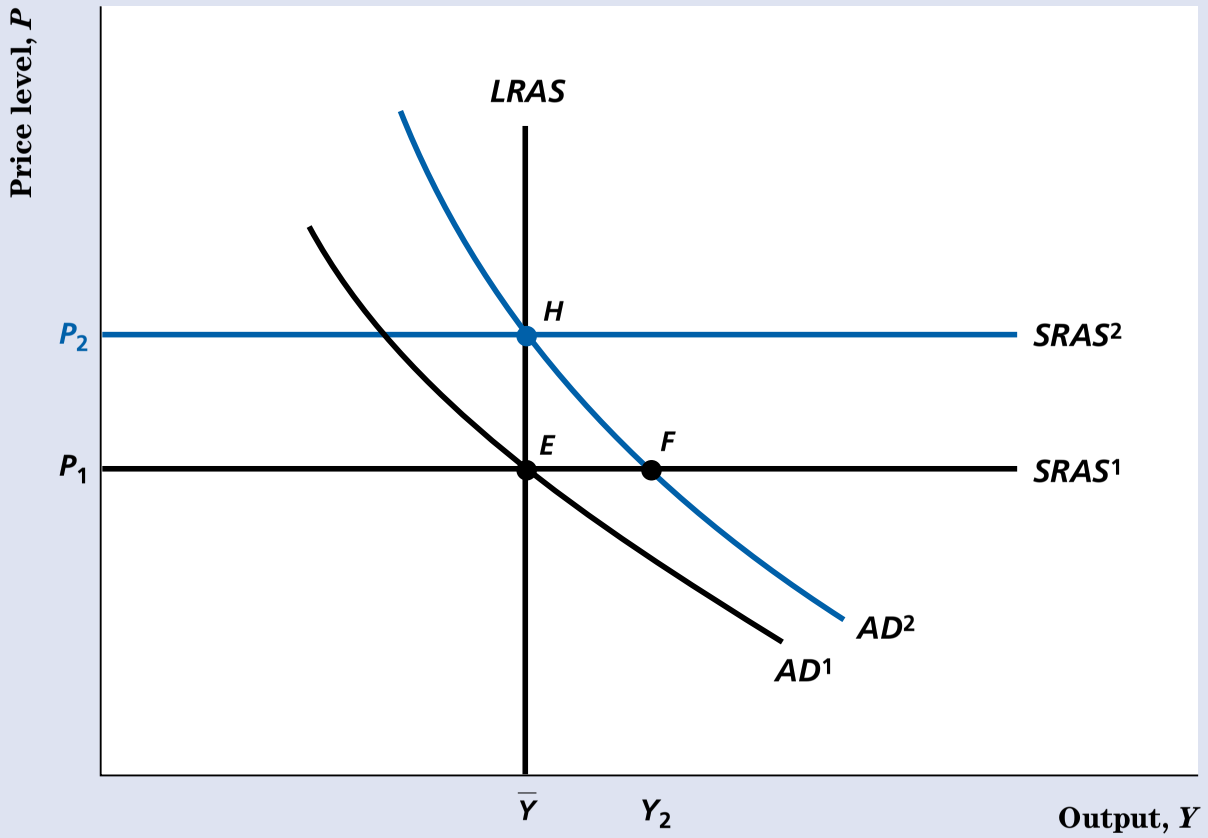


FIGURE 10.1

CANADIAN REAL AND NOMINAL EXCHANGE RATES AND NET EXPORTS, 1970–2001

Canadian real net exports are measured along the left vertical axis and the Canadian nominal exchange rate and real exchange rate are measured along the right vertical axis, as trade-weighted indexes relative to other countries. Note that the nominal and real exchange rates tend to move together. Note also that net exports generally rise when the real exchange rate falls.

Source: Net exports in billions of chained 1997 dollars, seasonally adjusted, quarterly: 1947-1980 CANSIM D14862-D14866; 1981-2001 D100119-D100122. Data prior to 1981 are not chain-weighted and have been rescaled. Real and nominal effective exchange rates, 1990=100: J.P. Morgan.

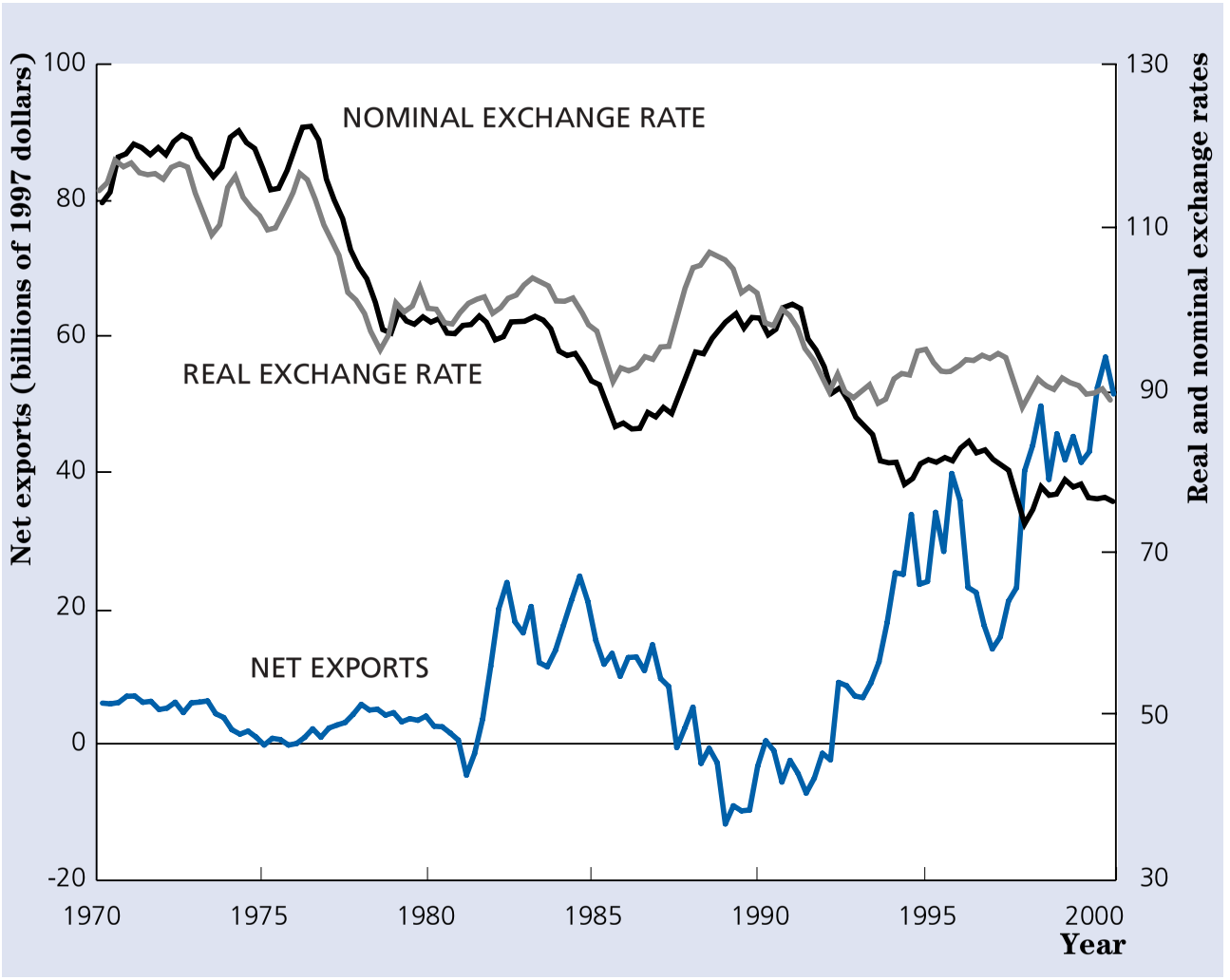


FIGURE 10.2

THE SUPPLY OF AND DEMAND FOR THE DOLLAR

The figure shows the determination of the value of the dollar in the foreign exchange market. The supply curve for dollars, *S*, indicates the number of dollars that people are willing to sell in the foreign exchange market at each value of the Canadian nominal exchange rate e_{nom}. The demand curve for dollars, *D*, shows the number of dollars that people want to buy at each nominal exchange rate. At equilibrium, point *E*, the value of the dollar, e^1_{nom}, is the nominal exchange rate at which the quantity of dollars supplied equals the quantity of dollars demanded.

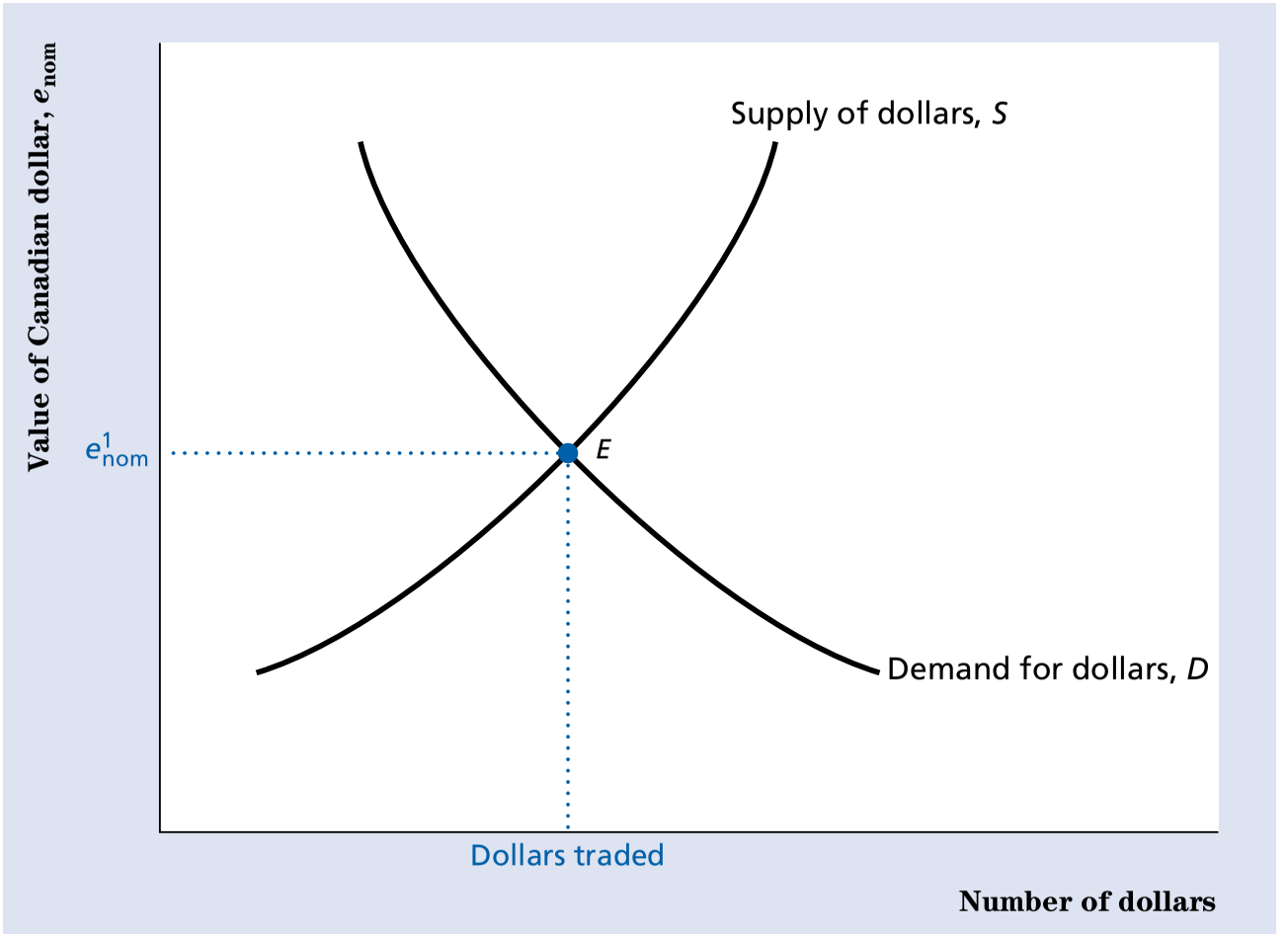


FIGURE 10.3

THE EFFECT OF INCREASED EXPORT QUALITY ON THE VALUE OF THE DOLLAR

An increase in the quality of Canadian exports raises foreigners' demands for Canadian goods and, hence, their demand for Canadian dollars, which are needed to buy Canadian goods. The demand curve for dollars shifts, from D^1 to D^2, raising the value of the dollar (the nominal exchange rate) from e^1_{nom} to e^2_{nom}.

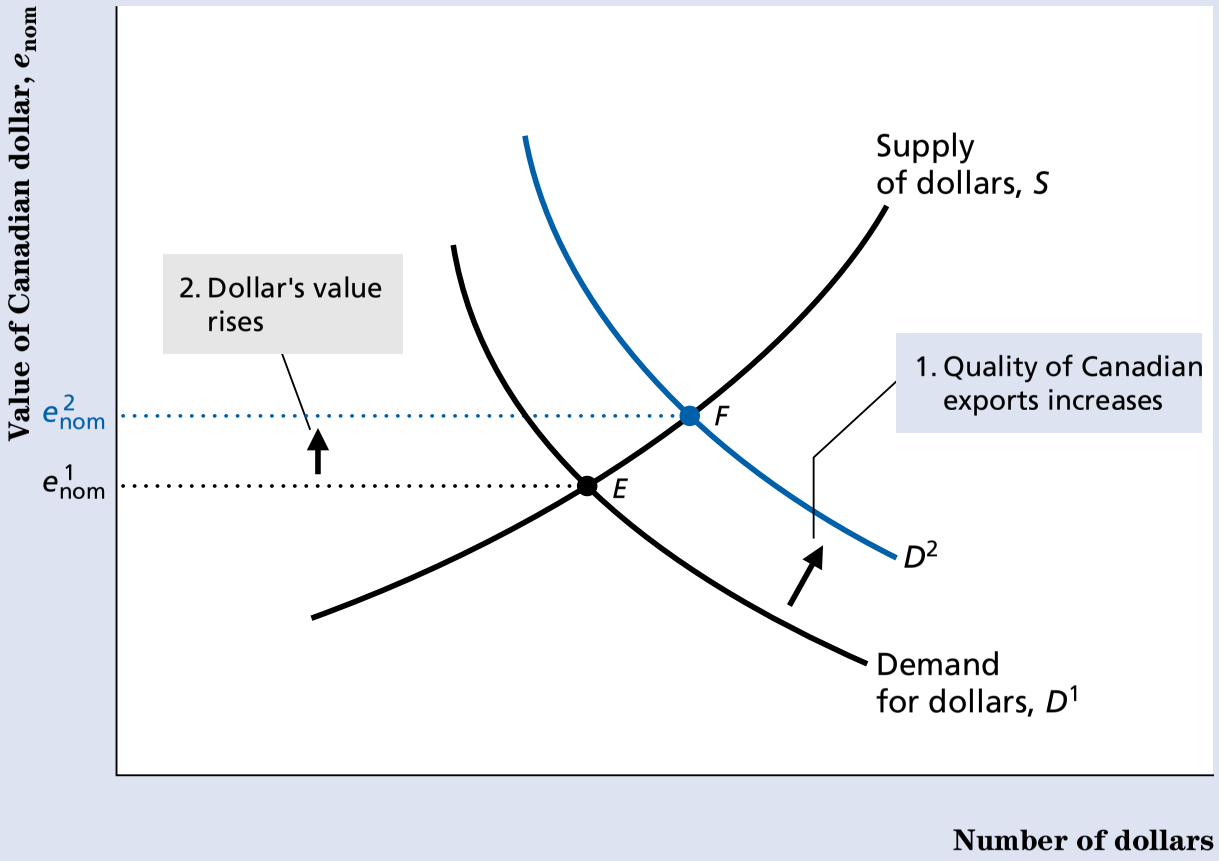
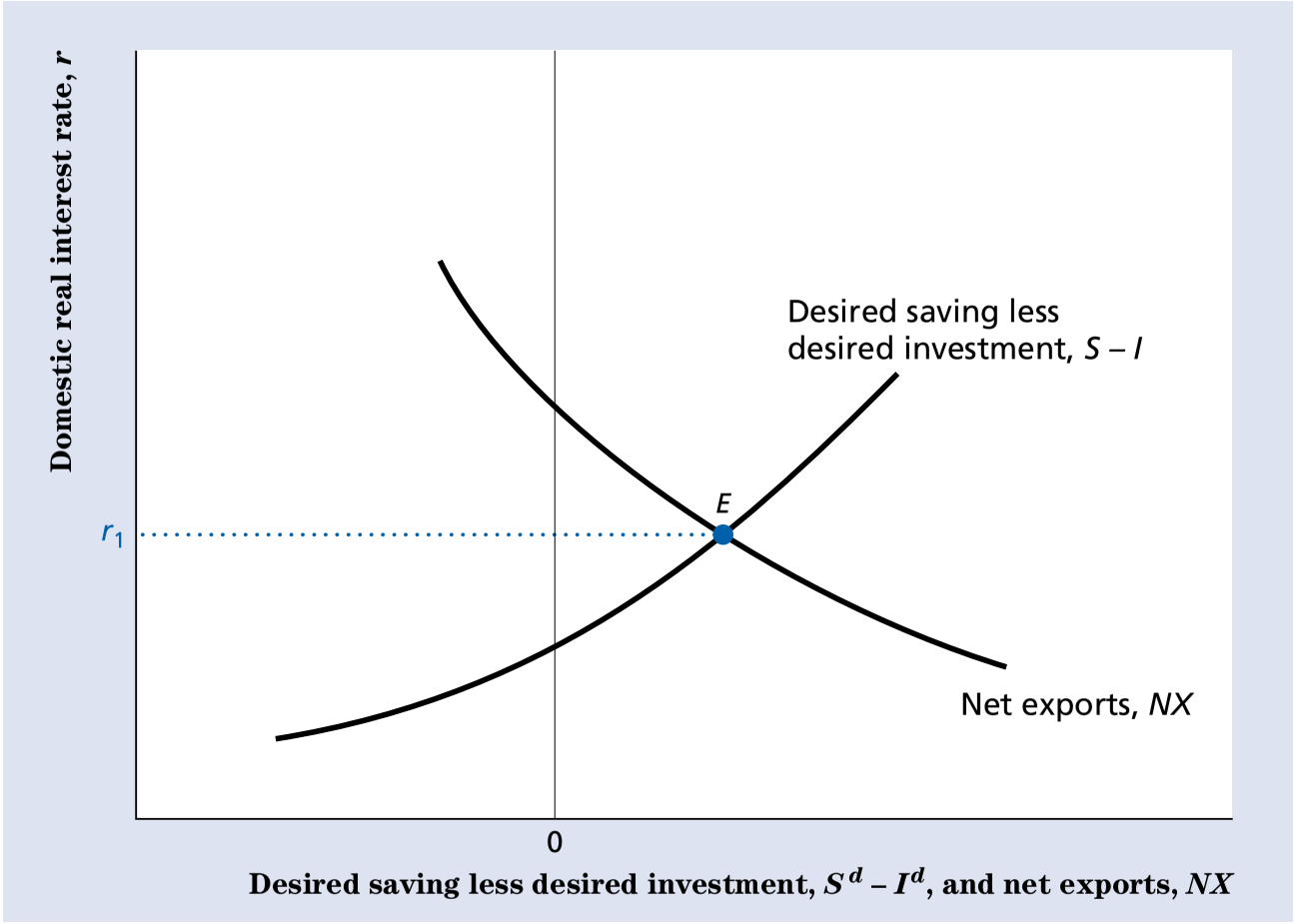
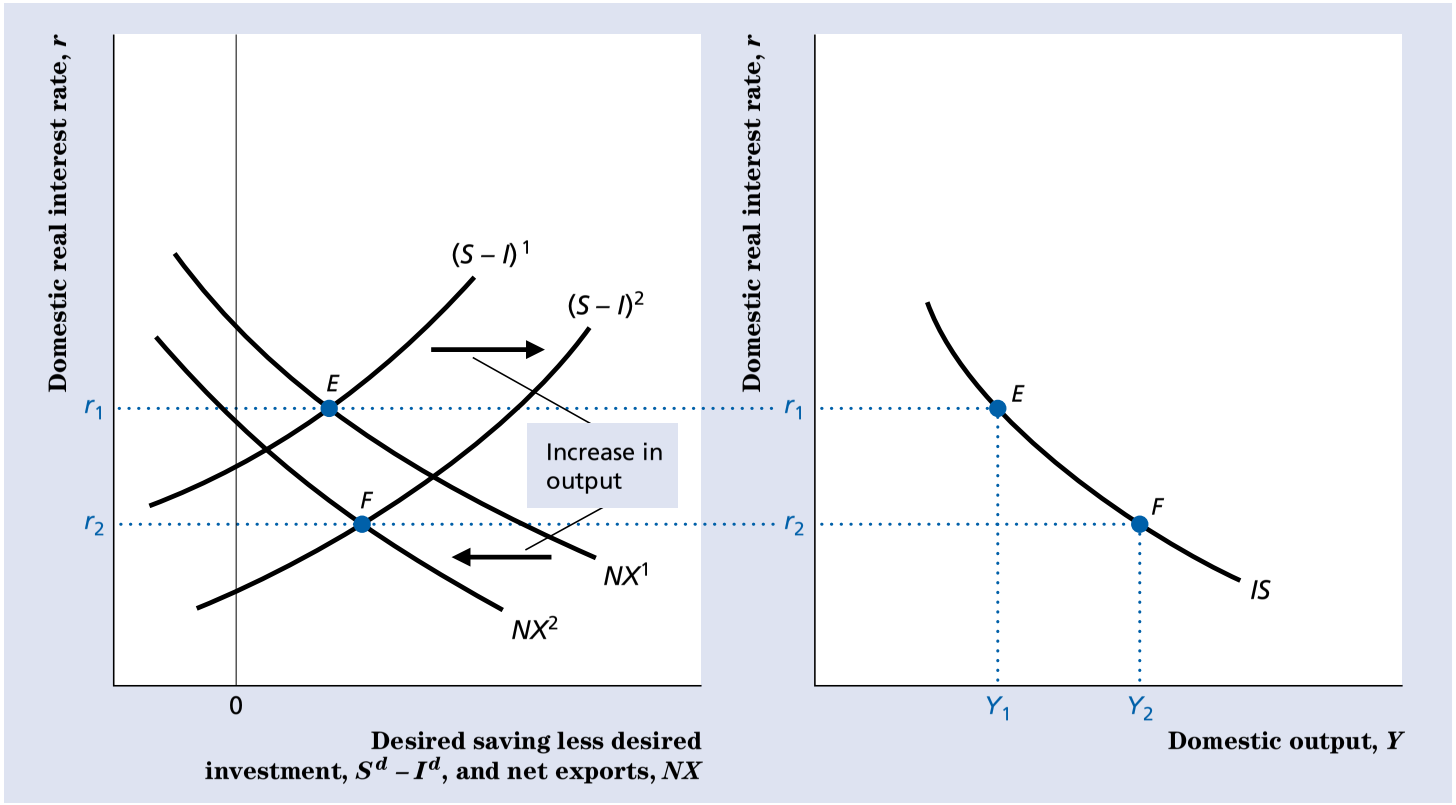


FIGURE 10.4

GOODS MARKET EQUILIBRIUM IN AN OPEN ECONOMY

The upward-sloping curve shows desired saving S^d less desired investment I^d. This curve slopes upward because a higher domestic real interest rate increases the excess of desired saving over desired investment. The *NX* curve relates net exports to the domestic real interest rate. This curve slopes downward because a higher domestic real interest rate causes the real exchange rate to rise, reducing net exports. Goods market equilibrium occurs at point *E*, where the excess of desired saving over desired investment equals net exports (equivalently, where desired lending abroad equals desired borrowing by foreigners). The real interest rate that clears the goods market is r_1.



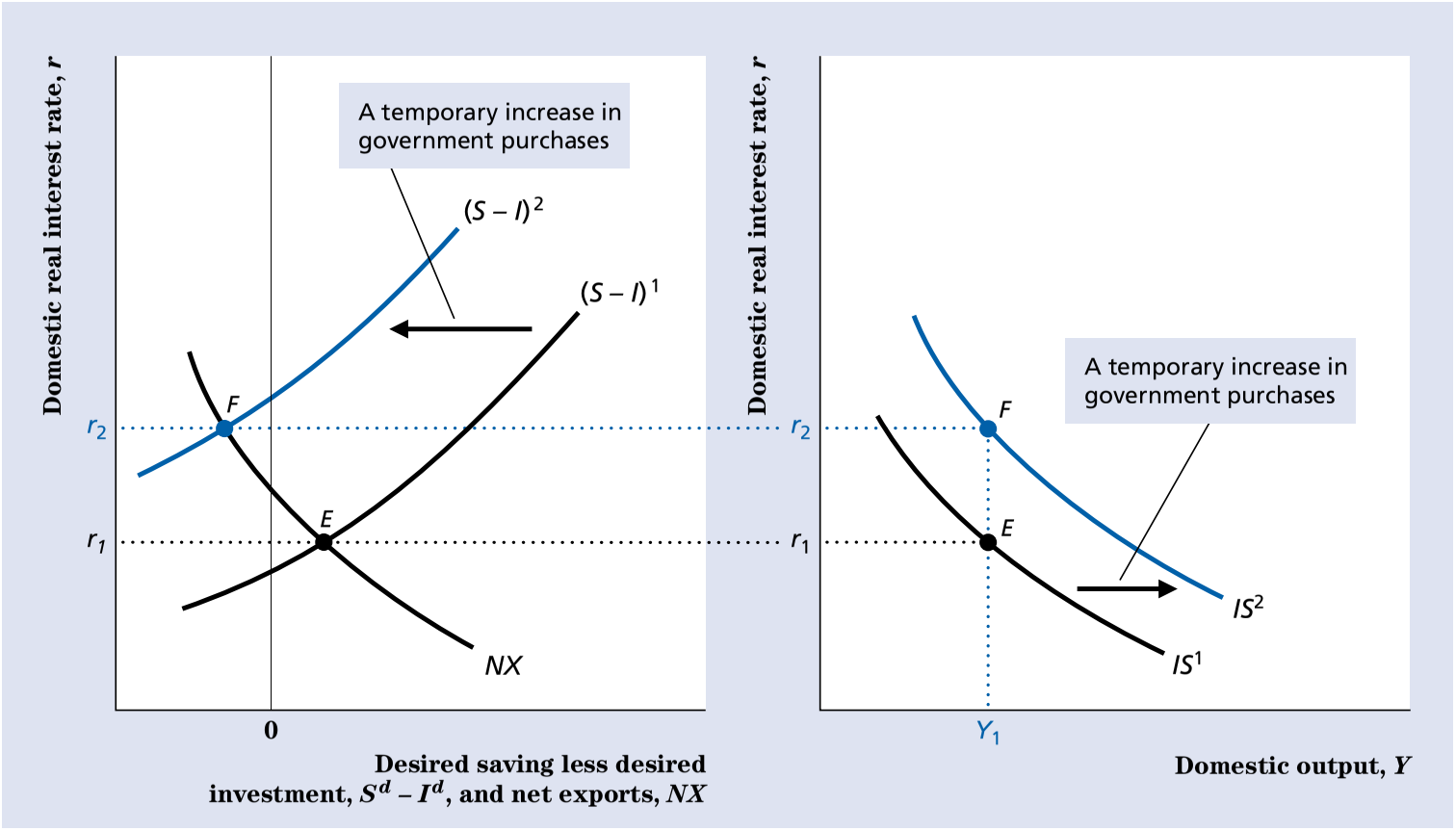


(a) Goods market equilibrium **(b) Open-economy *IS* curve**

FIGURE 10.5

DERIVATION OF THE *IS* CURVE IN AN OPEN ECONOMY

The initial equilibrium in the goods market is represented by point *E* in both (a) and (b).
(a) At point *E*, domestic output is Y_1 and the domestic real interest rate is r_1. An increase in domestic output from Y_1 to Y_2 raises desired national saving at each real interest rate and does not affect desired investment. Therefore, the $S - I$ curve shifts to the right, from $(S - I)^1$ to $(S - I)^2$. The increase in output also raises domestic spending on imports, reducing net exports and causing the *NX* curve to shift to the left, from NX^1 to NX^2. At the new equilibrium point, *F*, the real interest rate is r_2.
(b) Because an increase in output from Y_1 to Y_2 lowers the real interest rate that clears the goods market from r_1 to r_2, the *IS* curve slopes downward.



(a) Goods market equilibrium

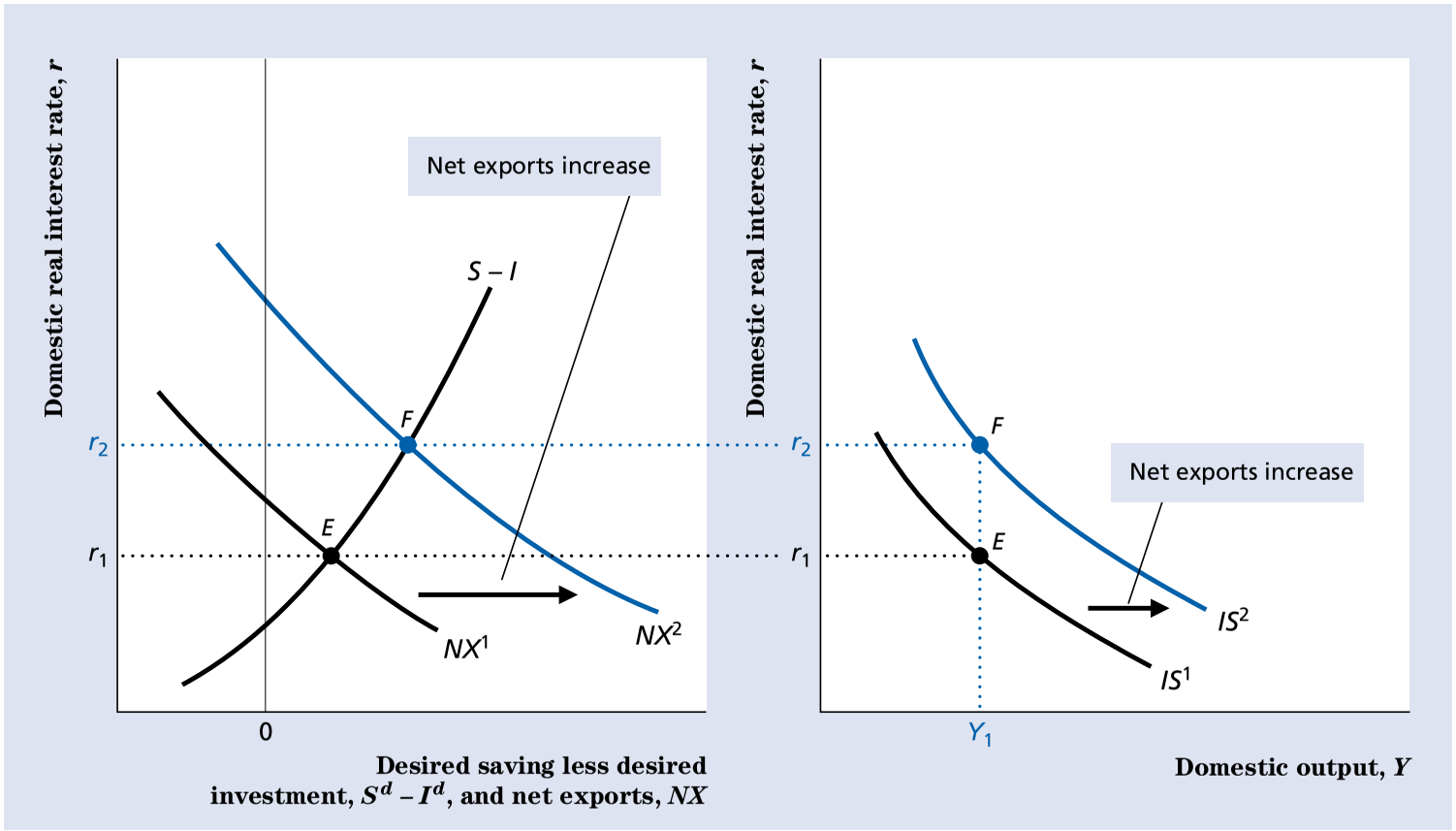
(b) Open-economy *IS* curve

FIGURE 10.6

EFFECT OF AN INCREASE IN GOVERNMENT PURCHASES ON THE OPEN-ECONOMY *IS* CURVE

Initial equilibrium is at point E, where output is Y_1 and the real interest rate is r_1, in both (a) and (b).

(a) A temporary increase in government purchases lowers desired national saving at every level of output and the real interest rate. Thus, the $S - I$ curve shifts to the left, from $(S - I)^1$ to $(S - I)^2$. **(b)** For output Y_1, the real interest rate that clears the goods market is now r_2, at point F in both (a) and (b). Because the real interest rate that clears the goods market has risen, the *IS* curve shifts up and to the right, from IS^1 to IS^2.



(a) Goods market equilibrium **(b) Open-economy *IS* curve**

FIGURE 10.7

EFFECT OF AN INCREASE IN NET EXPORTS ON THE OPEN-ECONOMY *IS* CURVE

In both (a) and (b), at the initial equilibrium point, *E*, output is Y_1 and the real interest rate that clears the goods market is r_1.

(a) If some change raises the country's net exports at any given domestic output and domestic real interest rate, the *NX* curve shifts to the right, from NX^1 to NX^2.
(b) For output Y_1, the real interest rate that clears the goods market has risen from r_1 to r_2, at point *F* in both (a) and (b). Thus, the *IS* curve shifts up and to the right, from IS^1 to IS^2.

FIGURE 10.8

AN INCREASE IN GOVERNMENT PURCHASES IN A SMALL OPEN ECONOMY

An increase in government purchases shifts the *IS* curve up and to the right, from IS^1 to IS^2. In the short-run Keynesian model, output and the domestic real interest rate both rise. Net exports fall and the exchange rate rises (though theoretically the exchange rate could fall if it were more responsive to output than to the real interest rate). In the long-run, or classical, model, price adjustment restores general equilibrium at point *H*, with a higher real interest rate and exchange rate, and lower net exports than at point *E*.

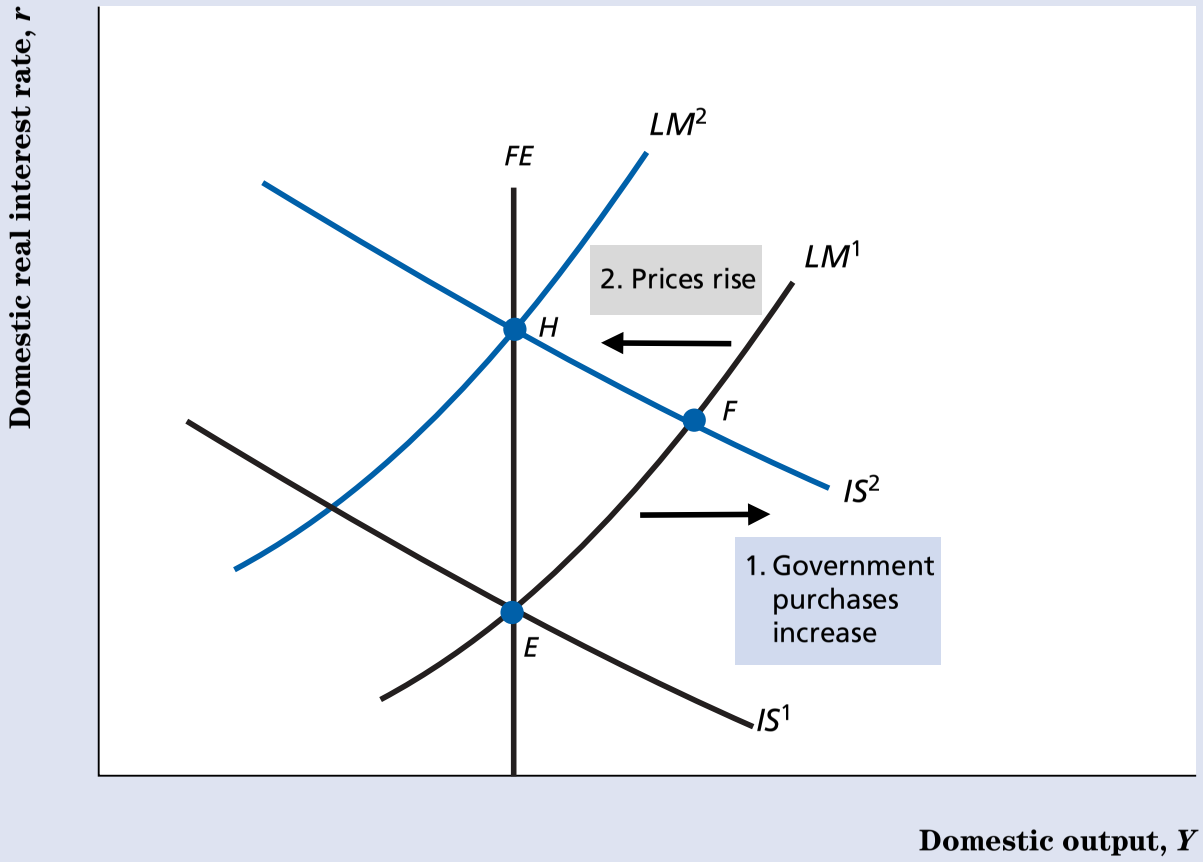


FIGURE 10.9

A DECREASE IN THE MONEY SUPPLY IN A SMALL OPEN ECONOMY

A decrease in the money supply shifts the *LM* curve up and to the left, from LM^1 to LM^2. In the short-run Keynesian model, output falls and the domestic real interest rate rises. The exchange rate rises, and net exports fall (though theoretically net exports could rise if they were more responsive to output than to the interest rate). In the long-run, or in the classical model, price adjustment restores general equilibrium at point *E*, with real variables unchanged but a lower price level and a higher nominal exchange rate.

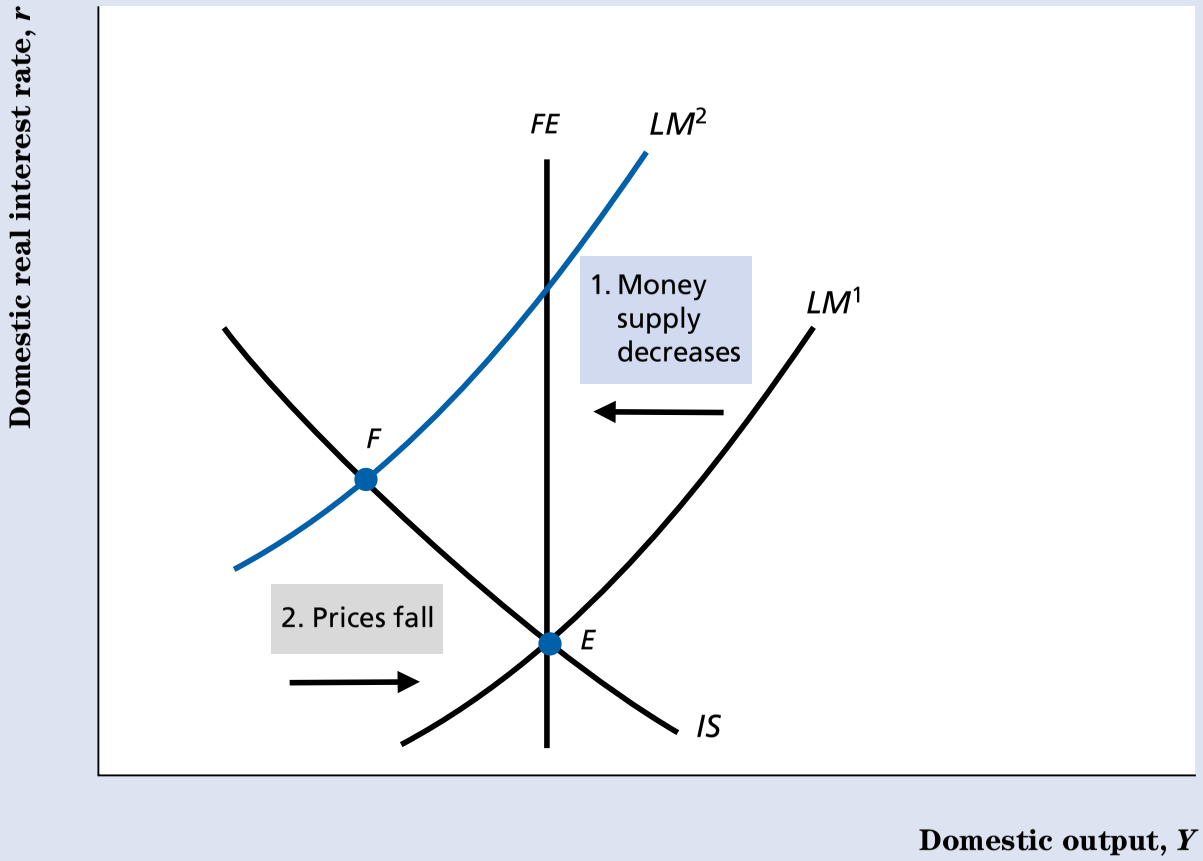


FIGURE 10.10

A DECREASE IN THE MONEY SUPPLY IN THE MUNDELL–FLEMING MODEL

The economy is in general equilibrium at point *E*. The *IS* curve is horizontal at r_{For}. A decrease in the domestic money supply shifts the *LM* curve up and to the left, from LM^1 to LM^2. The short-run equilibrium in the Keynesian model is at point *F*, with lower output and net exports, and a higher real exchange rate. In the long run, prices fall and the economy returns to equilibrium at point *E*. Thus, in the long run, money is neutral.

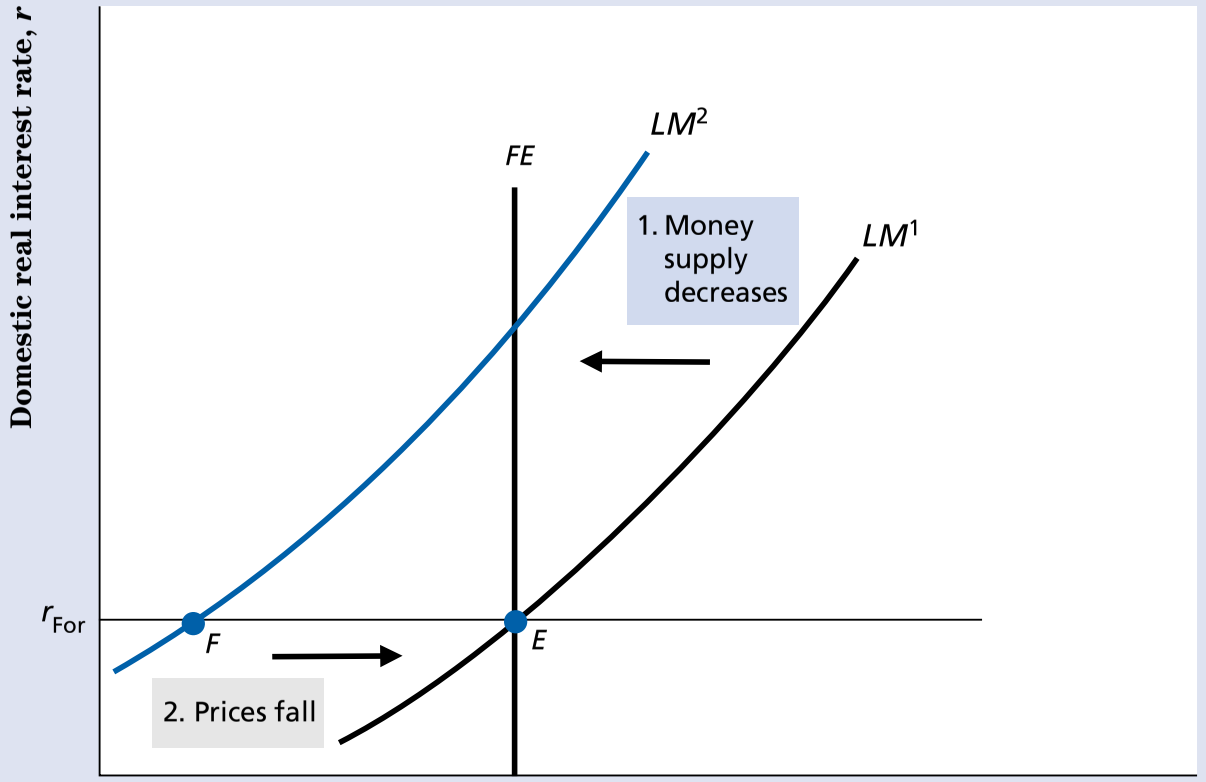


FIGURE 10.11

EFFECTS OF AN INCREASE IN FOREIGN GOVERNMENT PURCHASES

(a) An increase in foreign government purchases shifts the *IS* curve up and to the right, from IS^1_{For} to IS^2_{For}. In the short-run Keynesian model, foreign output and the foreign real interest rate both rise. Net exports fall and the exchange rate rises (though theoretically the exchange rate could fall if it were more responsive to output than to the real interest rate). In the long-run, or classical, model, price adjustment restores general equilibrium at point *H*, with a higher foreign real interest rate and exchange rate, and lower foreign net exports than at point *E*.

(b) Because the foreign economy's exports are the domestic economy's imports and vice versa, the decrease in the foreign economy's net exports is equivalent to a rise in the domestic economy's net exports. This increase shifts the domestic *IS* curve up, from IS^1 to IS^2. In the classical model, prices adjust rapidly, shifting the *LM* curve from LM^1 to LM^2. The new equilibrium is at point *H*, where the domestic real interest rate and price level are higher but output is unchanged. In the Keynesian model, price stickiness causes a temporary increase in domestic output at point *F* before price adjustment restores equilibrium at point *H*.

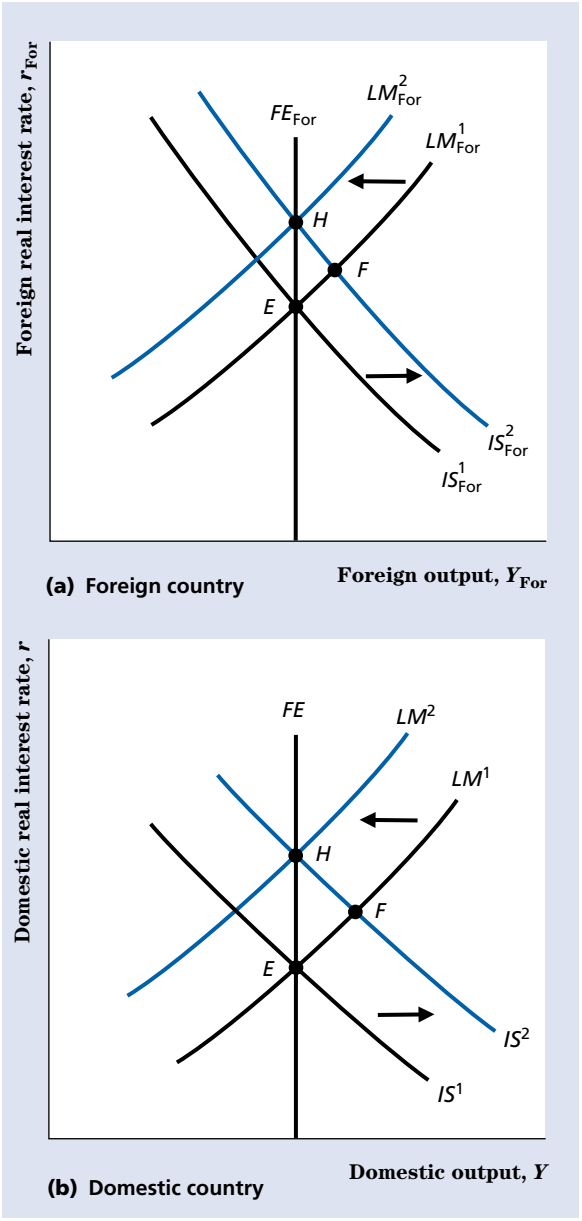
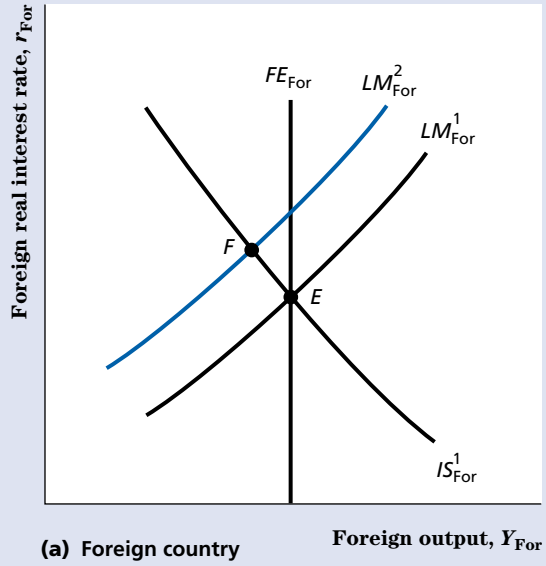


FIGURE 10.12

EFFECTS OF A DECREASE IN THE FOREIGN MONEY SUPPLY

(a) A foreign monetary contraction shifts the foreign *LM* curve up and to the left, from LM^1_{For} to LM^2_{For}. In the short-run Keynesian model, output falls and the foreign real interest rate rises. The exchange rate rises, but net exports can rise or fall. In this example, the effect of lower output dominates, and foreign net exports rise.



(b) Because the foreign economy's net exports rise, the domestic economy's net exports fall, and the domestic *IS* curve shifts down, from IS^1 to IS^2. Thus, output falls in the domestic economy in the short run. In the long-run, or classical, model, foreign output and the foreign real interest rate return to their original levels, the domestic *IS* curve shifts back to IS^1, and both economies return to equilibrium at point *E*. Thus, in the long run, money is neutral.

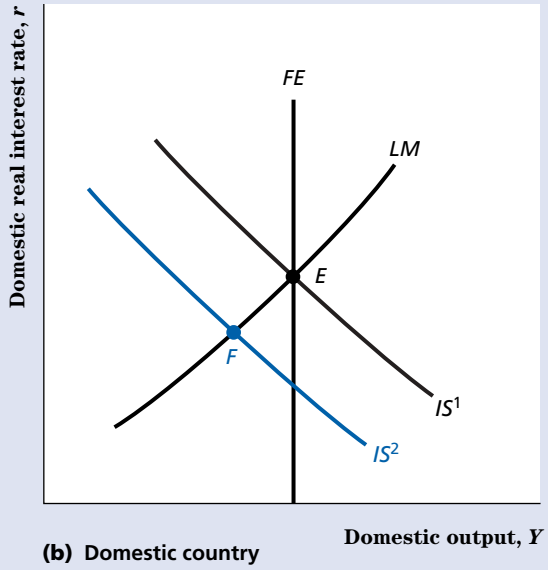


FIGURE 10.13

AN OVERVALUED EXCHANGE RATE

The figure shows a situation in which the officially fixed nominal exchange rate, $\bar{e}_{nom}$, is higher than the fundamental value of the exchange rate, e^1_{nom}, as determined by supply and demand in the foreign exchange market. In this situation, the exchange rate is said to be overvalued. The country's central bank can maintain the exchange rate at the official rate by using its reserves to purchase its own currency in the foreign exchange market, in the amount of *AB* in each period. This loss of reserves also is referred to as the country's balance of payments deficit.

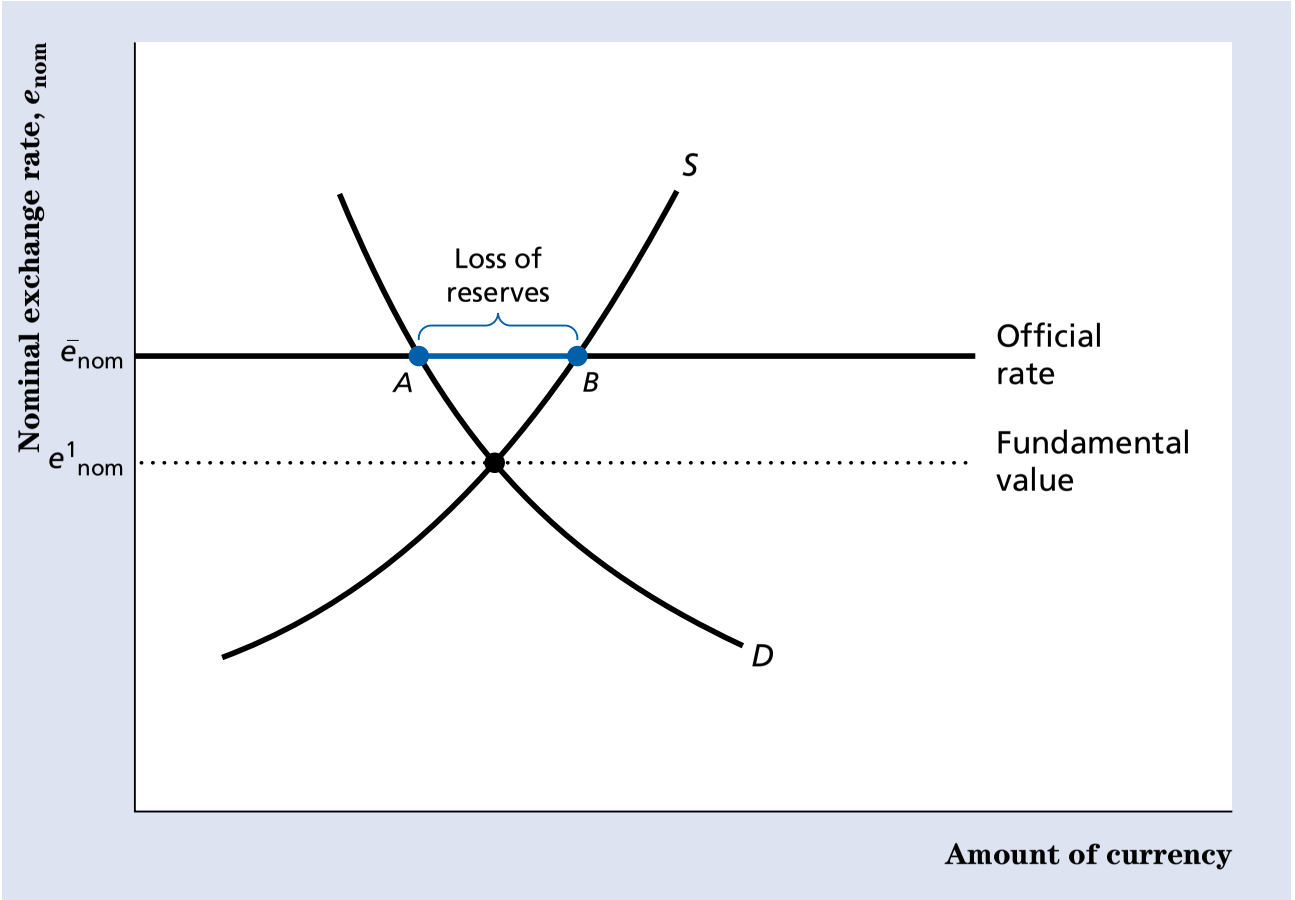


FIGURE 10.14

A SPECULATIVE RUN ON AN OVERVALUED CURRENCY

Initially, the supply curve of the domestic currency is S^1 and, to maintain the fixed exchange rate, the central bank must use amount *AB* of its reserves each period to purchase its own currency in the foreign exchange market. A speculative run occurs when holders of domestic assets begin to fear a devaluation, which would reduce the values of their assets (measured in terms of foreign currency). Panicky sales of domestic-currency assets lead to more domestic currency being supplied to the foreign exchange market, which shifts the supply curve of the domestic currency to the right, from S^1 to S^2. The central bank must now purchase its currency and lose reserves in the amount *AC*. This more rapid loss of reserves may force the central bank to stop supporting the overvalued currency and to devalue it, confirming the market's expectations.

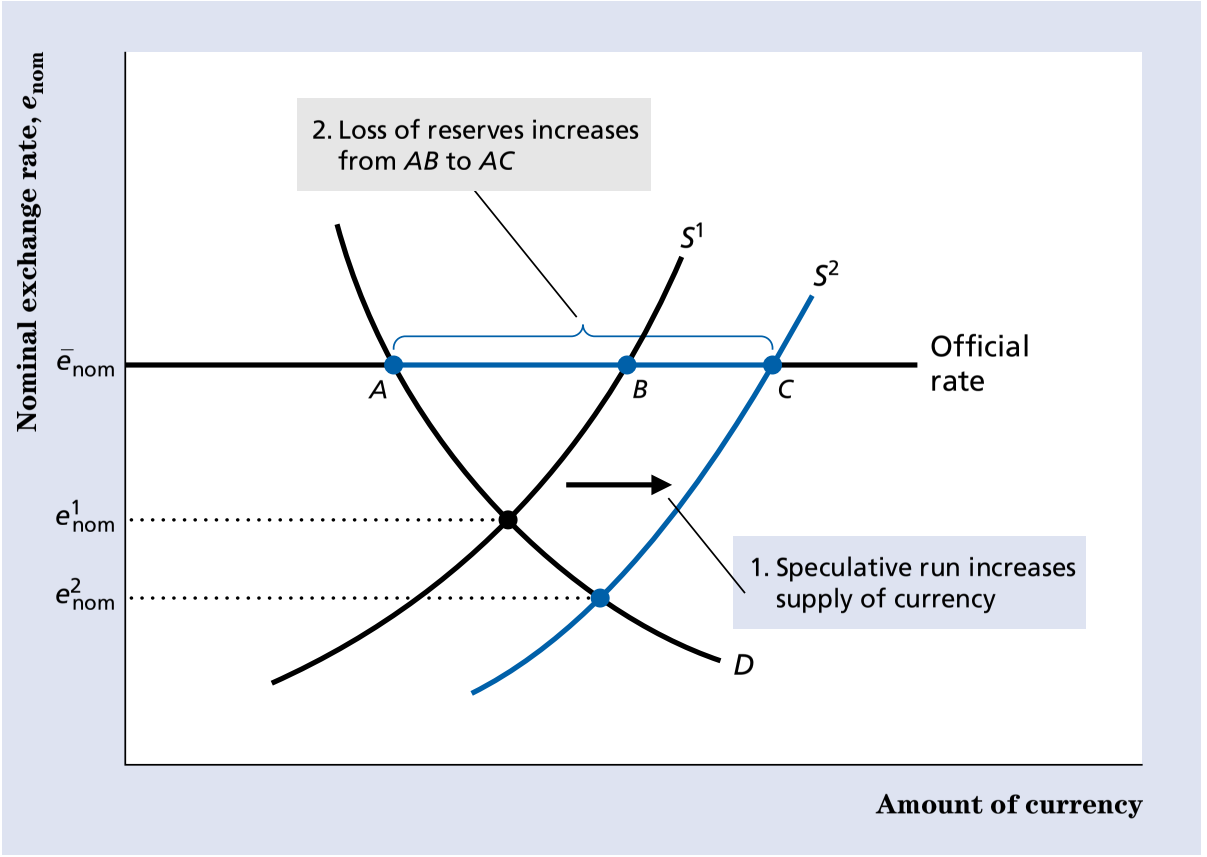


FIGURE 10.15

CURRENCY VALUES IN THE EAST ASIAN CRISIS

The figure shows daily values for six East Asian exchange rates, from May 1, 1997, to April 30, 1998. Rates are in US dollars and apply to the Indonesian rupiah, Malaysian ringgit, Philippine peso, Singapore dollar, Taiwanese dollar, and Korean won. The exchange rates are scaled so that they are equal to 1.0 in May 1997. These sharp depreciations reflect speculative runs or attacks.

Source: Based on statistics accessed from Pacific Exchange Rate Service, *pacific.commerce.ubc. ca/xr/.*

FIGURE 10.16

AN UNDERVALUED EXCHANGE RATE

The exchange rate is undervalued when the officially determined nominal exchange rate, $\bar{e}_{nom}$, is less than the fundamental value of the exchange rate as determined by supply and demand in the foreign exchange market, e^1_{nom}. To maintain the exchange rate at its official level, the central bank must supply its own currency to the foreign exchange market in the amount *AB* each period, thereby accumulating foreign reserves.

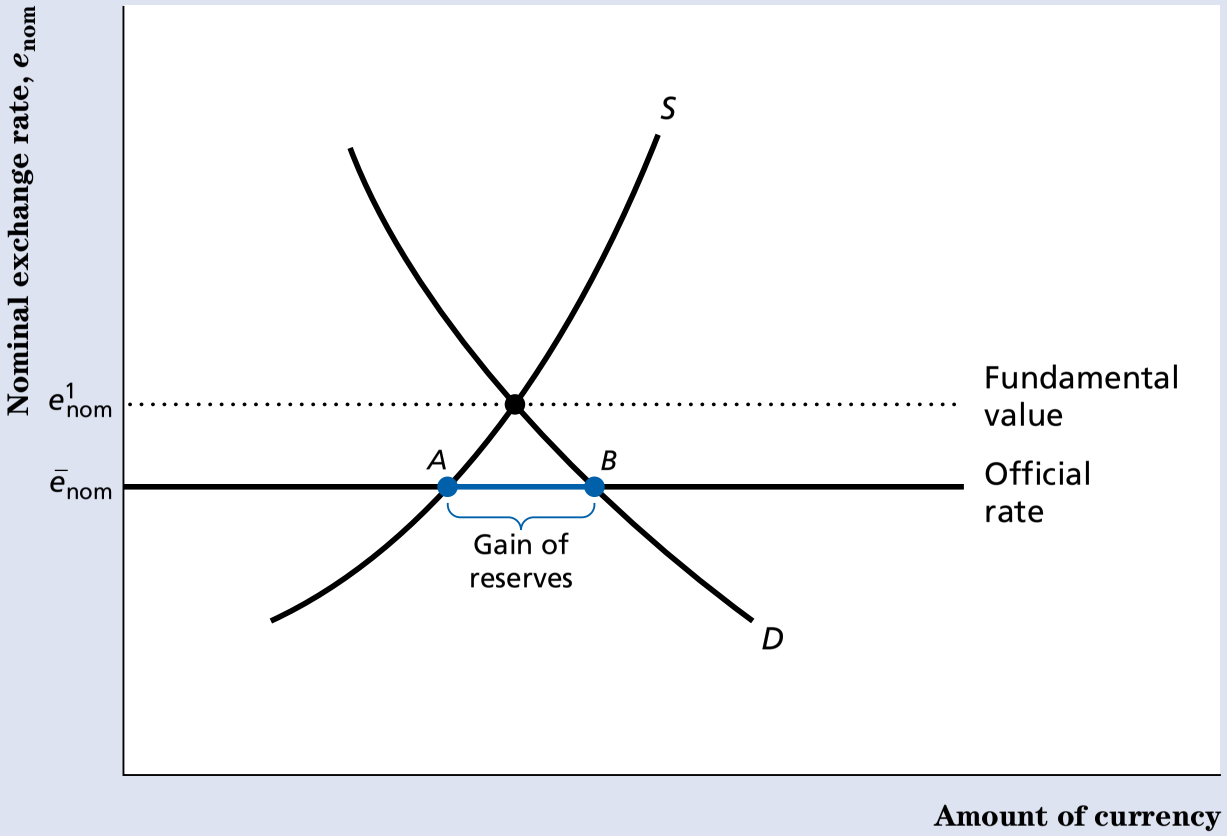


FIGURE 10.17

DETERMINATION OF THE MONEY SUPPLY UNDER FIXED EXCHANGE RATES

The downward-sloping fundamental value curve shows that a higher domestic money supply causes a lower fundamental value of the exchange rate. The horizontal line shows the officially fixed nominal exchange rate. Only when the country's money supply equals M_1 does the fundamental value of the exchange rate equal the official rate. If the central bank increased the money supply above M_1, the exchange rate would become overvalued. A money supply below M_1 would result in an undervalued currency.

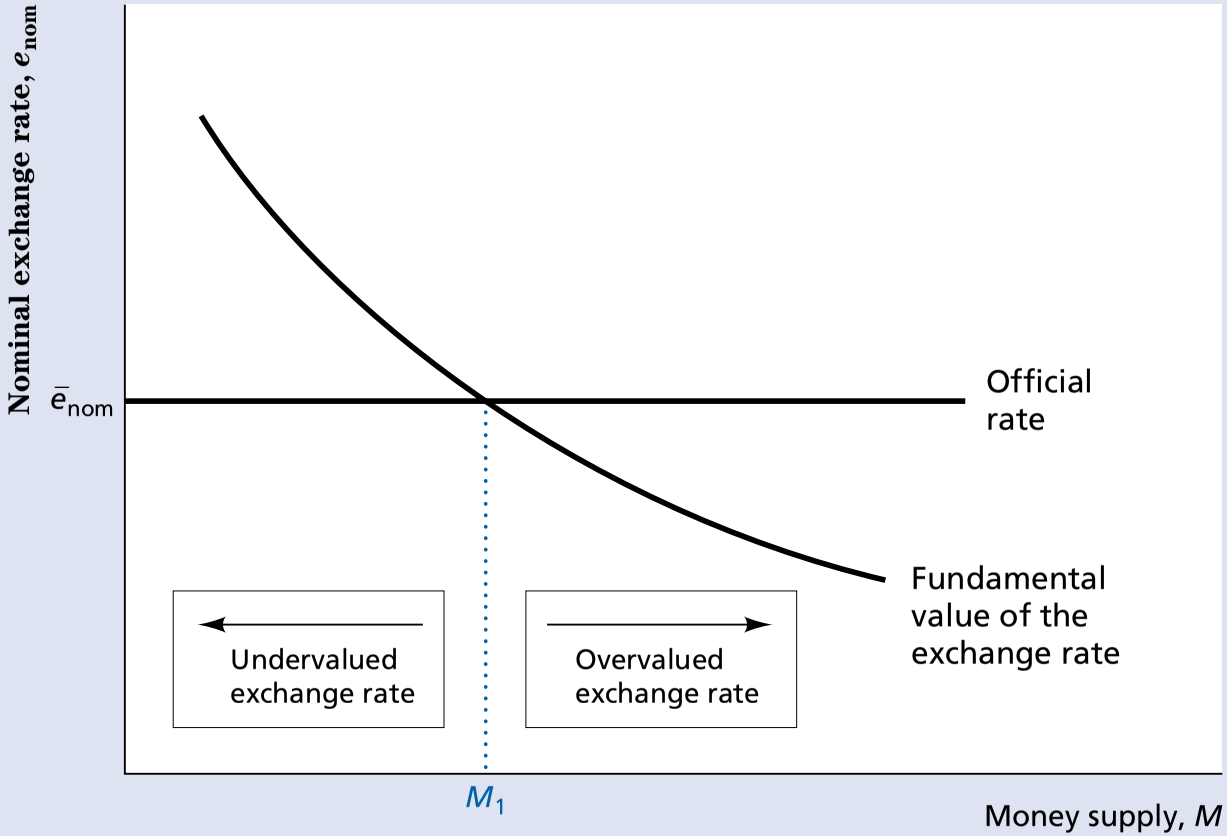


FIGURE 10.18

COORDINATED MONETARY EXPANSION

Suppose that Spain and Portugal are members of a fixed-exchange-rate system and that both are suffering from recessions. Initially, the fundamental value of Portugal's exchange rate as a function of the country's money supply is FV^1, and its money supply level consistent with maintenance of the official exchange rate is M_1. If Portugal raises its money supply to M_2 in an attempt to stimulate its economy, the fundamental value of its exchange rate will fall below the official fixed rate, and Portugal's currency would be overvalued.

Now, suppose that Spain also expands its money supply in a coordinated effort to stimulate both economies. For any level of Portugal's money supply, the increase in Spain's money supply will lower the fundamental value of Spain's exchange rate and raise the fundamental value of Portugal's exchange rate. The fundamental value curve of Portugal's exchange rate shifts up from FV^1 to FV^2. Portugal can now increase its money supply to M_2 without creating an overvaluation problem. Thus, Spain and Portugal have achieved a coordinated monetary expansion.

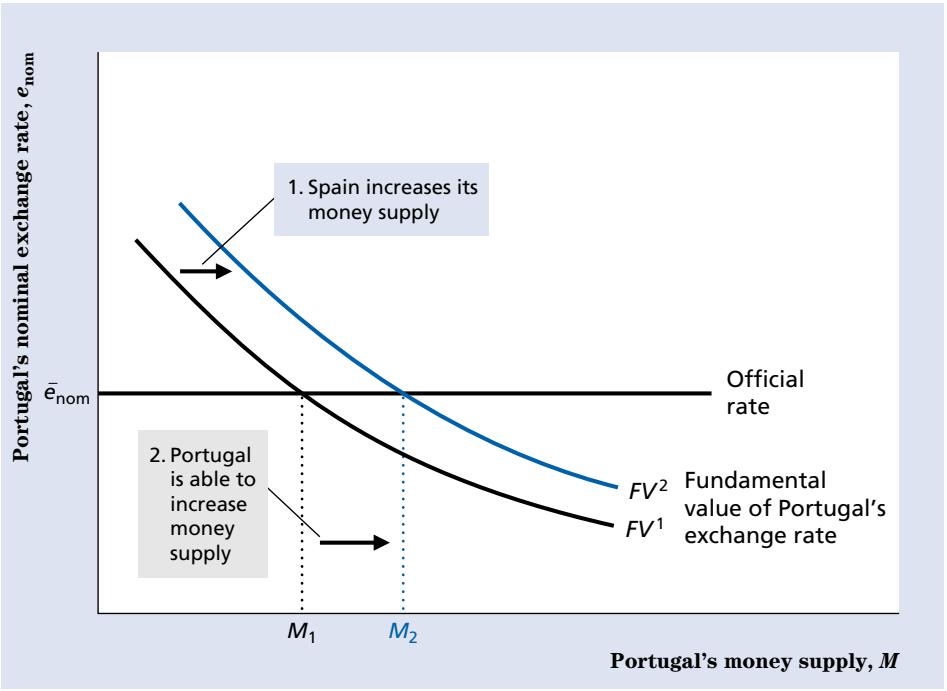


FIGURE 11.1

ACTUAL VERSUS SIMULATED VOLATILITIES OF KEY MACROECONOMIC VARIABLES

The figure compares the actual volatilities of key macroeconomic variables observed in post–World War II US data with the volatilities of the same variables predicted by computer simulations of Edward Prescott's calibrated RBC model. Prescott set the size of the random productivity shocks in his simulations so that the simulated volatility of GNP would match the actually observed volatility of GNP exactly. For these random productivity shocks, the simulated volatilities of the other five macroeconomic variables (with the possible exception of consumption) match the observed volatilities fairly well.

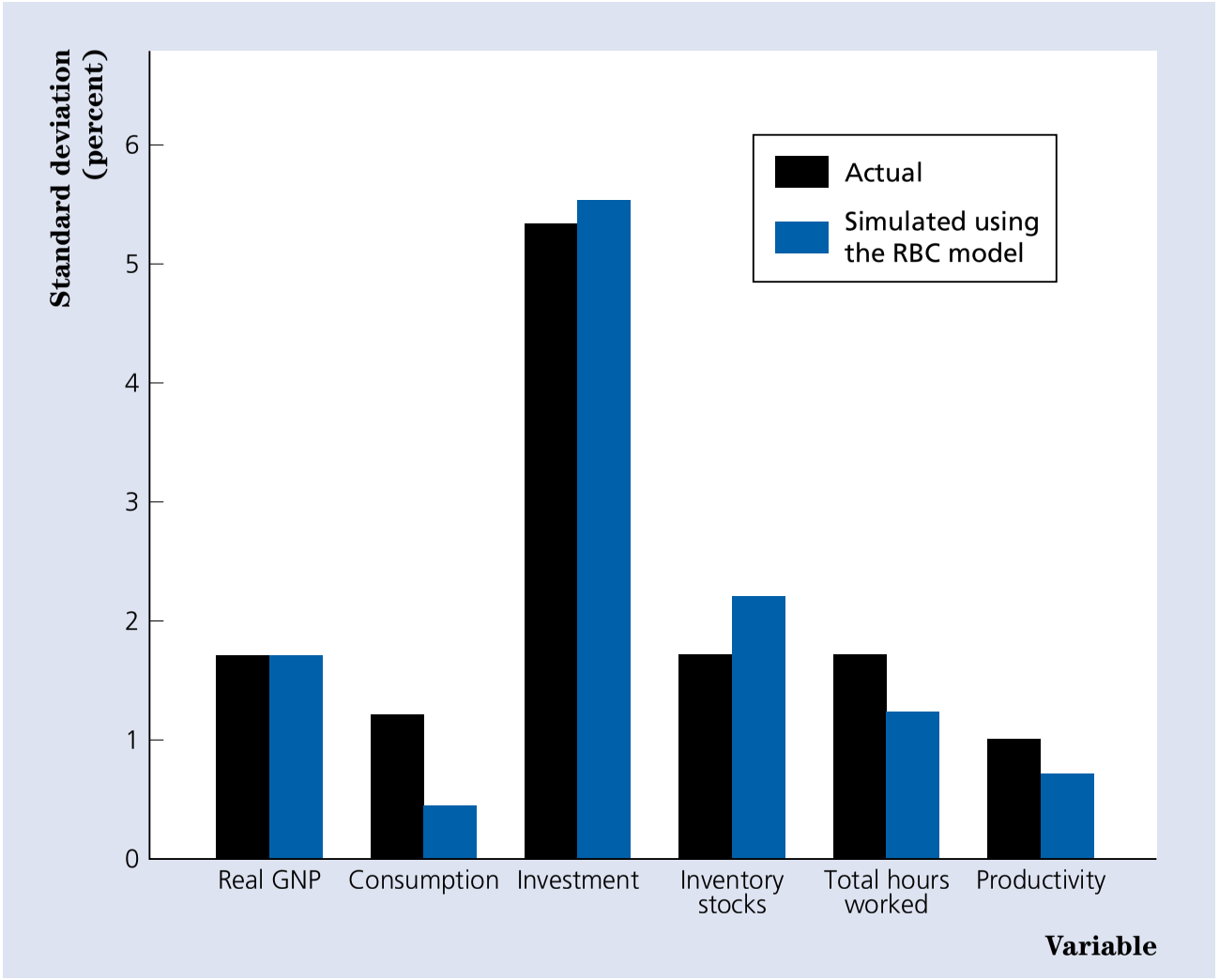


FIGURE 11.2

ACTUAL VERSUS SIMULATED CORRELATIONS OF KEY MACROECONOMIC VARIABLES WITH GNP

How closely a variable moves with GNP over the business cycle is measured by its correlation with GNP, with higher correlations implying a closer relationship. The figure compares the correlations of key variables with GNP that were actually observed in the post–World War II US economy with the correlations predicted by computer simulations of Prescott's calibrated RBC model. Except for productivity, whose predicted correlation with GNP is too high, the simulations predicted correlations of macroeconomic variables with GNP that closely resemble the actual correlations of these variables with GNP.

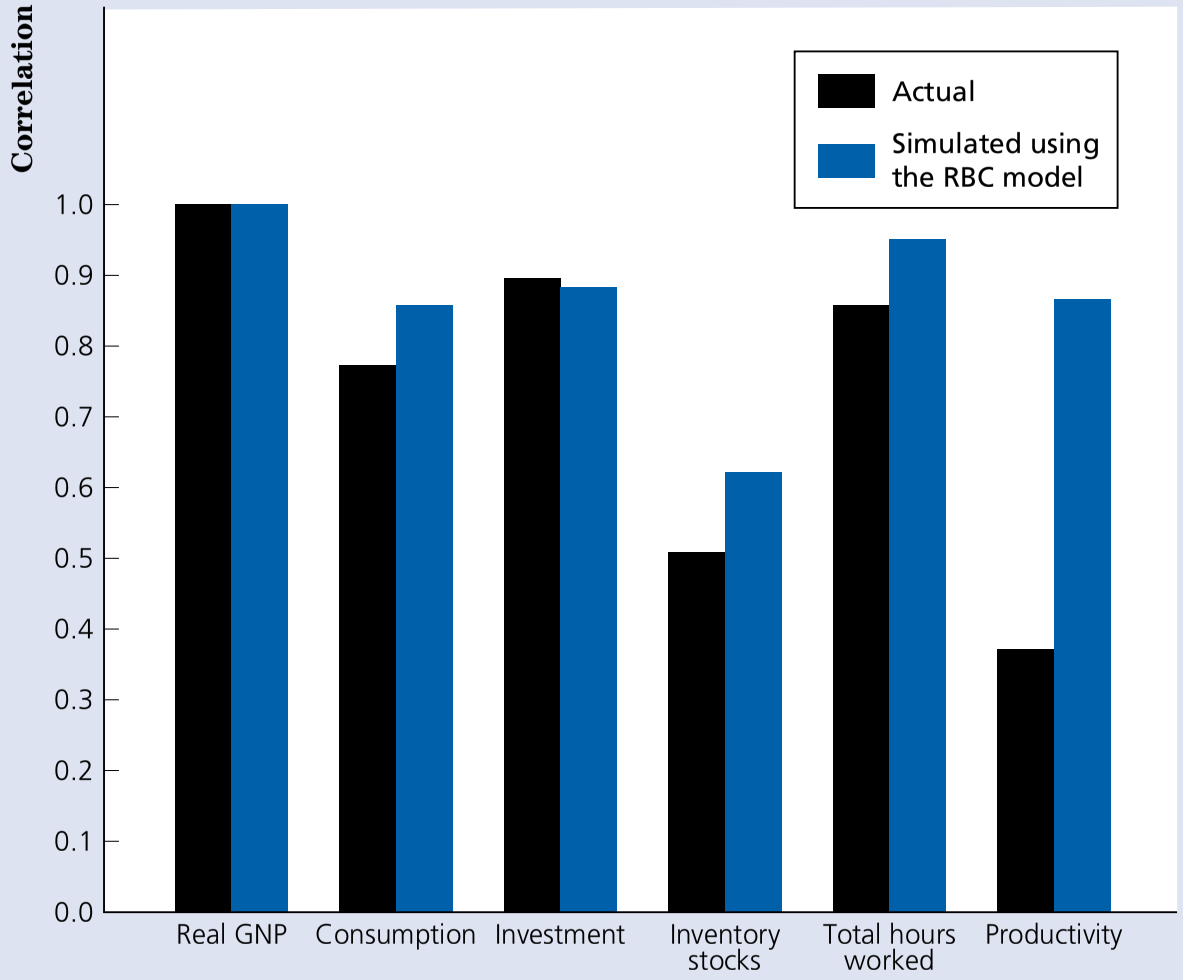


FIGURE 11.3

SMALL SHOCKS AND LARGE CYCLES

A computer simulation of a simple RBC model is used to find the relationship between computer-generated random productivity shocks (shown at the bottom of the figure) and aggregate output (shown in the middle of the figure). Even though all the productivity shocks are small, the simulation produces large cyclical fluctuations in aggregate output. Thus, large productivity shocks are not necessary to generate large cyclical fluctuations.

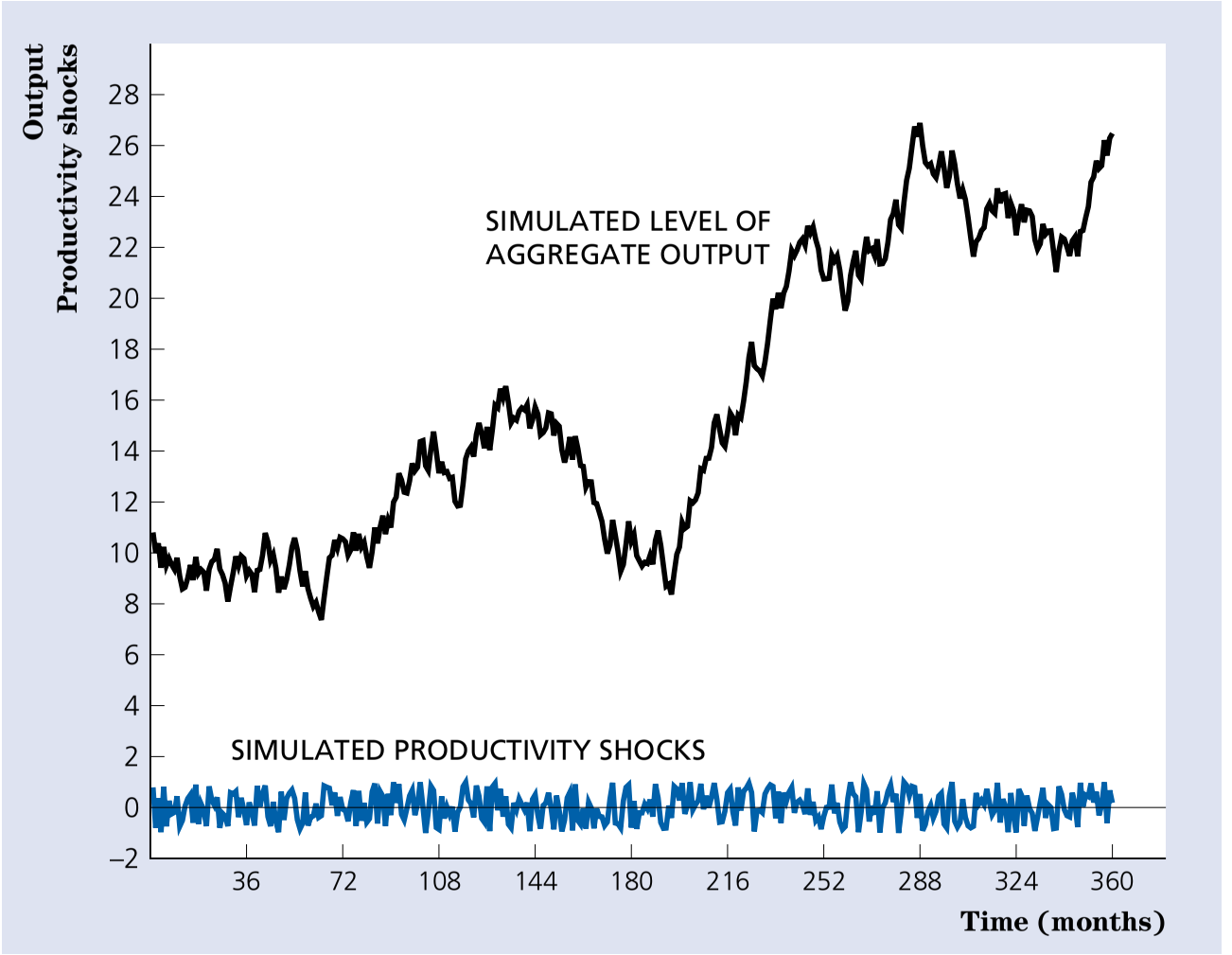
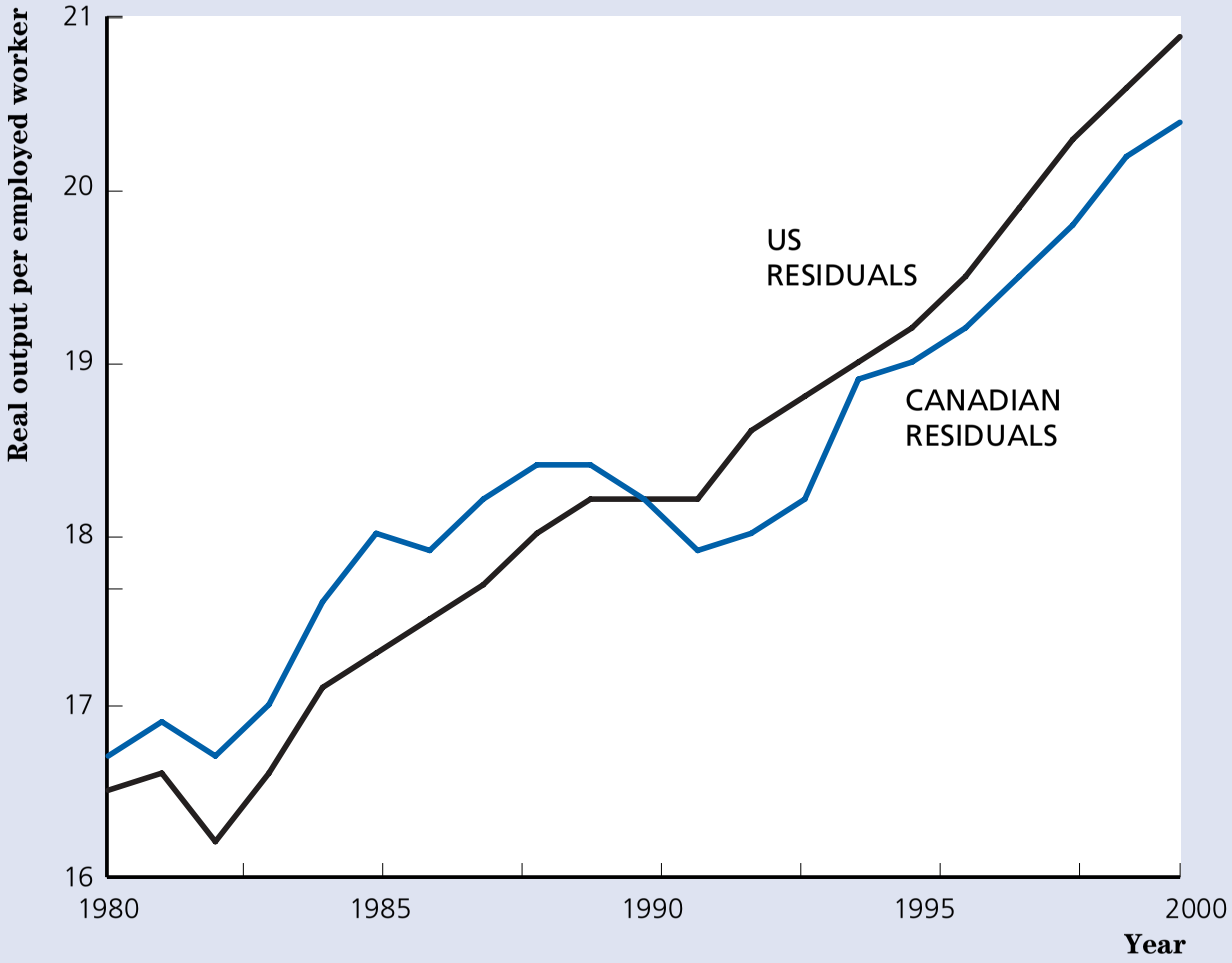


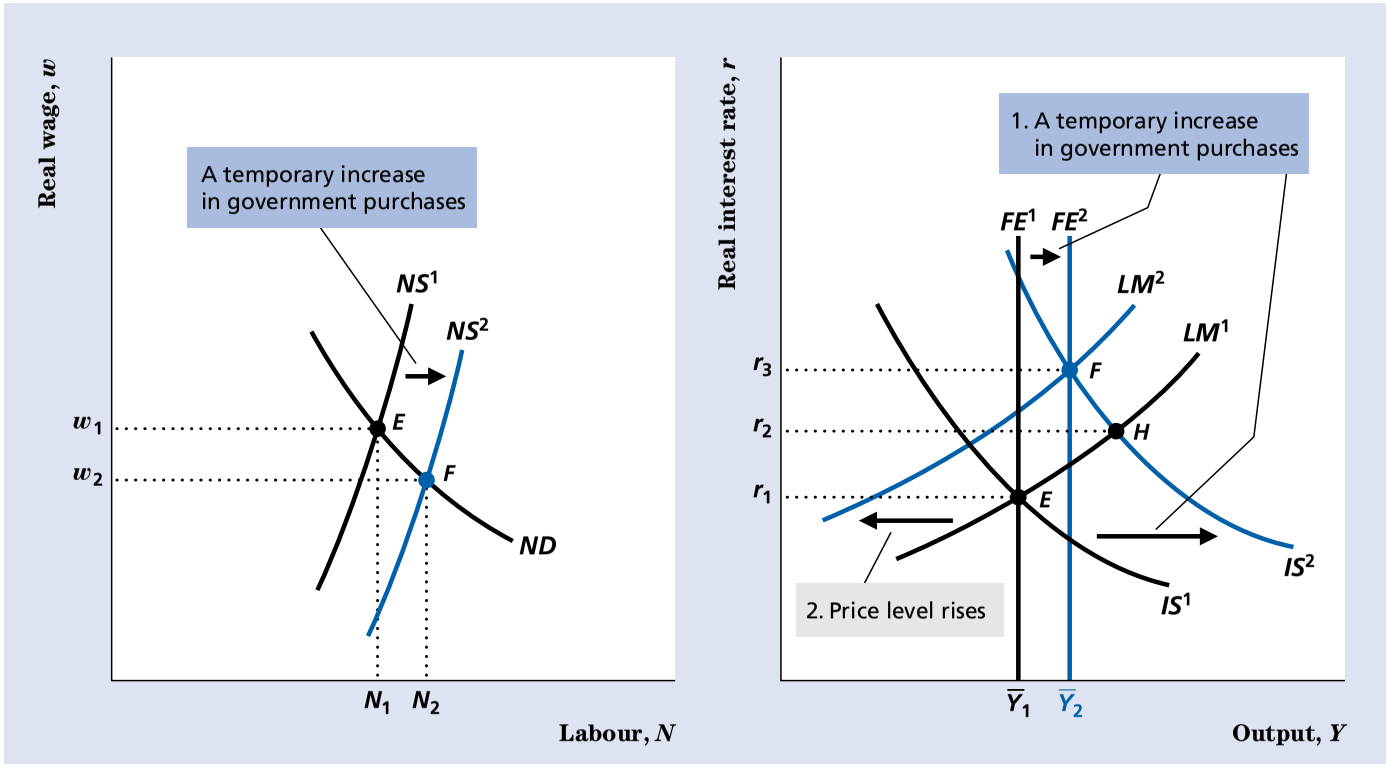
FIGURE 11.4

CANADIAN AND US SOLOW RESIDUALS, 1980–2000

Solow residuals are constructed from annual output, employment, and capital series, with $\alpha = 0.3$. Note that both Canadian and US Solow residuals are procyclical.

Sources: Canadian data: table 3.1; US data: output is real GDP in chained 1996 dollars, employment is civilian employment, from *Economic Report of the president* tables B2 and B36; capital is a quantity index of the non-residential fixed capital stock from the Bureau of Economic Analysis, *www.bea.gov.doc*, table 4.2. US residuals have been rescaled to have the same average as Canadian residuals.





(a) Labour market

(b) General equilibrium

FIGURE 11.5

EFFECTS OF A TEMPORARY INCREASE IN GOVERNMENT PURCHASES

Initial equilibrium is at point *E* in both (a) and (b).

(a) A temporary increase in government purchases raises workers' current or future taxes. Because workers feel poorer, they supply more labour and the labour supply curve shifts to the right, from NS^1 to NS^2. The shift in the labour supply curve reduces the real wage and increases employment, as indicated by point *F*.

(b) The increase in employment raises full-employment output and shifts the *FE* line to the right, from FE^1 to FE^2. The increase in government purchases also reduces desired national saving and shifts the *IS* curve up, from IS^1 to IS^2. Because the intersection of IS^2 and LM^1 is to the right of FE^2, the aggregate quantity of output demanded is higher than the full-employment level of output $\overline{Y}_2$, so the price level rises. The rise in the price level reduces the real money supply and shifts the *LM* curve up, from LM^1 to LM^2, until the new general equilibrium is reached at point *F*. The effect of the increase in government purchases is to increase output, the real interest rate, and the price level.

FIGURE 11.6

THE AGGREGATE SUPPLY CURVE IN THE MISPERCEPTIONS THEORY

The misperceptions theory holds that for a given value of the expected price level P^e, an increase in the actual price level P fools producers into increasing output. This relationship between output and the price level is shown by the short-run aggregate supply curve *SRAS*. Along the *SRAS* curve, output equals $\overline{Y}$ when prices equal their expected level ($P = P^e$, at point *E*), output exceeds $\overline{Y}$ when the price level is higher than expected ($P > P^e$), and output is less than $\overline{Y}$ when the price level is lower than expected ($P < P^e$). In the long run, the expected price level equals the actual price level so that output equals $\overline{Y}$. Thus, the long-run aggregate supply curve *LRAS* is vertical at $Y = \overline{Y}$.

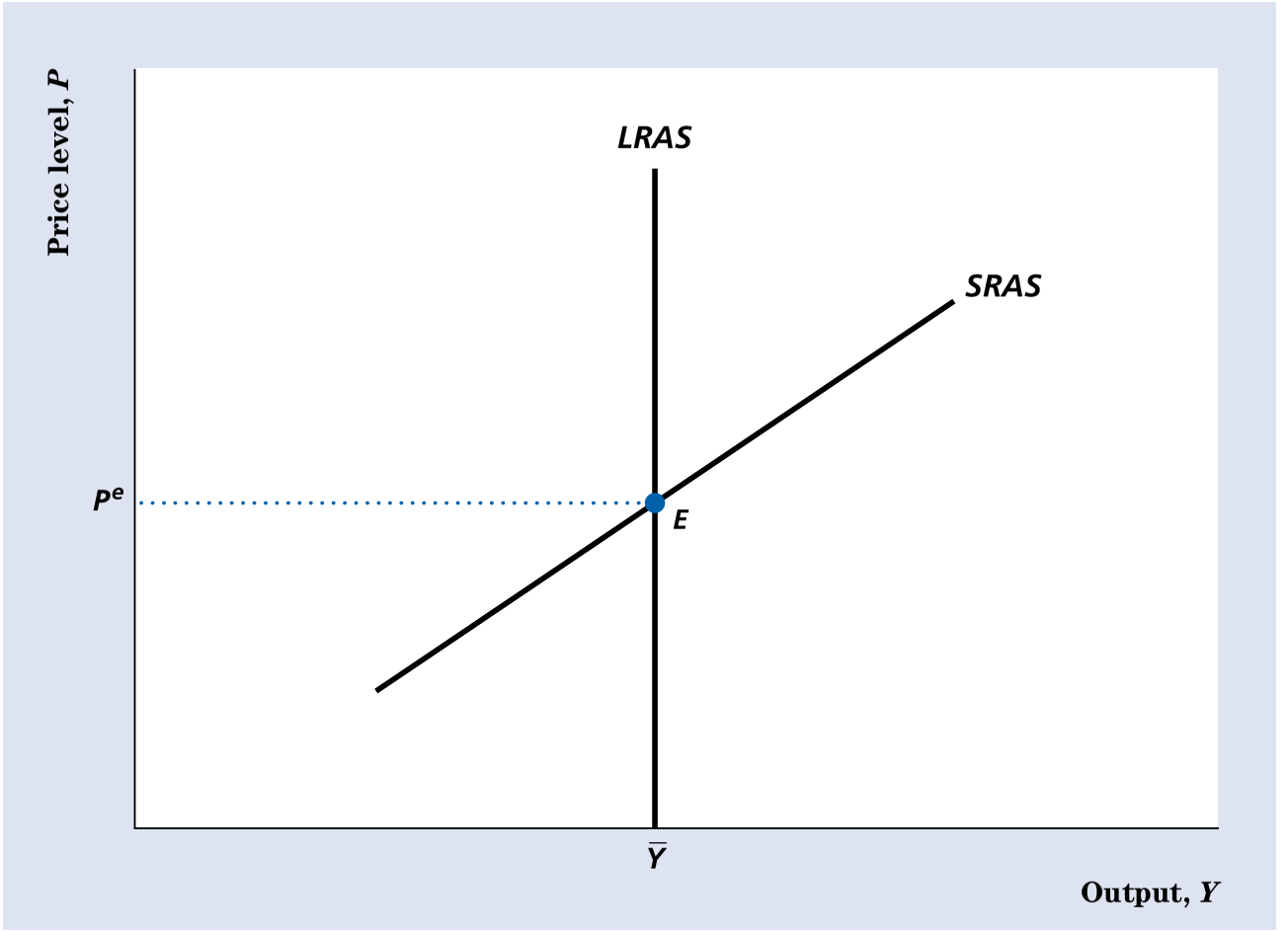


FIGURE 11.7

AN UNANTICIPATED INCREASE IN THE MONEY SUPPLY

If we start from the initial equilibrium at point *E*, an unanticipated 10% increase in the money supply shifts the *AD* curve up by 10% at each level of output, from AD^1 to AD^2. The short-run equilibrium is located at point *F*, the intersection of AD^2 and the short-run aggregate supply curve $SRAS^1$, where prices and output are both higher than at point *E*. Thus, an unanticipated change in the money supply is not neutral in the short run. In the long run, people learn the true price level and the equilibrium shifts to point *H*, the intersection of AD^2 and the long-run aggregate supply curve *LRAS*. In the long-run equilibrium at *H*, the price level has risen by 10% but output returns to its full-employment level $\overline{Y}$ so that money is neutral in the long run. As expectations of the price level rise from P_1 to P_3, the *SRAS* curve also shifts up until it passes through *H*.

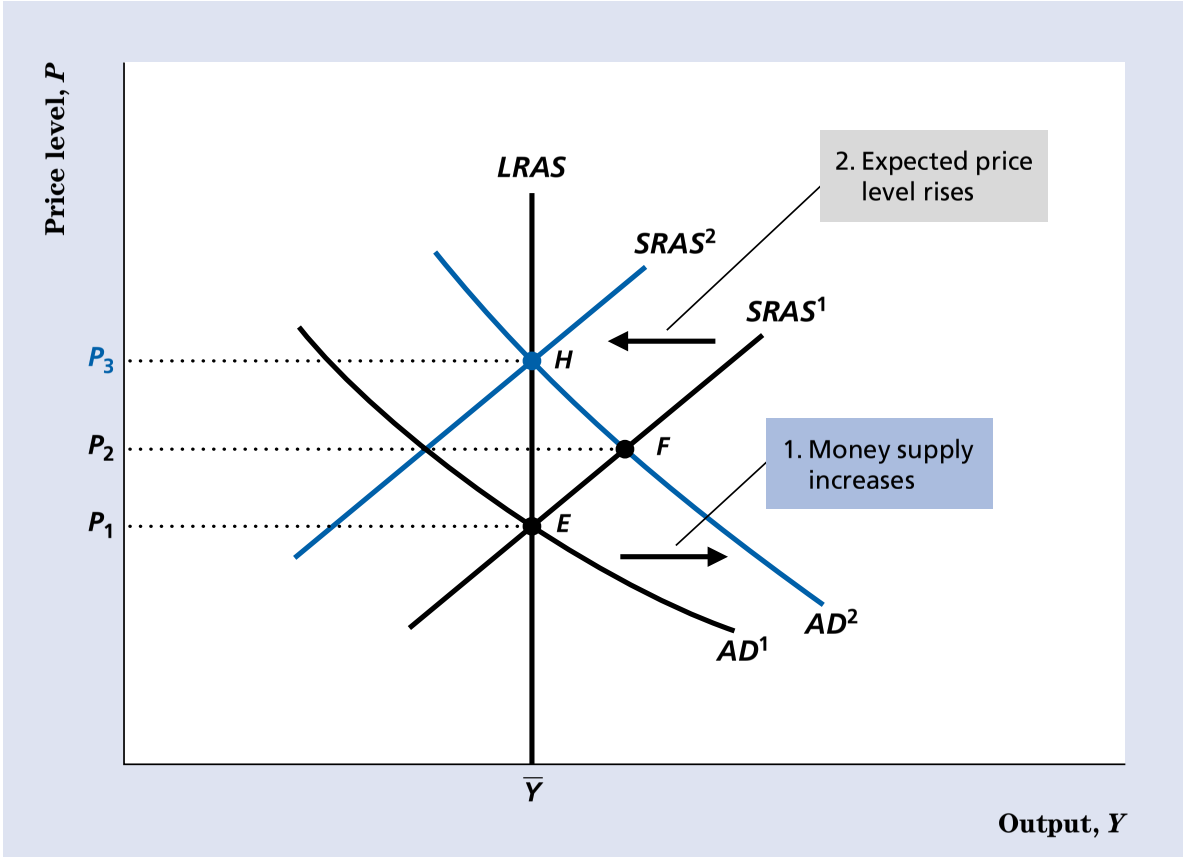
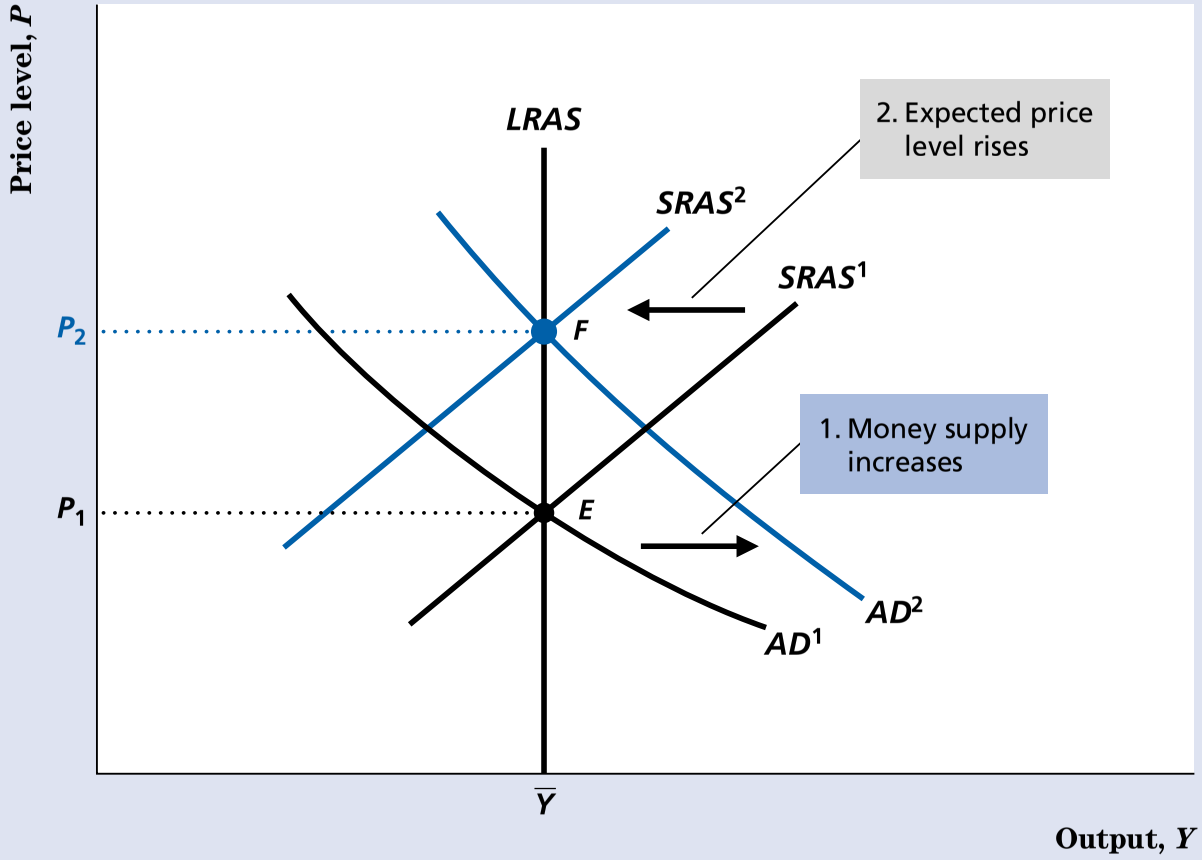


FIGURE 11.8

AN ANTICIPATED INCREASE IN THE MONEY SUPPLY

The economy is in initial equilibrium at point *E* when the Bank of Canada publicly announces a 10% increase in the money supply. When the money supply increases, the *AD* curve shifts upward by 10%, from AD^1 to AD^2. But in addition, because the increase in the money supply is anticipated by the public, the expected price level increases by 10%, from P_1 to P_2. Thus, the short-run aggregate supply curve shifts up from $SRAS^1$ to $SRAS^2$. The new short-run equilibrium, which is the same as the long-run equilibrium, is at point *F*. At *F*, output is unchanged at $\overline{Y}$ and the price level is 10% higher than in the initial equilibrium at *E*. Thus, an anticipated increase in the money supply is neutral in the short run as well as in the long run.



KEY DIAGRAM 8

THE MISPERCEPTIONS VERSION OF THE *AD–AS* MODEL

The misperceptions version of the *AD–AS* model shows how the aggregate demand for output and the aggregate supply of output interact to determine the price level and output in a classical model in which producers misperceive the aggregate price level.

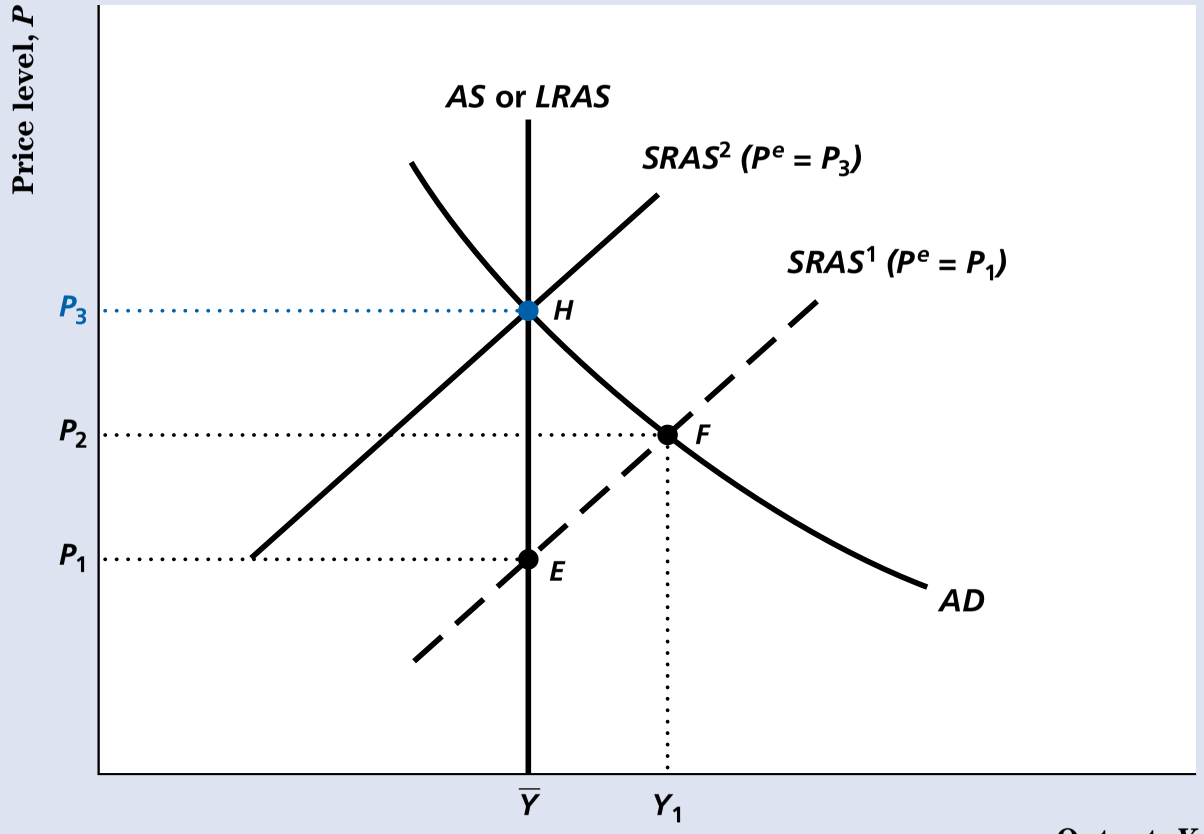


FIGURE 12.1

DETERMINATION OF THE EFFICIENCY WAGE

The effort curve shows the relation between worker effort, E, and the real wage workers receive, w. A higher real wage leads to more effort, but above a certain point, higher wages are unable to spur effort much, so the effort curve is S-shaped. For any point on the curve, the amount of effort per dollar of real wage is the slope of the line from the origin to that point. At point A, effort per dollar of real wage is E_A/w_A. The highest level of effort per dollar of real wage is at point B, where the line from the origin is tangent to the curve. The real wage rate at B is the efficiency wage w^*, and the corresponding level of effort is E^*.

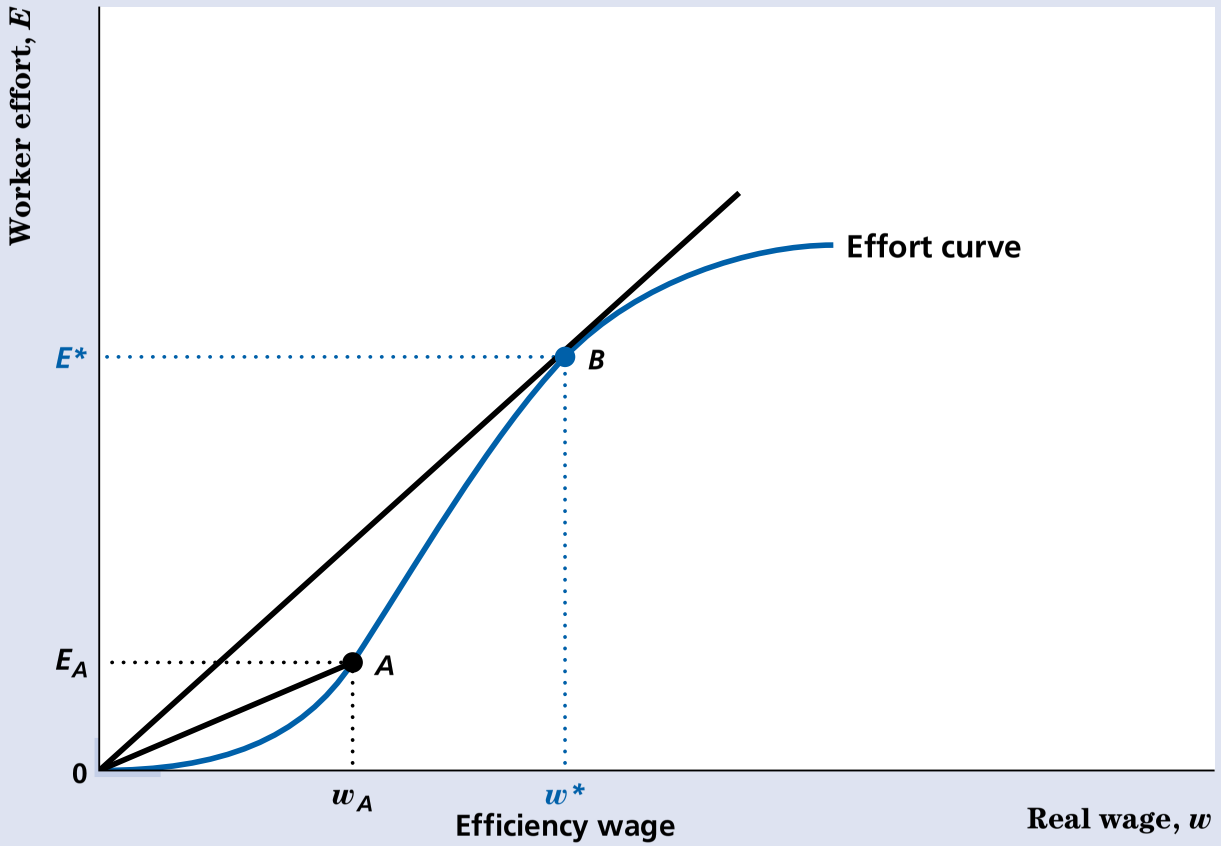


FIGURE 12.2

EXCESS SUPPLY OF LABOUR IN THE EFFICIENCY WAGE MODEL

When the efficiency wage w^* is paid, the firm's demand for labour is $\bar{N}$, represented by point *A*. However, the amount of labour that workers want to supply at a real wage of w^* is NS_1. The excess supply of labour equals distance *AB*. We assume that the efficiency wage w^* is higher than the market-clearing wage w_E that would prevail if the supply of labour equalled the demand for labour at point *E*.

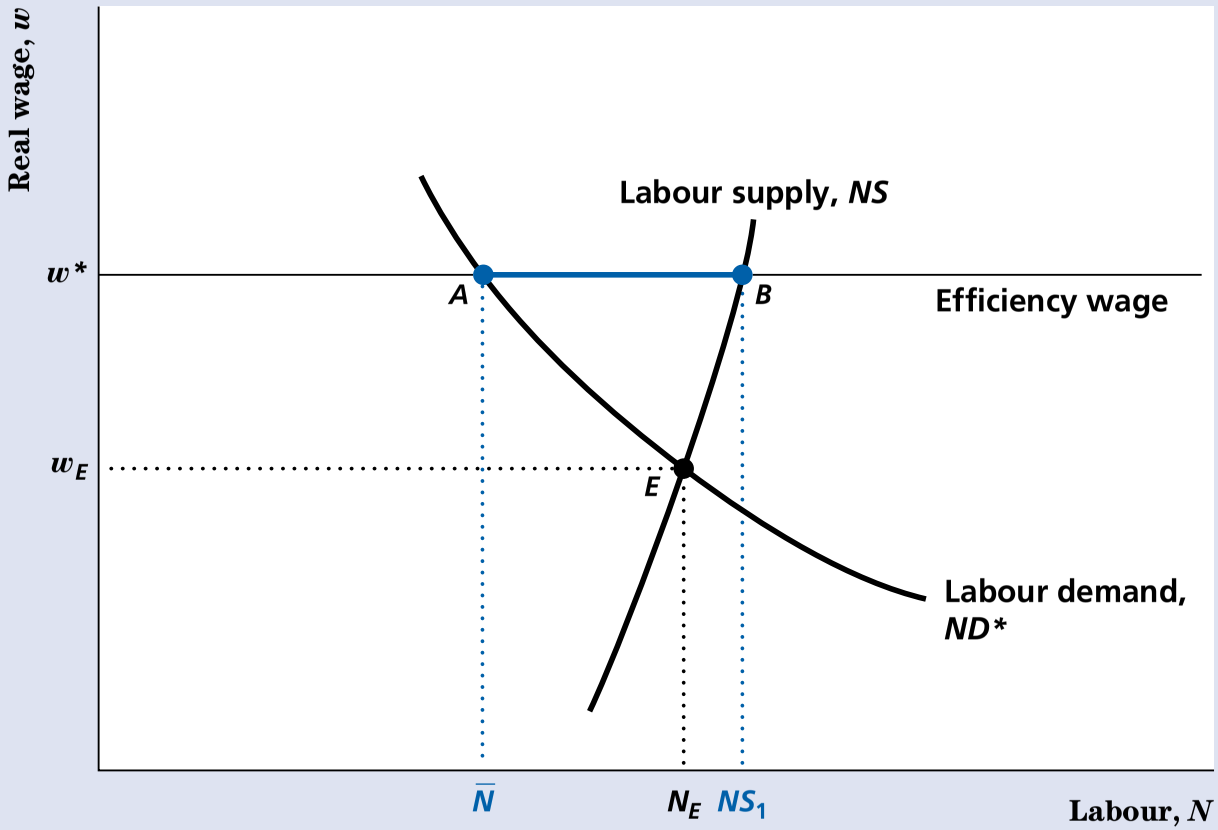


FIGURE 12.3

THE EFFECTIVE LABOUR DEMAND CURVE

When a firm meets the demand for its output, it employs just the amount of labour needed to produce the quantity of output demanded. Because more labour is required to produce more output, firms must employ more labour when the demand for output is high. This relation between the amount of output demanded and the amount of labour employed is the effective labour demand curve. The effective labour demand curve is the same as the production function relating output and labour, except that labour is plotted on the vertical axis and output is plotted on the horizontal axis.

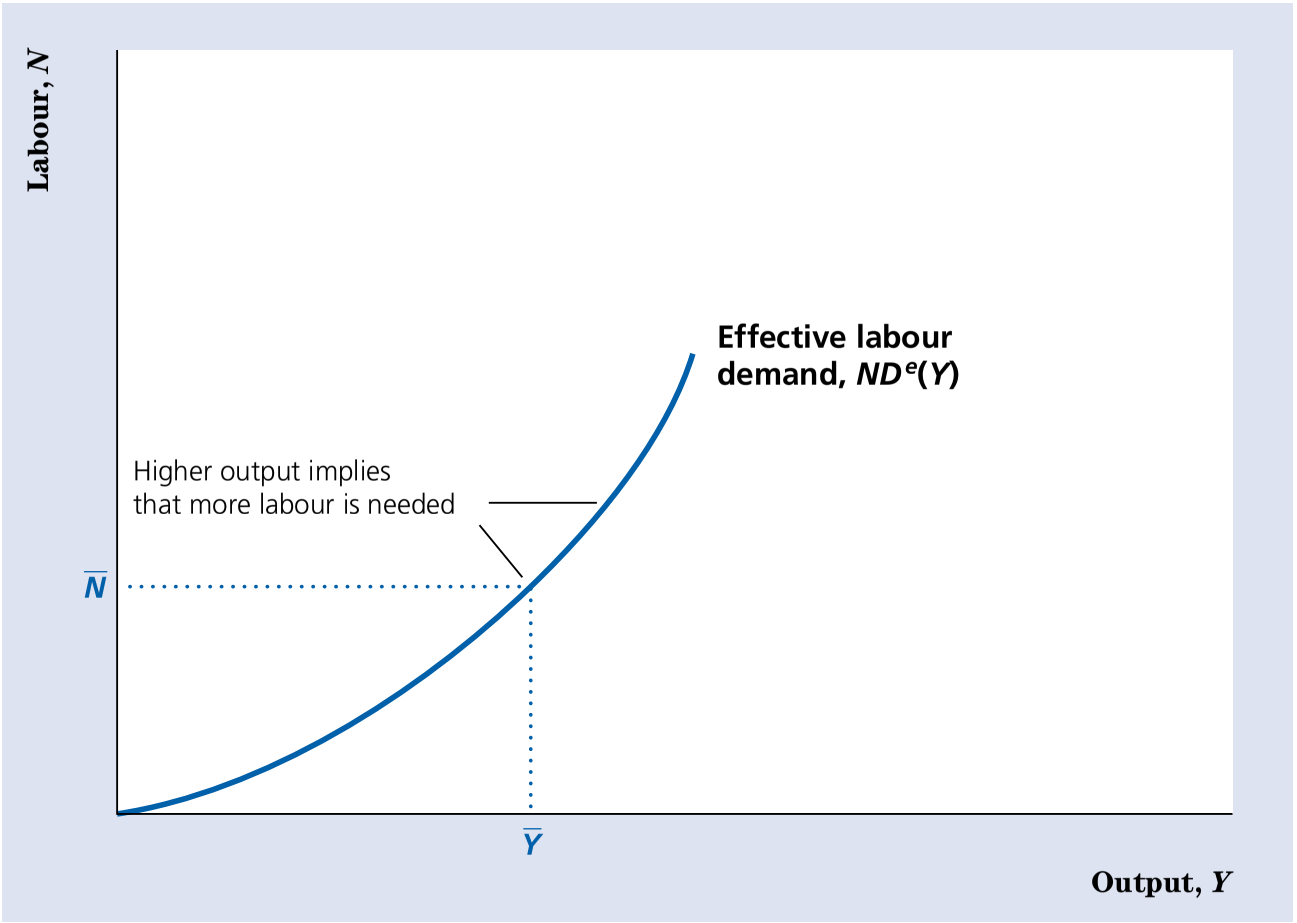
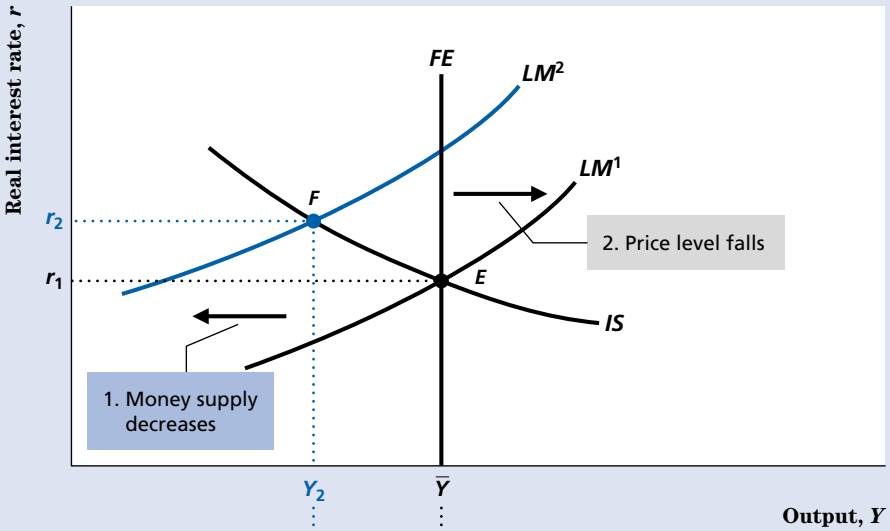


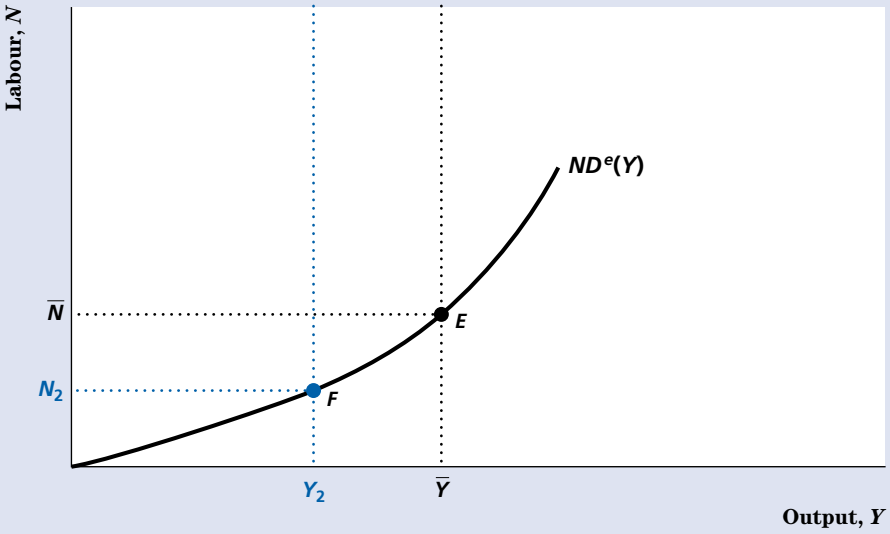
FIGURE 12.4

A DECREASE IN THE MONEY SUPPLY

(a) If we start from an initial general equilibrium at point *E*, a decrease in the money supply shifts the *LM* curve up and to the left, from LM^1 to LM^2; the *IS* curve and the *FE* line remain unchanged. Because prices are fixed and firms meet the demand for output in the short run, the economy moves to point *F*, which is to the left of the *FE* line. Output falls to Y_2 and the real interest rate rises. **(b)** Because firms produce less output, employment falls to N_2, as shown by the effective labour demand curve.
In the long run, the price level falls in the same proportion as the money supply, the real money supply returns to its initial level, and the *LM* curve returns to its initial position, LM^1, in (a). The economy returns to *E* in both (a) and (b), and money is neutral in the long run.



(a) *IS–LM* analysis



(b) Effective labour demand

FIGURE 12.5

AN INCREASE IN GOVERNMENT PURCHASES

(a) If we start from the general equilibrium at point *E*, an increase in government purchases reduces desired national saving and shifts the *IS* curve up and to the right, from IS^1 to IS^2. The short-run equilibrium is at point *F*, with output increasing to Y_2 and the real interest rate rising to r_2.
(b) As firms increase production to meet the demand, employment increases from $\bar{N}$ to N_2, as shown by the effective labour demand curve. However, the economy does not remain at point *F*. Because aggregate output demanded exceeds $\bar{Y}$ in the short run, the price level increases, reducing the real money supply and shifting the *LM* curve up and to the left, from LM^1 to LM^2. In the long run, with equilibrium at point *H*, output returns to $\bar{Y}$ and employment returns to $\bar{N}$, but the real interest rate rises further to r_3.

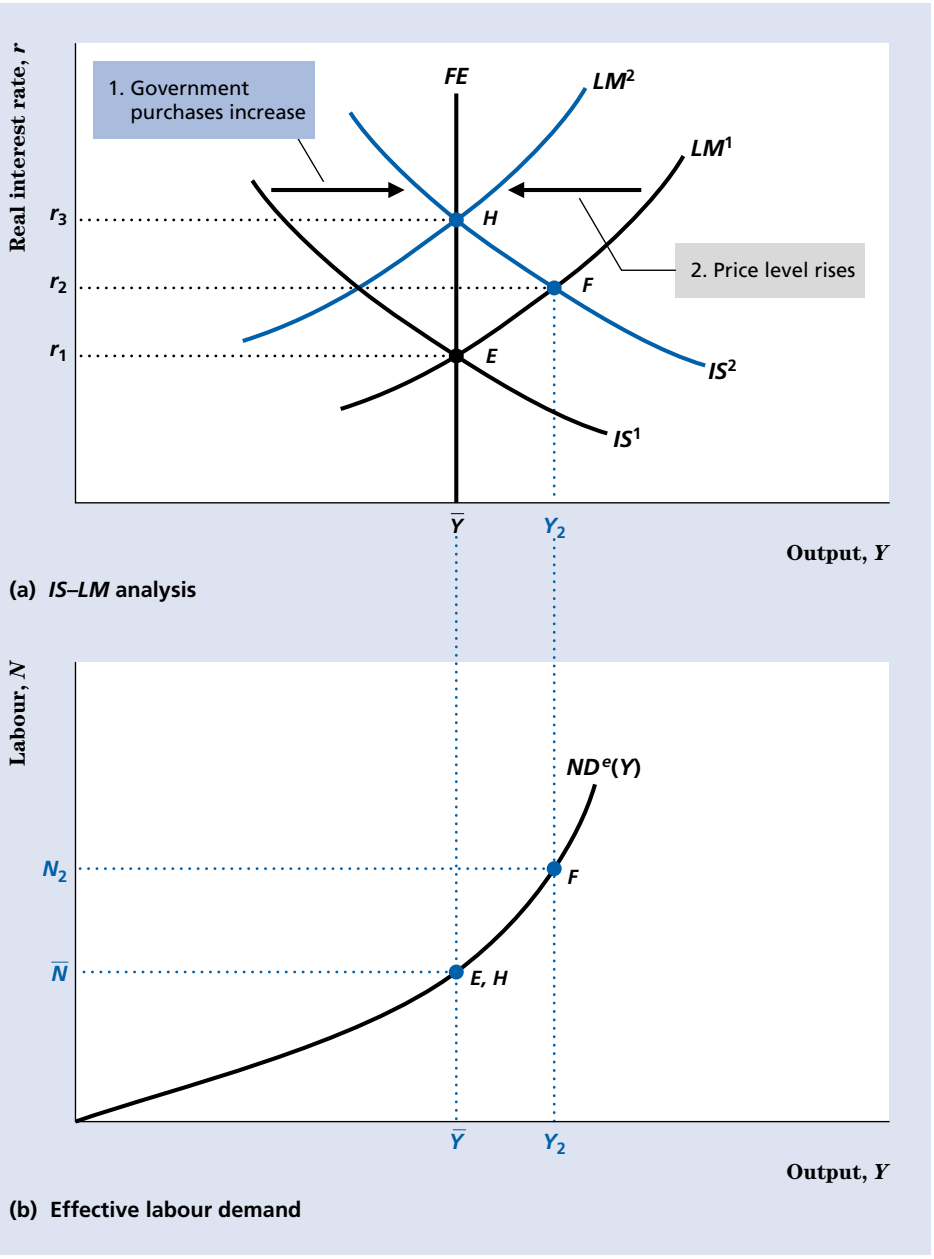


FIGURE 12.6

AN INCREASE IN GOVERNMENT PURCHASES IN THE KEYNESIAN *AD–AS* FRAMEWORK

An increase in government purchases raises the aggregate demand for output at any price level (see Figure 12.5). Thus, the aggregate demand curve shifts to the right, from AD^1 to AD^2. In the short run, the increase in aggregate demand increases output to Y_2 (point *F*) but does not affect the price level, because prices are sticky in the short run. Because aggregate output demanded Y_2 exceeds $\overline{Y}$ at *F*, firms eventually raise their prices. The long-run equilibrium is at *H*, where AD^2 intersects the long-run aggregate supply curve *LRAS*. At *H*, output has returned to $\overline{Y}$ and the price level has risen from P_1 to P_2. The higher price level raises the short-run aggregate supply curve, from $SRAS^1$ to $SRAS^2$.

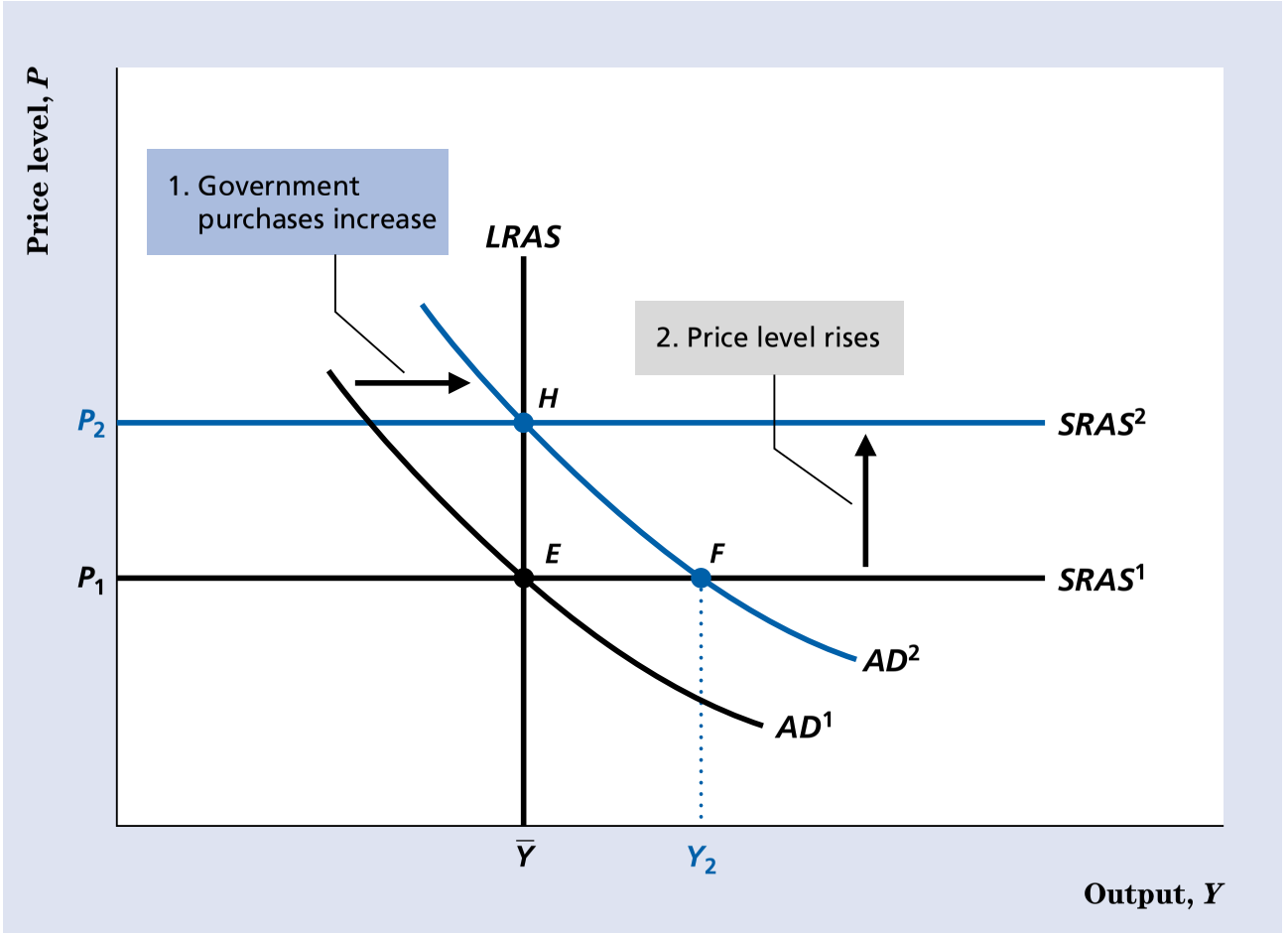


FIGURE 12.7

A RECESSION ARISING FROM AN AGGREGATE DEMAND SHOCK

The figure illustrates how an adverse aggregate demand shock can cause a recession in the Keynesian model. The economy starts at general equilibrium at point *E*. A decline in consumer confidence about the future of the economy reduces desired consumption and raises desired saving so that the *IS* curve shifts down, from IS^1 to IS^2. The economy falls into recession at point *F*, with output below its full-employment level $\bar{Y}$.

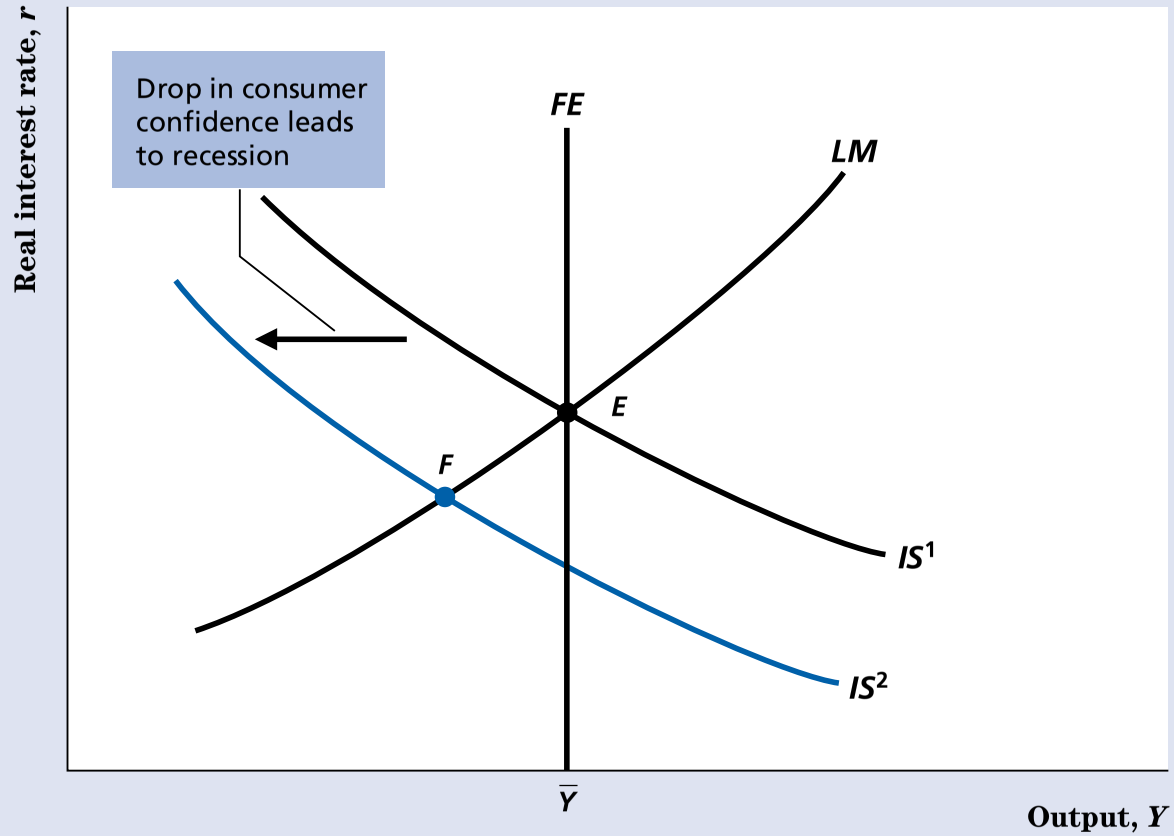


FIGURE 12.8

STABILIZATION POLICY IN THE KEYNESIAN MODEL

From point *E*, the economy is driven into a recession at point *F* by a drop in consumer confidence and spending, which shifts the *IS* curve down, from IS^1 to IS^2. If the government took no action, in the long run, price adjustment would shift the *LM* curve from LM^1 to LM^2 and restore general equilibrium at point *H* (scenario 1). Alternatively, the government could try to offset the recession through stabilization policy. For example, the Bank of Canada could increase the money supply, which would shift the *LM* curve directly from LM^1 to LM^2, speeding the recovery in output (scenario 2). Another possibility is a fiscal expansion, such as an increase in government purchases, which would shift the *IS* curve from IS^2 back to IS^1, again restoring full employment at *E* (scenario 3). Compared with a strategy of doing nothing, expansionary monetary or fiscal policy helps the economy recover more quickly but leads to a higher price level in the long run.

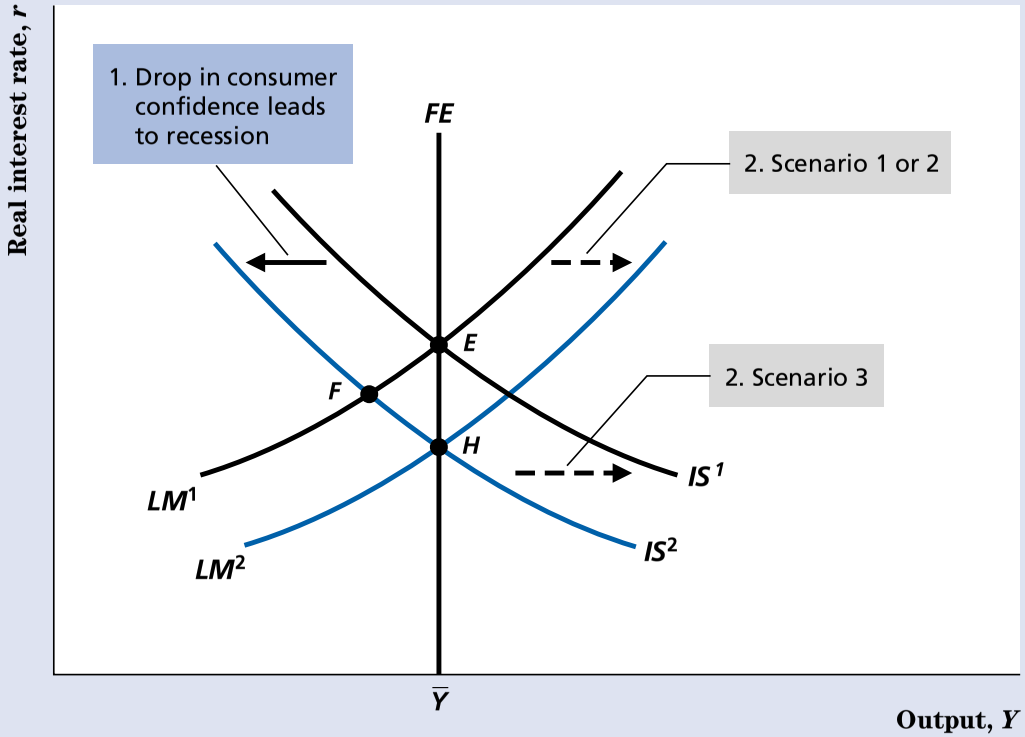


FIGURE 12.9

FISCAL EXPANSION WITH MONETARY ACCOMMODATION

The Japanese economy was in a recession in the early 1990s (point *F*). The Japanese government increased public spending several times (and also reduced taxes) to try to hasten the economy's recovery. The fiscal expansions shifted the *IS* curve up and to the right from IS^1 to IS^2. At the same time, the Bank of Japan expanded the money supply so that the *LM* curve shifted down and to the right from LM^1 to LM^2. This monetary accommodation prevented the interest rate from rising and reinforced the expansionary policy, leading to an increase in output (point *E*). Without the monetary expansion (at point *D*) interest rates would have risen and so private investment would have been discouraged and the yen might have appreciated even more, leading to a fall in net exports.

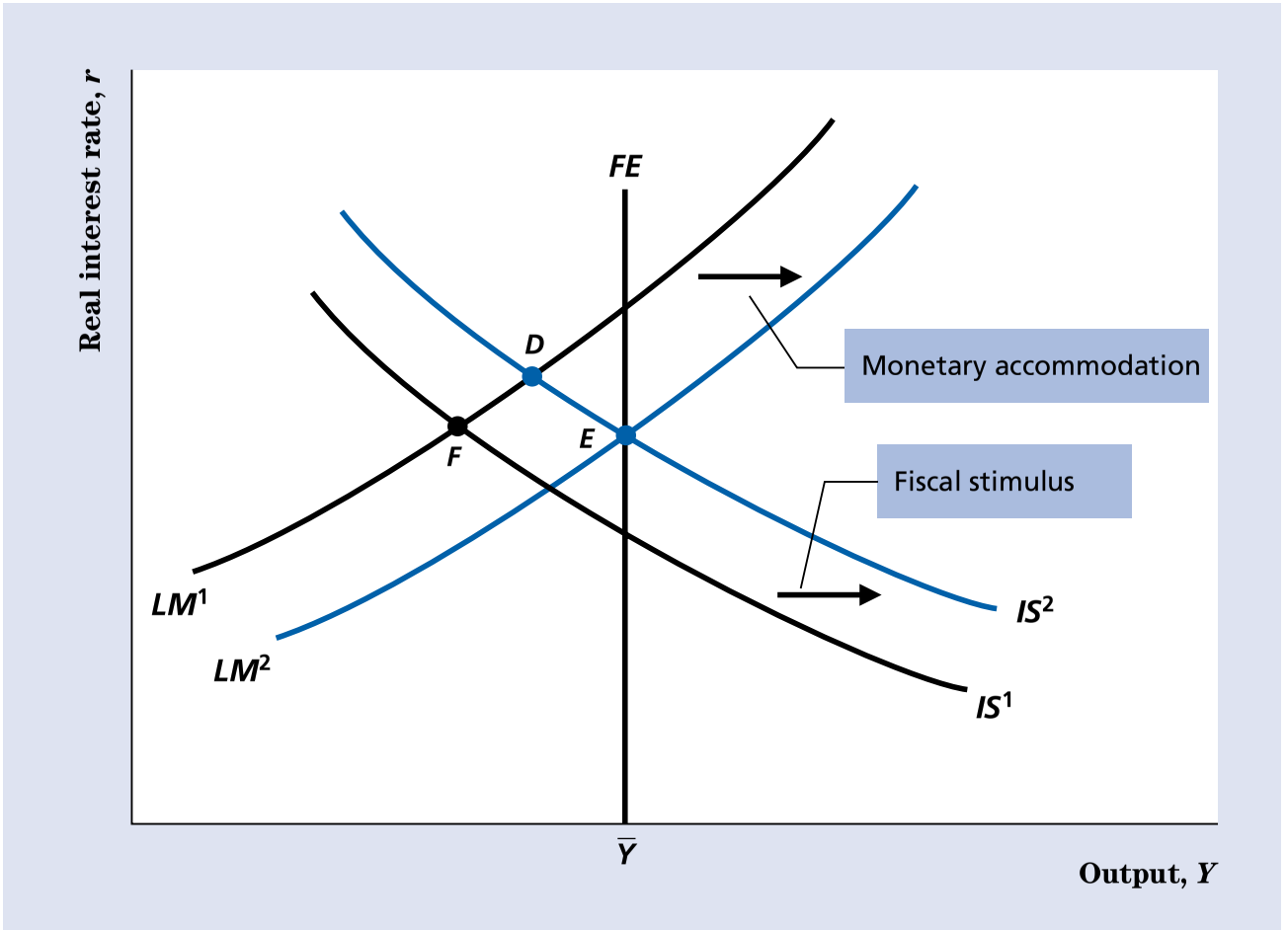


FIGURE 12.10

THE LIQUIDITY TRAP

Point *F* shows the position of the Japanese economy in recent years. At point *F*, output is below the full-employment level, at the intersection of the curves IS^1 and LM^1. But interest rates are near zero, preventing further stimulus from monetary policy. The figure shows both real and nominal interest rates equal to zero, which is accurate for the case of Japan because inflation and expected inflation were both approximately zero. Note that the *LM* curve is flat at a zero interest rate; this shape reflects the fact that increases in the money supply are powerless to lower the nominal interest rate once it has reached zero. Creating expected inflation may lower the real interest rate and increase output, at point *E*.

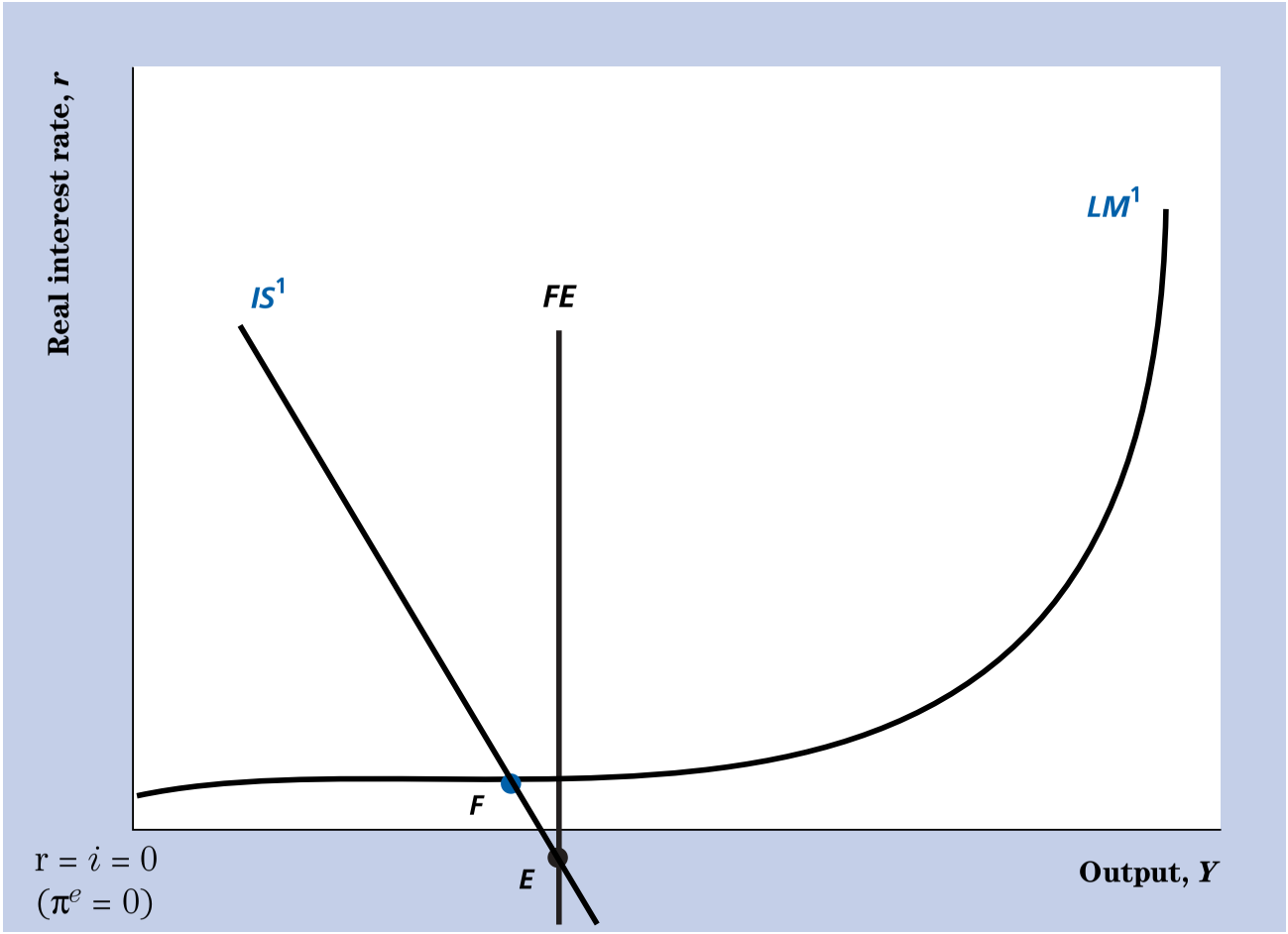


FIGURE 12.11

AN OIL PRICE SHOCK IN THE KEYNESIAN MODEL

An increase in the price of oil is an adverse supply shock that reduces full-employment output from $\bar{Y}_1$ to $\bar{Y}_2$ and, thus, shifts the *FE* line to the left. In addition, the increase in the price of oil increases prices in sectors that depend heavily on oil, whereas prices in other sectors remain fixed in the short run. Thus, the average price level rises, which reduces the real money supply *M/P* and shifts the *LM* curve up and to the left, from LM^1 to LM^2. In the short run, the economy moves to point *F*, with output falling below the new, lower value of full-employment output and the real interest rate increasing. Because the aggregate quantity of goods demanded at *F* is less than the full-employment level of output $\bar{Y}_2$, in the long run, the price level falls, partially offsetting the initial increase in prices. The drop in the price level causes the *LM* curve to shift down and to the right, from LM^2 to LM^3, moving the economy to full-employment equilibrium at point *H*.

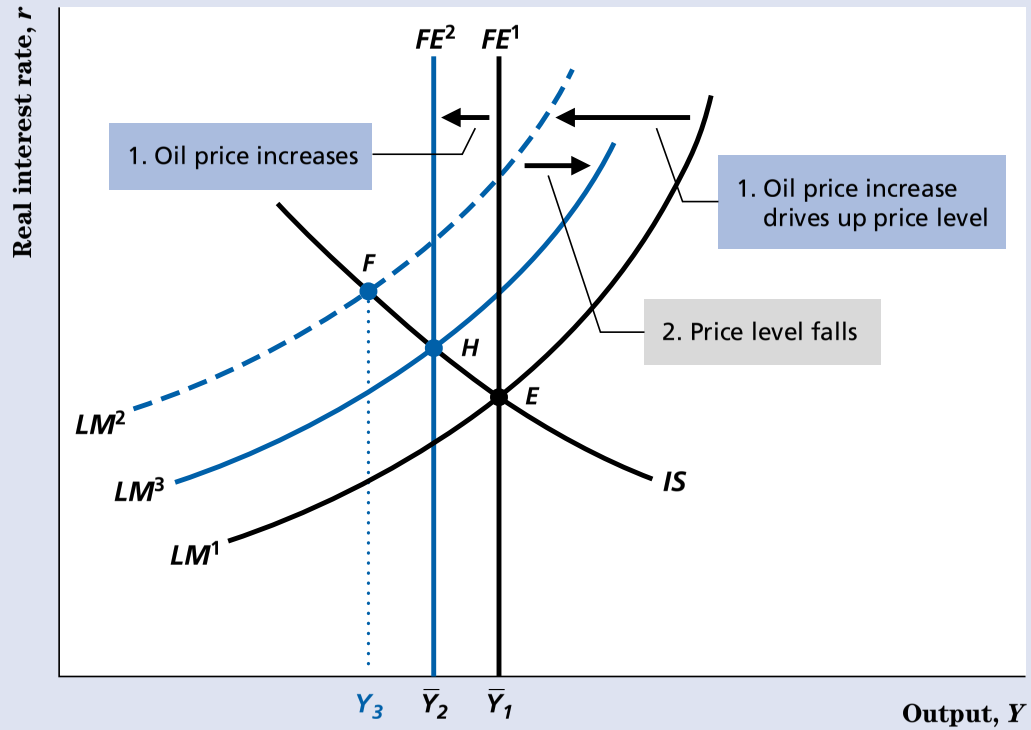


FIGURE 13.1

THE PHILLIPS CURVE AND THE CANADIAN ECONOMY DURING THE 1960S

During the 1960s, Canadian rates of inflation seemed to lie along a Phillips curve. Inflation rose and unemployment fell fairly steadily during this decade, and policymakers apparently had decided to live with higher inflation in order to reduce unemployment.

Source: Unemployment rate, 1963–1965: *Historical Statistics of Canada*, Series D233; 1966–1969: *Canadian Economic Observer, Historical Statistical Supplement*, Table 8; CPI inflation rate: *Canadian Economic Observer, Historical Statistical Supplement*, Table 12.

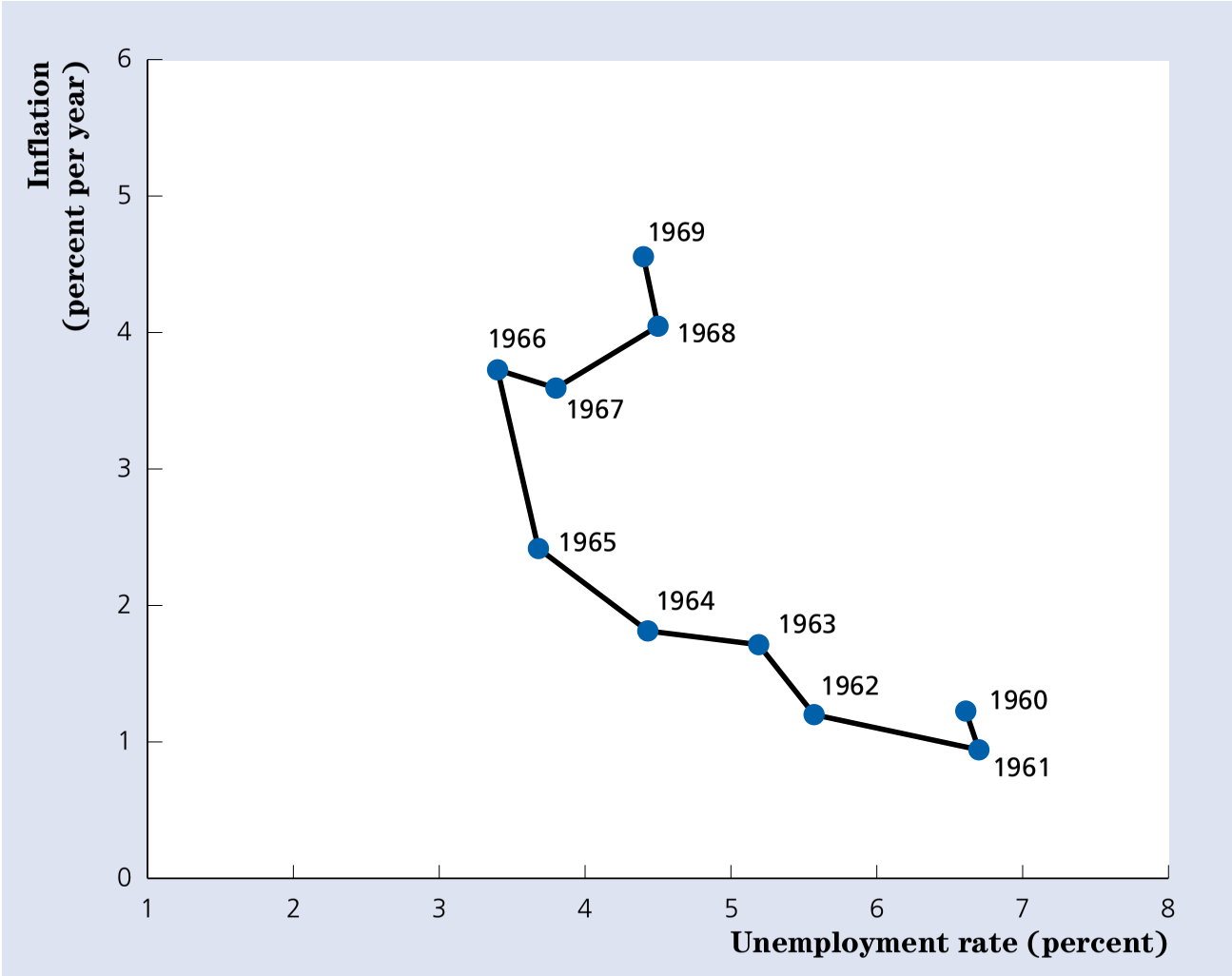


FIGURE 13.2

INFLATION AND UNEMPLOYMENT IN CANADA, 1970–2001

The figure shows the combinations of inflation and unemployment experienced in Canada each year from 1970 to 2001. Unlike the situation during the 1960s (see Figure 13.1), after 1970, a clear negative relationship between inflation and unemployment did not seem to exist.

Source: CPI inflation rate: *Canadian Economic Observer, Historical Statistical Supplement*, Table 12; unemployment rate: Table 8.

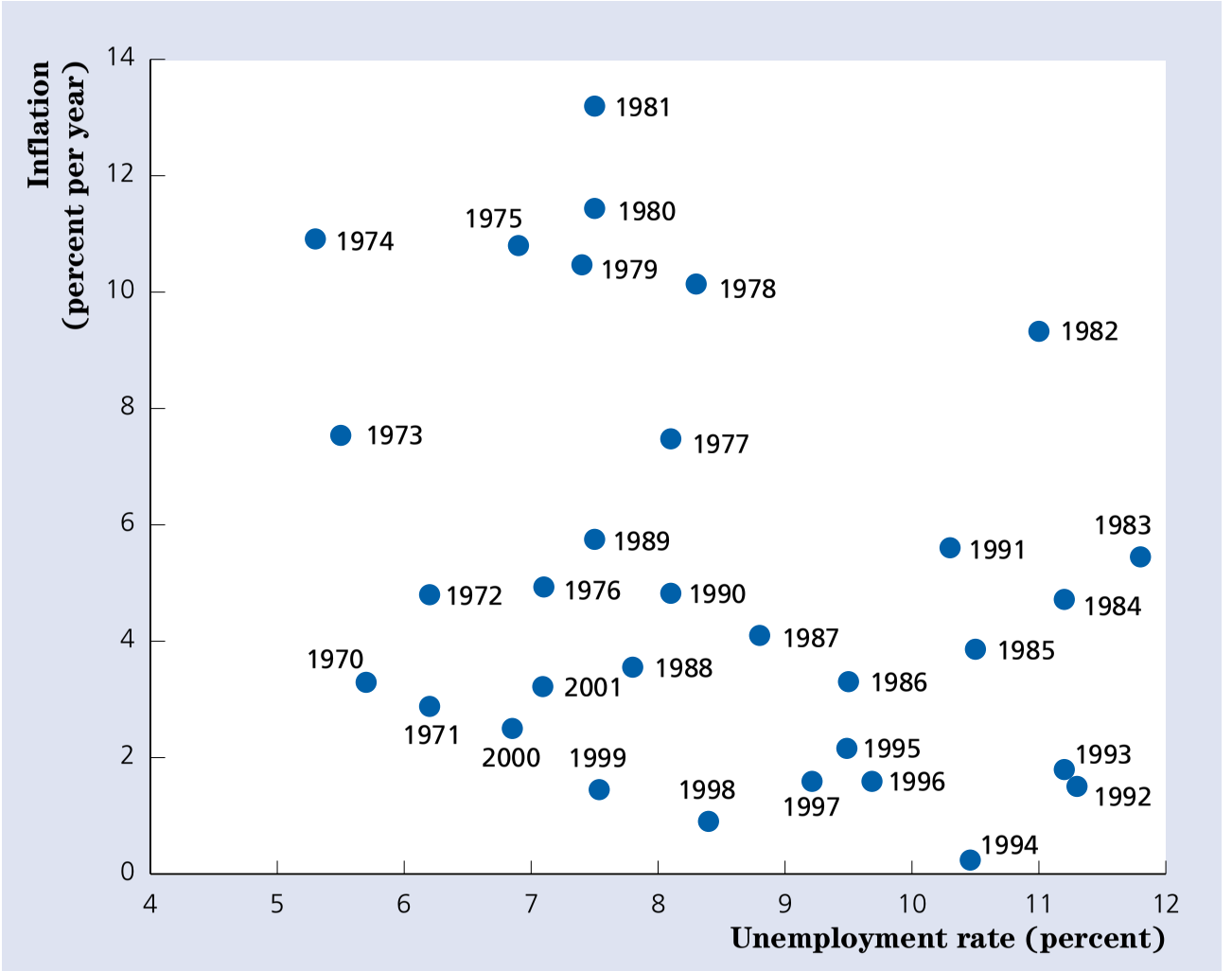


FIGURE 13.3

ONGOING INFLATION IN THE EXTENDED CLASSICAL MODEL

If the money supply grows by 10% every year, the *AD* curve shifts up by 10% every year, from AD^1 in year 1 to AD^2 in year 2, and so on. If the money supply has been growing by 10% per year for some time and the rate of inflation has been 10% for some time, the expected rate of inflation is also 10%. Thus, the expected price level also grows by 10% each year, from 100 in year 1 to 110 in year 2, and so on. The 10% annual increase in the expected price level shifts the *SRAS* curve up by 10% each year, for example, from $SRAS^1$ in year 1 to $SRAS^2$ in year 2. The economy remains in full-employment equilibrium at the intersection of the *AD* curve and the *SRAS* curve in each year (point *E* in year 1 and point *F* in year 2), with output at $\bar{Y}$, unemployment at the natural rate of unemployment $\bar{u}$, and inflation and expected inflation both at 10% per year.

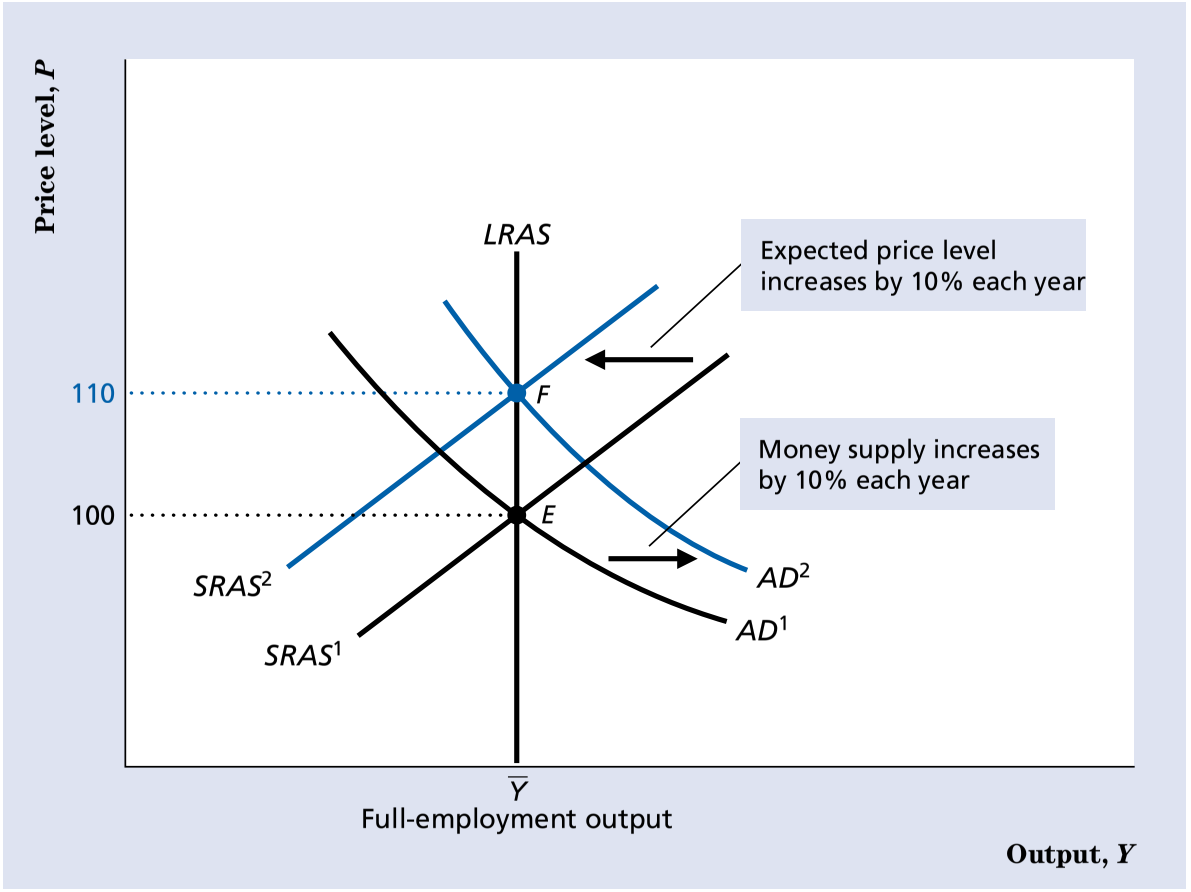


FIGURE 13.4

UNANTICIPATED INFLATION IN THE EXTENDED CLASSICAL MODEL

If the money supply has been growing by 10% per year for a long time and is expected to continue growing by 10%, the expected price level increases by 10% each year. The 10% increase in the expected price level shifts the *SRAS* curve up from $SRAS^1$ in year 1 to $SRAS^2$ in year 2. Then, if the money supply actually increases by 15% in year 2, rather than by the expected 10%, the *AD* curve is $AD^{2,\ new}$, rather than $AD^{2,\ old}$. As a result of higher-than-expected money growth, output increases above $\bar{Y}$ in year 2, and the price level increases to 113, at point *G*. Because the price level rises by 13%, rather than the expected 10%, unanticipated inflation is 3% in year 2. This unanticipated inflation is associated with output higher than $\bar{Y}$ and unemployment below the natural rate $\bar{u}$ (negative cyclical unemployment).

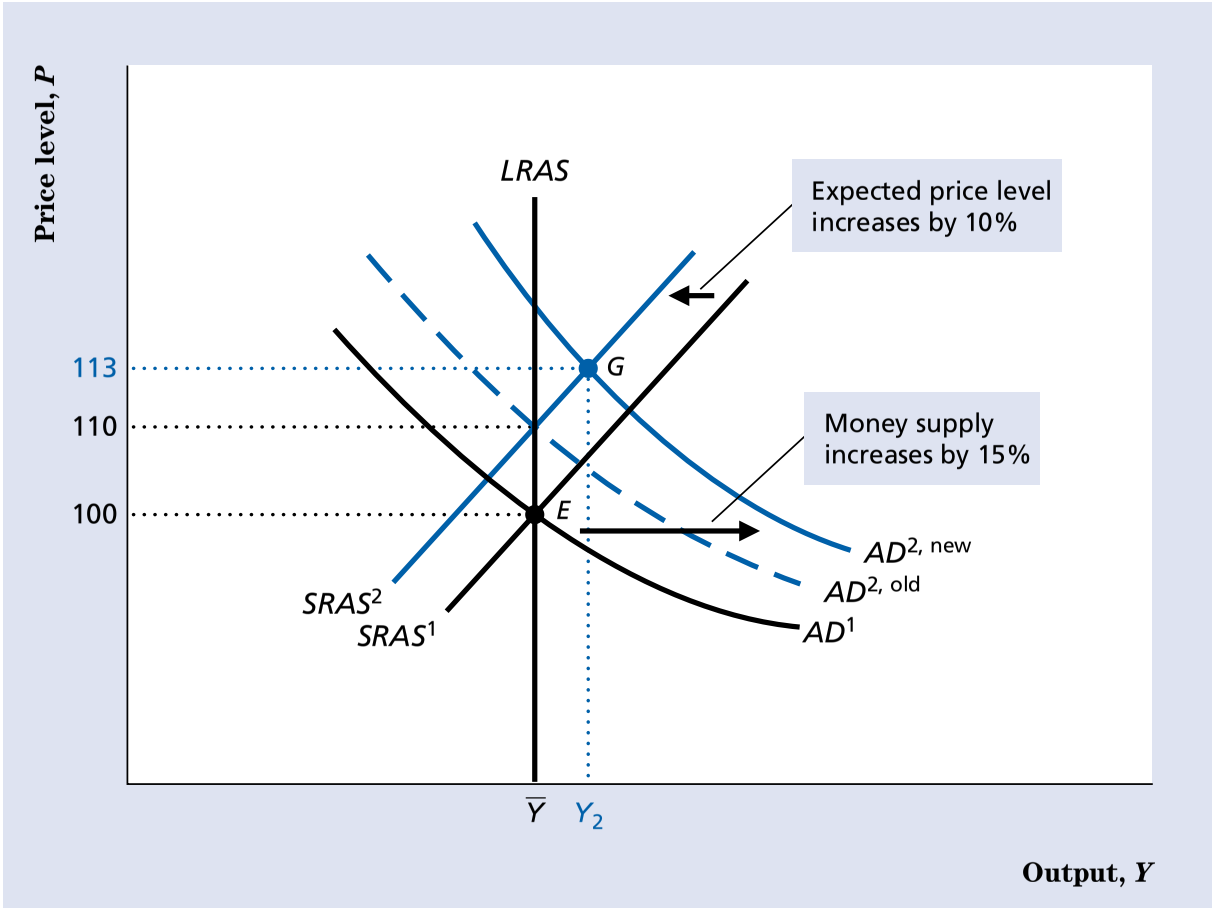


FIGURE 13.5

THE SHIFTING PHILLIPS CURVE: AN INCREASE IN EXPECTED INFLATION

The Friedman–Phelps theory implies that there is a different Phillips curve for every expected inflation rate. For example, PC^1 is the Phillips curve when the expected rate of inflation is 3%. To verify this claim, note from Eq. (13.1) that when the actual unemployment rate equals the natural rate $\bar{u}$ (6% here), the actual inflation rate equals the expected inflation rate. At point *A*, the unemployment rate equals the natural rate and the inflation rate equals 3% on PC^1, so the expected inflation rate is 3% on PC^1. Similarly, at point *B* on PC^2, where the unemployment rate equals its natural rate, the inflation rate is 12%, so the expected inflation rate is 12% along PC^2. Thus, an increase in the expected inflation rate from 3% to 12% shifts the Phillips curve up and to the right, from PC^1 to PC^2.

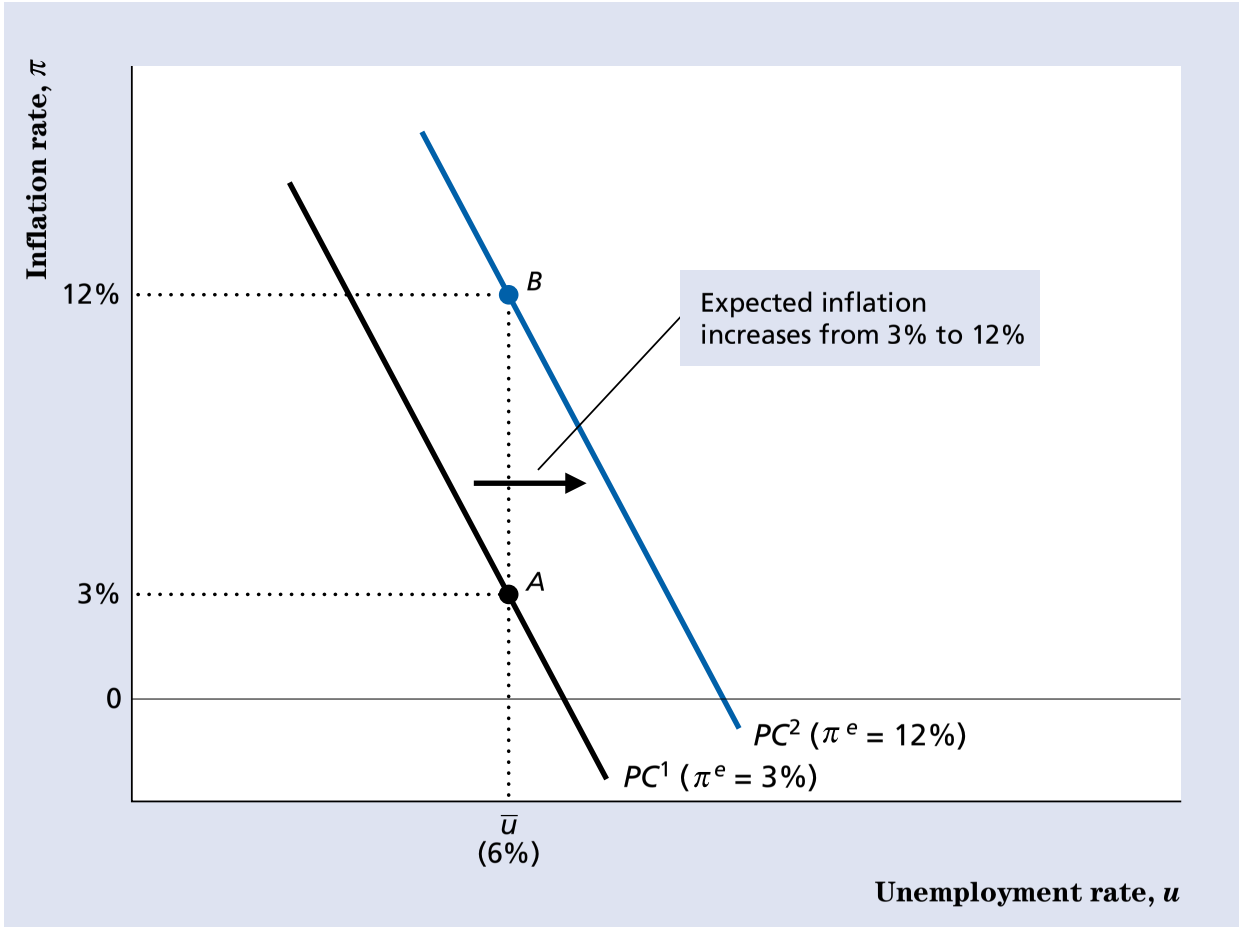


FIGURE 13.6

THE SHIFTING PHILLIPS CURVE: AN INCREASE IN THE NATURAL UNEMPLOYMENT RATE

According to the Friedman–Phelps theory, an increase in the natural unemployment rate shifts the Phillips curve up and to the right. At point *A* on PC^1, the actual inflation rate and the expected inflation rate are equal at 3%, so the natural unemployment rate equals the actual unemployment rate at *A*, or 6%. Thus, PC^1 is the Phillips curve when the natural unemployment rate is 6% and the expected inflation rate is 3%, as in Figure 13.5. If the natural unemployment rate increases to 7%, with expected inflation unchanged, the Phillips curve shifts to PC^3. At point *C* on PC^3, both expected and actual inflation equal 3%, so the natural unemployment rate equals the actual unemployment rate at *C*, or 7%.

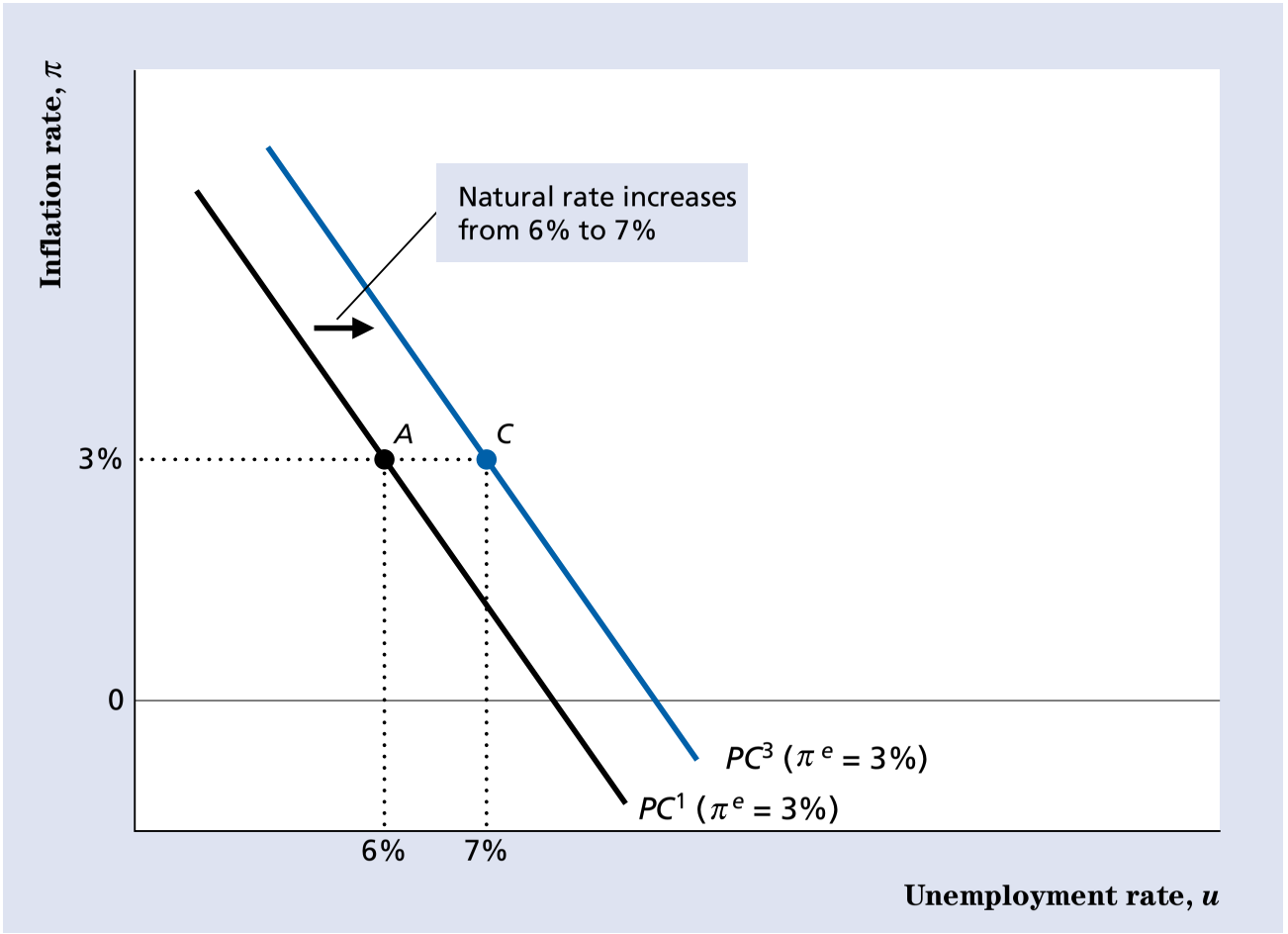


FIGURE 13.7

THE EXPECTATIONS-AUGMENTED PHILLIPS CURVE IN CANADA, 1963–2001

The expectations-augmented Phillips curve is a negative relationship between unanticipated inflation and cyclical unemployment. The figure shows this relationship for the years 1963 to 2001 in Canada. Unanticipated inflation equals actual inflation minus expected inflation, where expected inflation in any year is measured here as the average inflation rate for the preceding two years. Cyclical unemployment for each year is the actual unemployment rate minus an estimate of the natural unemployment rate for that year (see Figure 13.9). Note that years in which unanticipated inflation is high usually are years in which cyclical unemployment is low.

Source: Unemployment rate, 1963–1965: *Historical Statistics of Canada*, Series D233; 1966–2001: *Canadian Economic Observer, Historical Statistical Supplement*, Table 8; natural rate of unemployment: see Figure 13.9; CPI inflation rate: *Canadian Economic Observer, Historical Statistical Supplement*, Table 12.

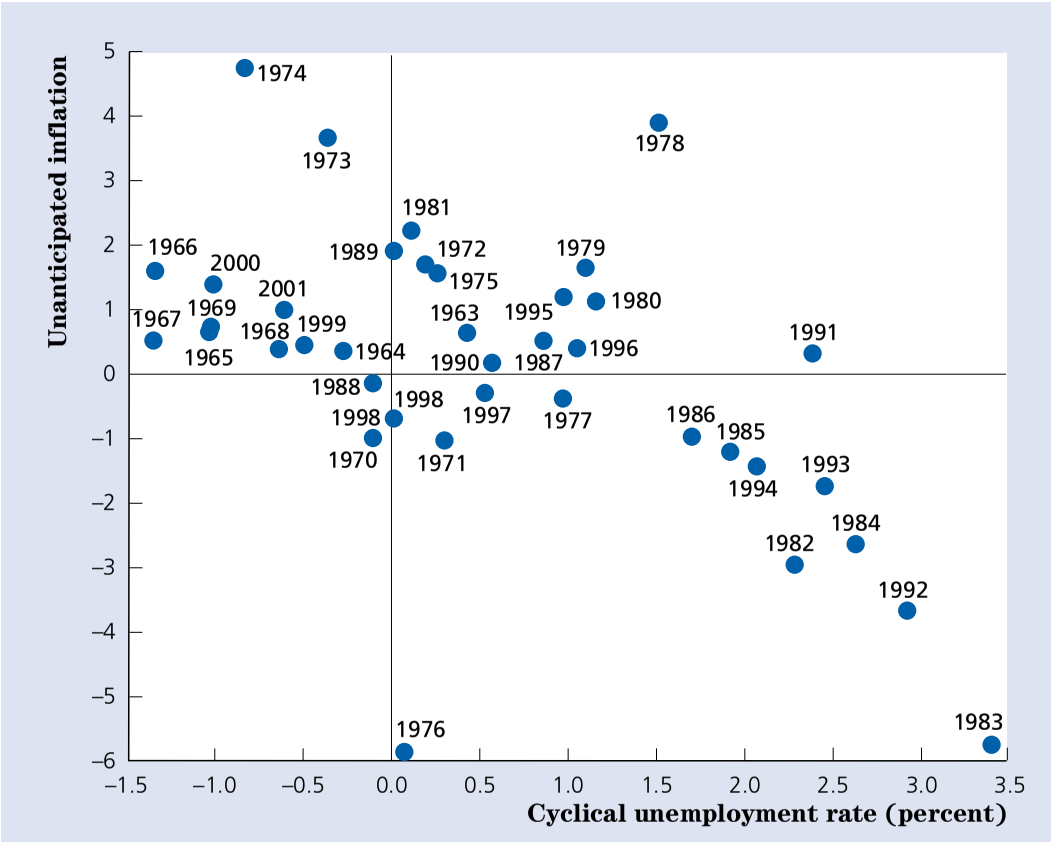


FIGURE 13.8

THE LONG-RUN PHILLIPS CURVE

Because people will not permanently overestimate or underestimate the rate of inflation, in the long run, the expected and actual inflation rates are equal and the actual unemployment rate equals the natural unemployment rate. Because in the long run, actual unemployment equals the natural rate regardless of the inflation rate, the long-run Phillips curve is vertical.

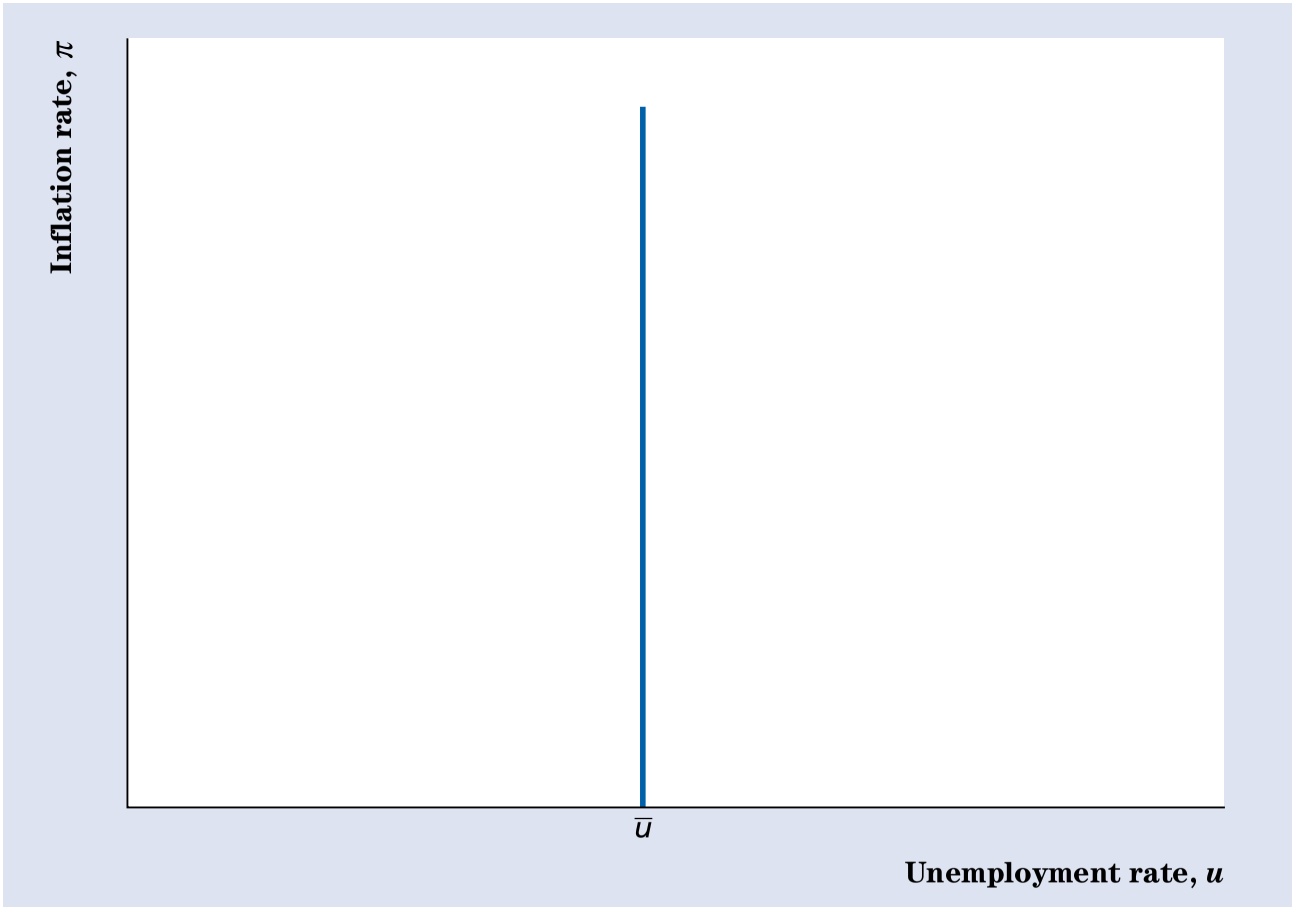


FIGURE 13.9

ACTUAL AND NATURAL UNEMPLOYMENT RATES IN CANADA

The figure shows the actual unemployment rate and an estimate of the natural rate of unemployment in Canada for the period 1963–2001. The difference between the actual and natural unemployment rates is the cyclical unemployment rate. Note that the natural rate of unemployment rose from the 1960s to the 1980s but has been more stable since.

Source: Unemployment rate, 1963–1965: *Historical Statistics of Canada*, Series D233; 1966–1997: *Canadian Economic Observer, Historical Statistical Supplement*, Table 8; natural rate of unemployment, 1963–1986: based on Andrew Burns, "The Natural Rate of Unemployment: Canada and the Provinces," Chapter 3 in Surendra Gera, ed., *Canadian Unemployment*, Ottawa: Economic Council of Canada, 1991; 1986– 2001: estimated by the authors as a weighted average of the actual unemployment rate and the previous natural rate.

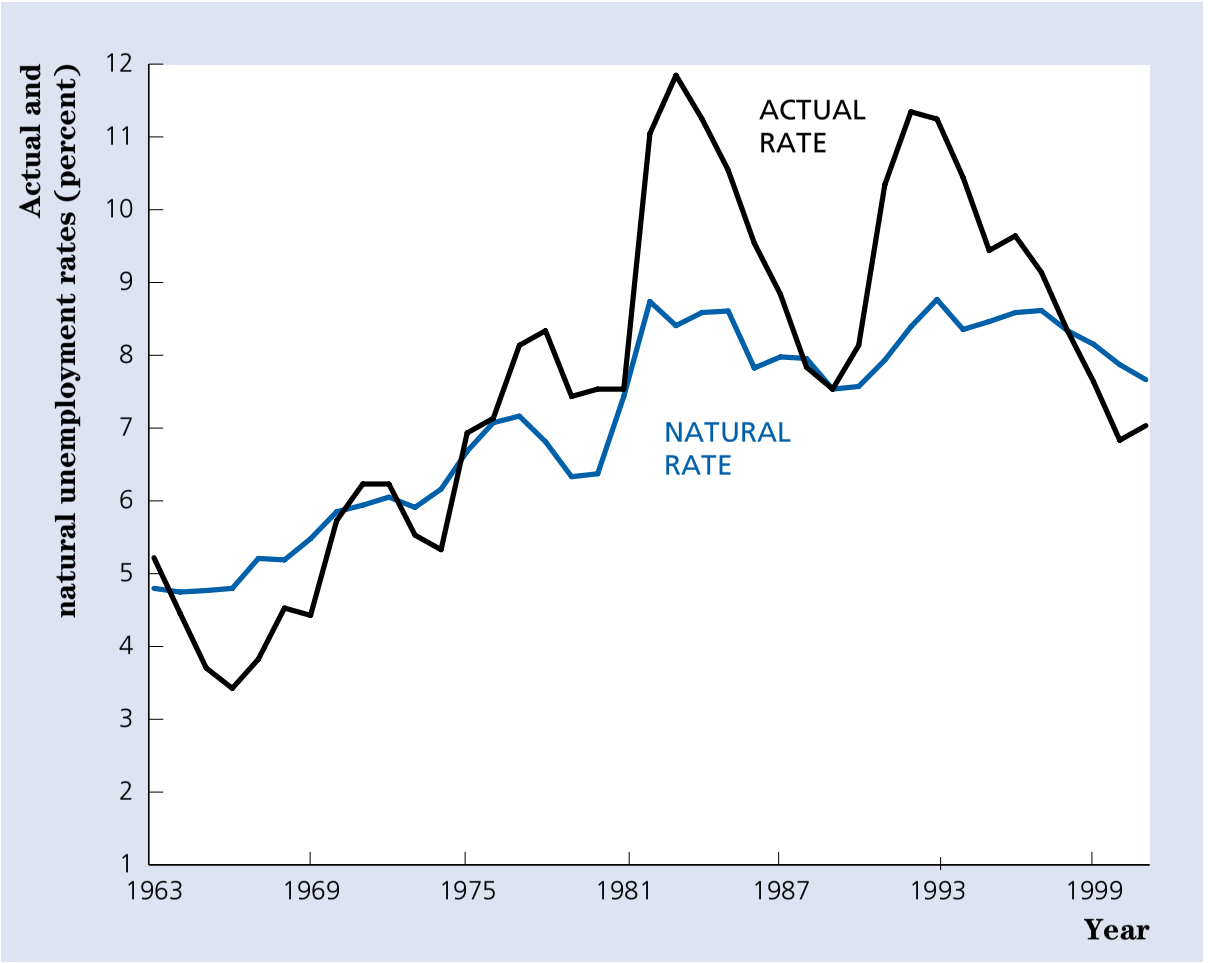


FIGURE 13.10

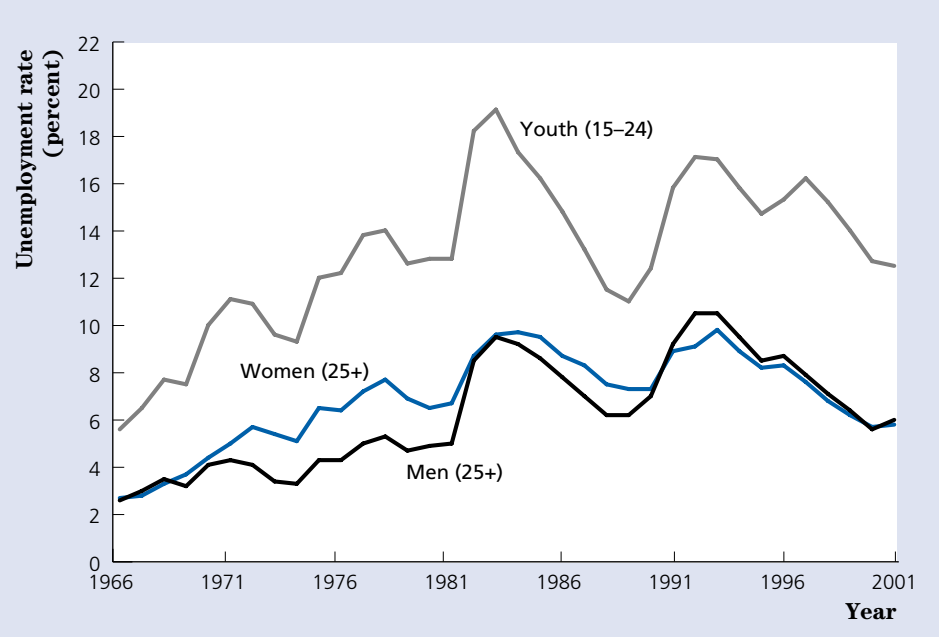
UNEMPLOYMENT RATES BY DEMOGRAPHIC GROUP AND REGION

(a) The figure shows Canadian unemployment rates since 1966 for men over age 25 years, women over age 25 years, and youth (ages 15 to 24 years) of both genders. Young workers have much higher unemployment rates than older workers, and for much of the period (though not recently) women have had higher unemployment rates than men.

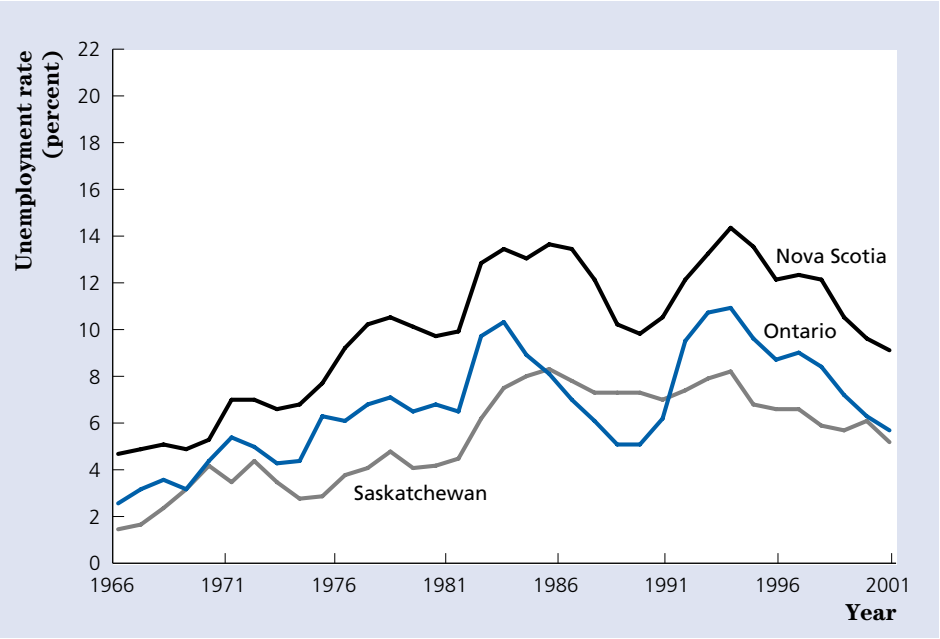
Source: Statistics Canada, CANSIM Series D984970, D984986, D984955.

(b) The figure shows unemployment rates for selected provinces from 1966 to 2000. The average value of the unemployment rate differs systematically across provinces. Although the changes in the provincial unemployment rates from year to year have a common pattern, there also are movements specific to each province. For example, during the 1990–1992 recession, unemployment rates rose much more in Nova Scotia and Ontario than in Saskatchewan.

Source: *Canadian Economic Observer, Historical Statistical Supplement,* Table 42.



(a) Unemployment by age and sex



(b) Unemployment by province

FIGURE 13.11

UNEMPLOYMENT RATES IN THE UNITED STATES AND FRANCE

The figure shows unemployment rates in the United States and France, graphed alongside the Canadian unemployment rate, for 1966–2000. While the US and Canadian unemployment rates declined after the 1981–1982 and 1990–1992 recessions, the unemployment rate in France (and is some other western European countries) rose from less than 3% in the early 1970s to more than 12% in the mid-1990s. The persistence of high unemployment suggests that the natural unemployment rate also increased. The increase in the natural rate, in response to an increase in actual unemployment, is an example of hysteresis.

Source: Canadian unemployment rate: *Canadian Economic Observer, Historical Statistical Supplement*, Table 8; European and US unemployment rates: *OECD Historical Statistics*, Table 2.15, various issues; updates from *IMF World Economic Outlook*.

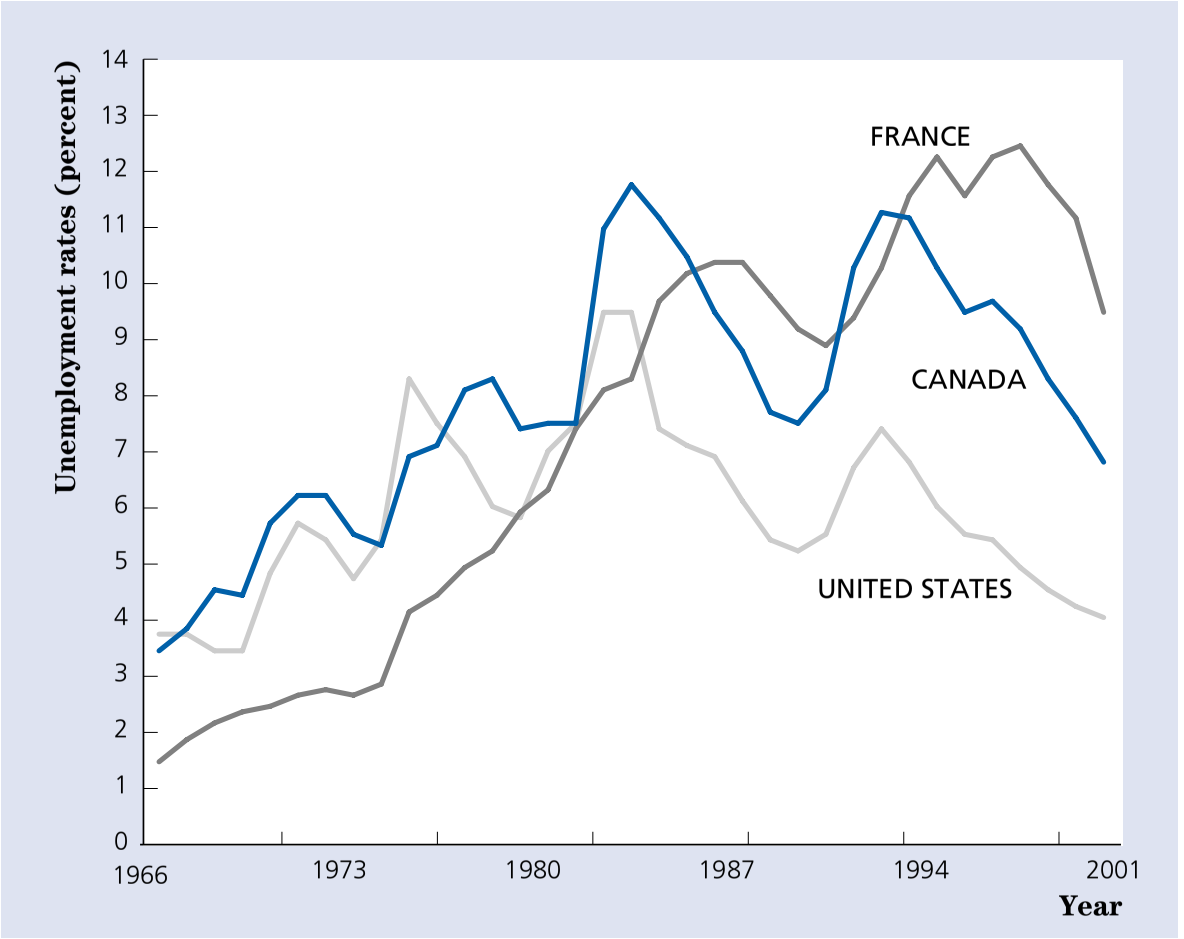


FIGURE 14.1

THE OVERNIGHT RATE AND THE BANK OF CANADA OPERATING BAND, 2001

The heavy lines show the lower and upper edges of the Bank of Canada's operating band for the overnight interest rate. The light line shows the actual overnight rate. The data are daily, so weekends and holidays appear as gaps. The overnight rate deviates very little from the target overnight rate (not shown) which is the centre of the operating band. Note that the Bank of Canada lowered the band on each of the eight, preset dates during 2001 on which policy announcements were made.

Source: *Bank of Canada Banking and Financial Statistics*, Table F1. Reprinted with the permission of the Bank of Canada.

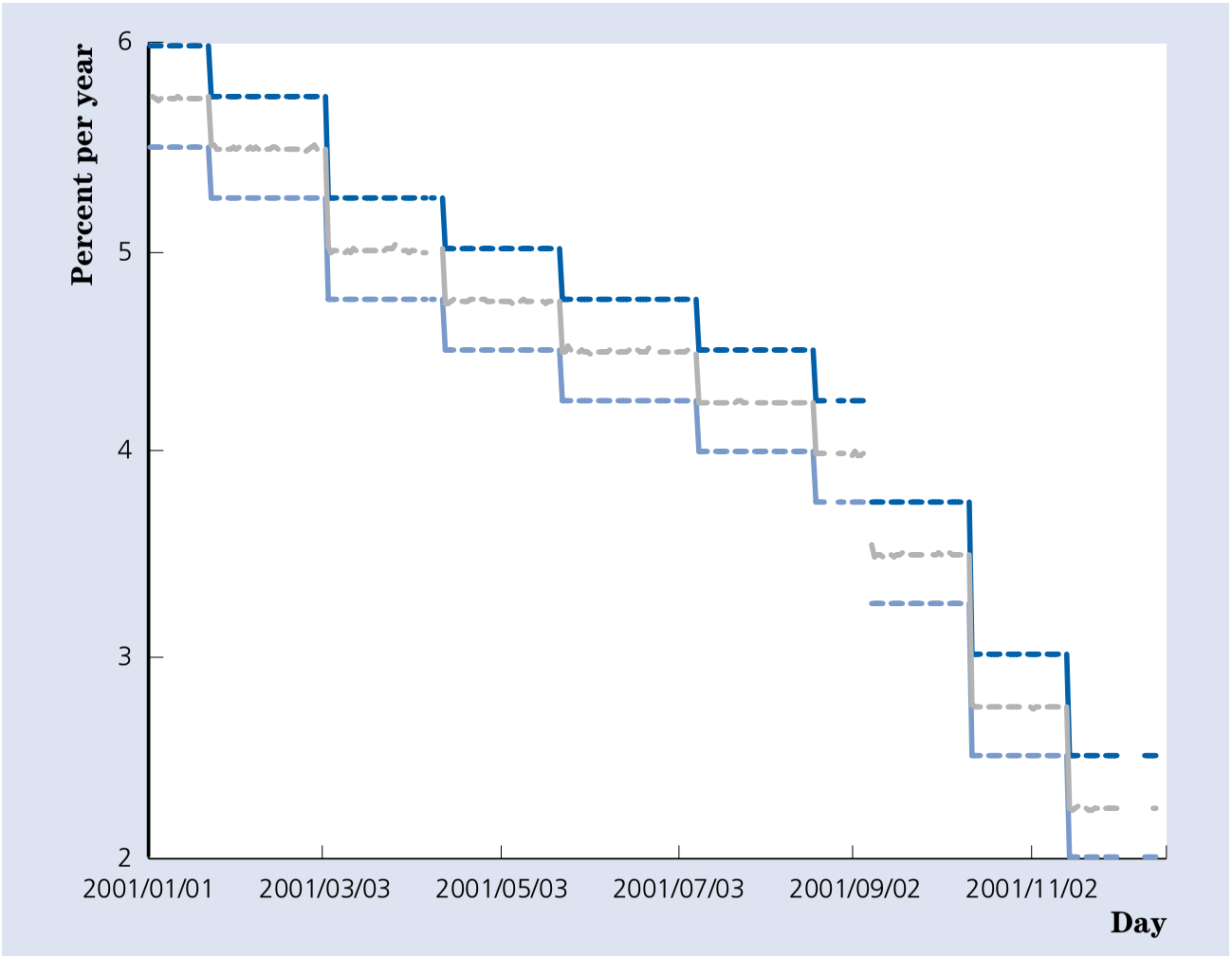


FIGURE 14.2

SHORT-TERM INTEREST RATES, 1994–2001

The figure shows monthly averages of the target overnight interest rate, the prime rate, and the interest rate on one-year mortgages during the period 1994–2001. Changes in the target overnight rate lead to similar changes in the interest rates administered by banks on loans and mortgages. This is a key way in which monetary policy influences the economy.

Source: *Bank of Canada Banking and Financial Statistics,* Table F1. Reprinted with permission from the Bank of Canada.

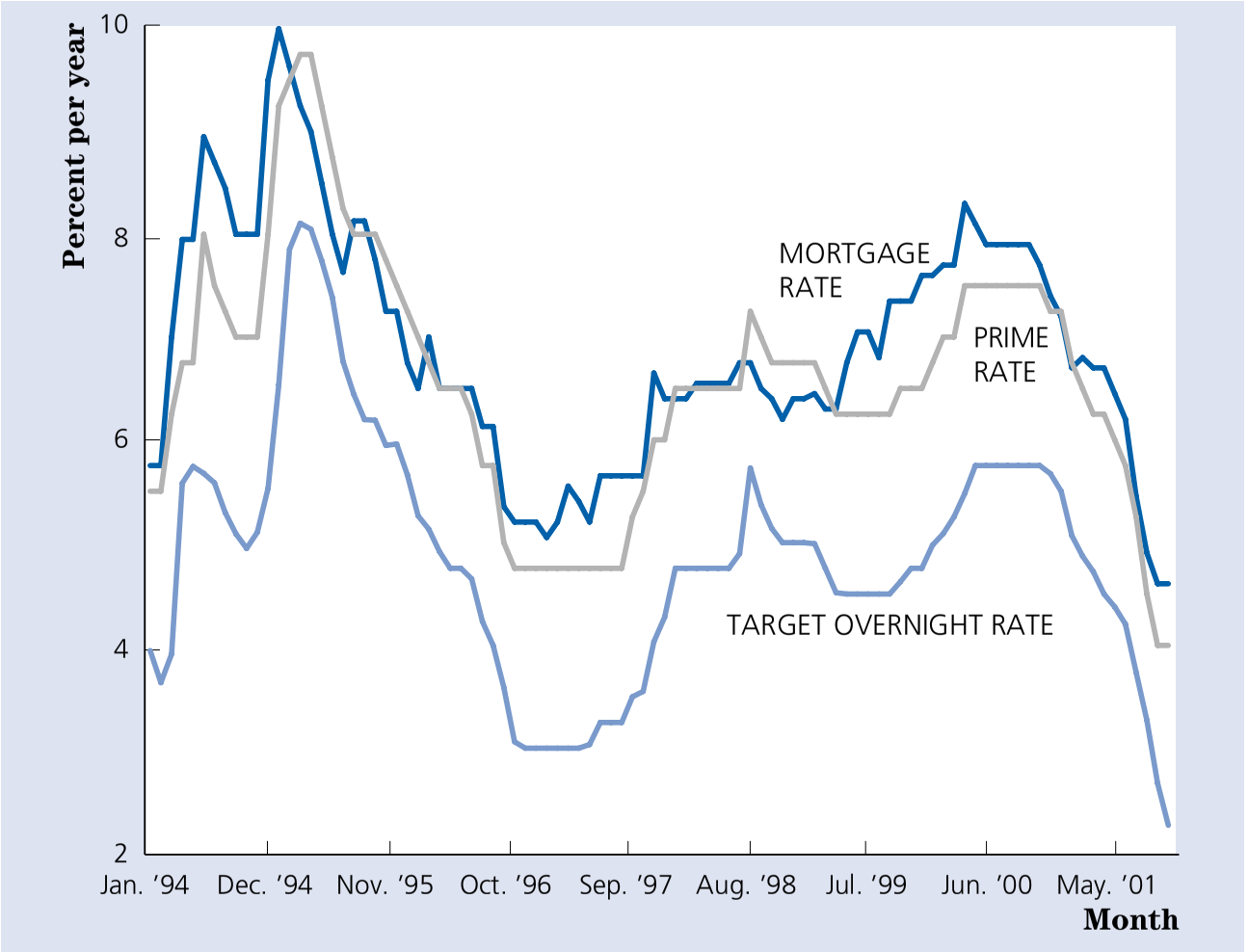


FIGURE 14.3

INTEREST RATE TARGETING

The figure shows an economy that is buffeted by nominal shocks. Changes in money demand cause the *LM* curve to shift between LM^2 and LM^3 and aggregate demand to move erratically between Y_2 and Y_3. A Bank policy of keeping the real interest rate at r_1, by making open-market purchases whenever the interest rate exceeds r_1 and by making open-market sales whenever the interest rate falls below r_1, will keep the economy at full employment at *E*.

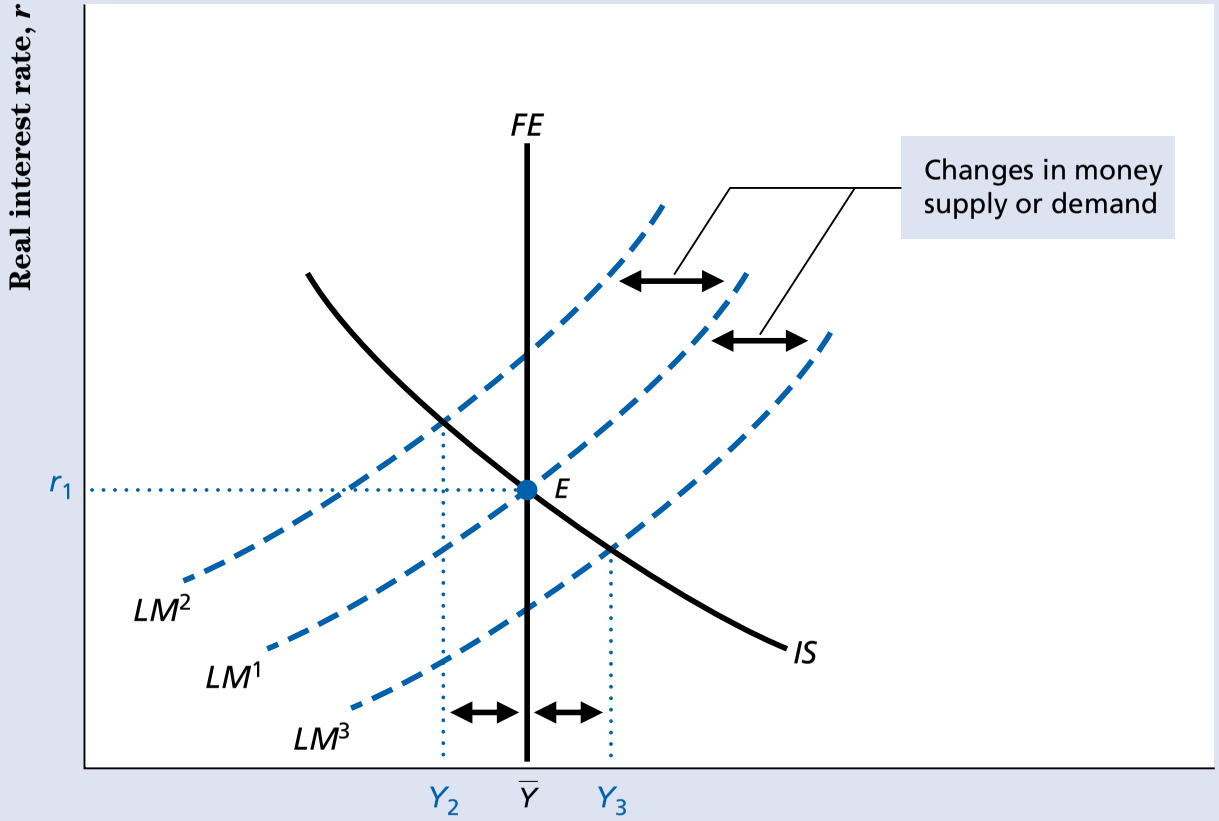


FIGURE 14.4

THE GAME BETWEEN DAD AND THE KIDS

Each square represents a combination of an action by the kids and an action by Dad. The points assigned to each combination of actions (shown in each square) measure how much each set of players likes each outcome. The kids "move" first by picking a column; then Dad "moves" by picking a row. The equilibrium is outcome A, in which the kids fight and still get to go to the game.

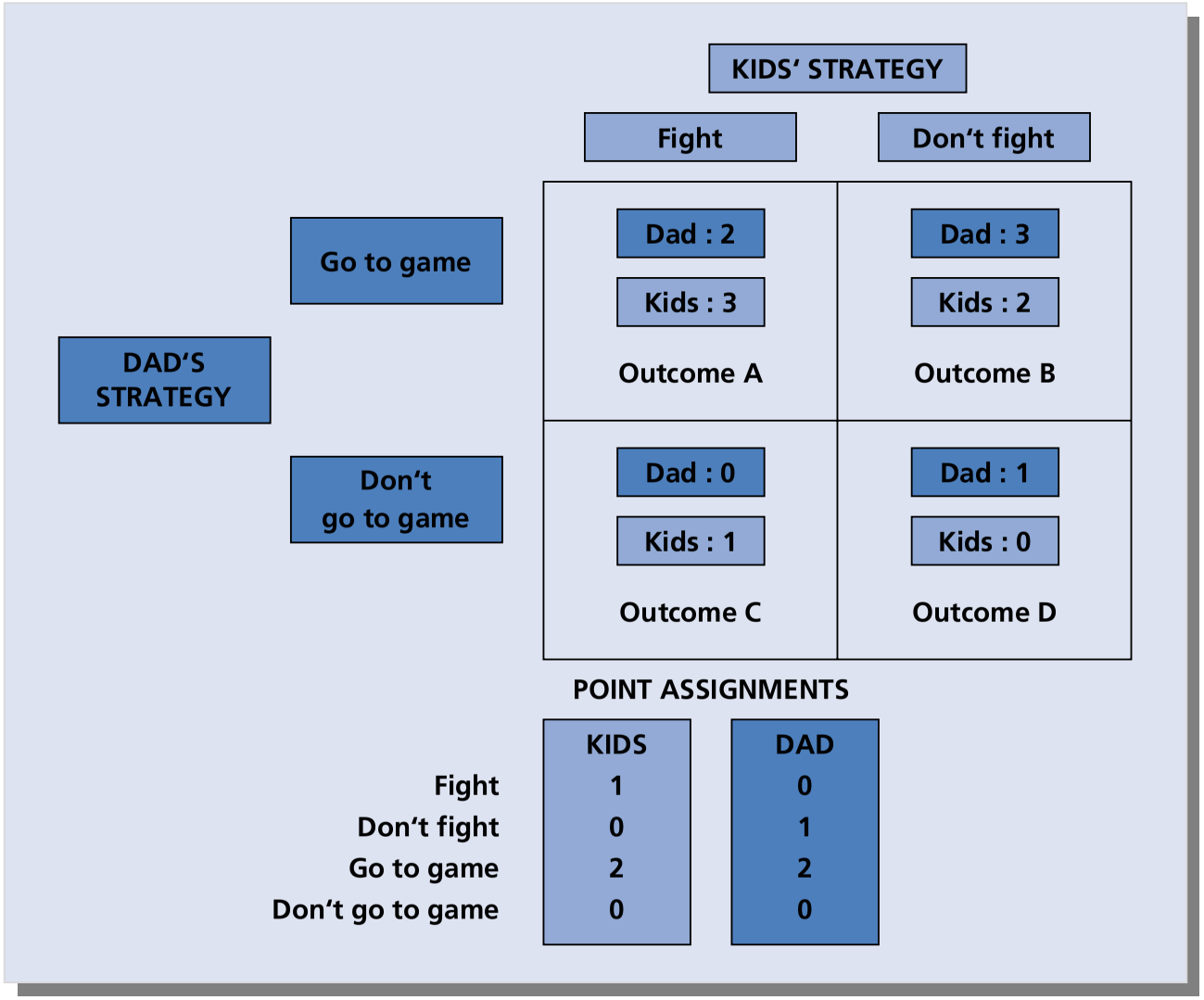


FIGURE 14.5

THE GAME BETWEEN THE BANK AND THE FIRMS

(a) This part of the figure shows the possible outcomes of the game between the Bank and the firms. Initially, the economy is at point *E* (full employment) with 10% inflation. The real money supply *M/P* depends both on the price level *P* chosen by firms and the money supply *M* chosen by the Bank. If the real money supply does not change, the economy remains at full employment at *E*. If the real money supply falls, the *LM* curve shifts from LM^1 to LM^2, and the economy goes into a recession with 9% unemployment at point *F*. If the real money supply increases, the *LM* curve shifts from LM^1 to LM^3, and the economy goes into a boom with 3% unemployment at point *H*.

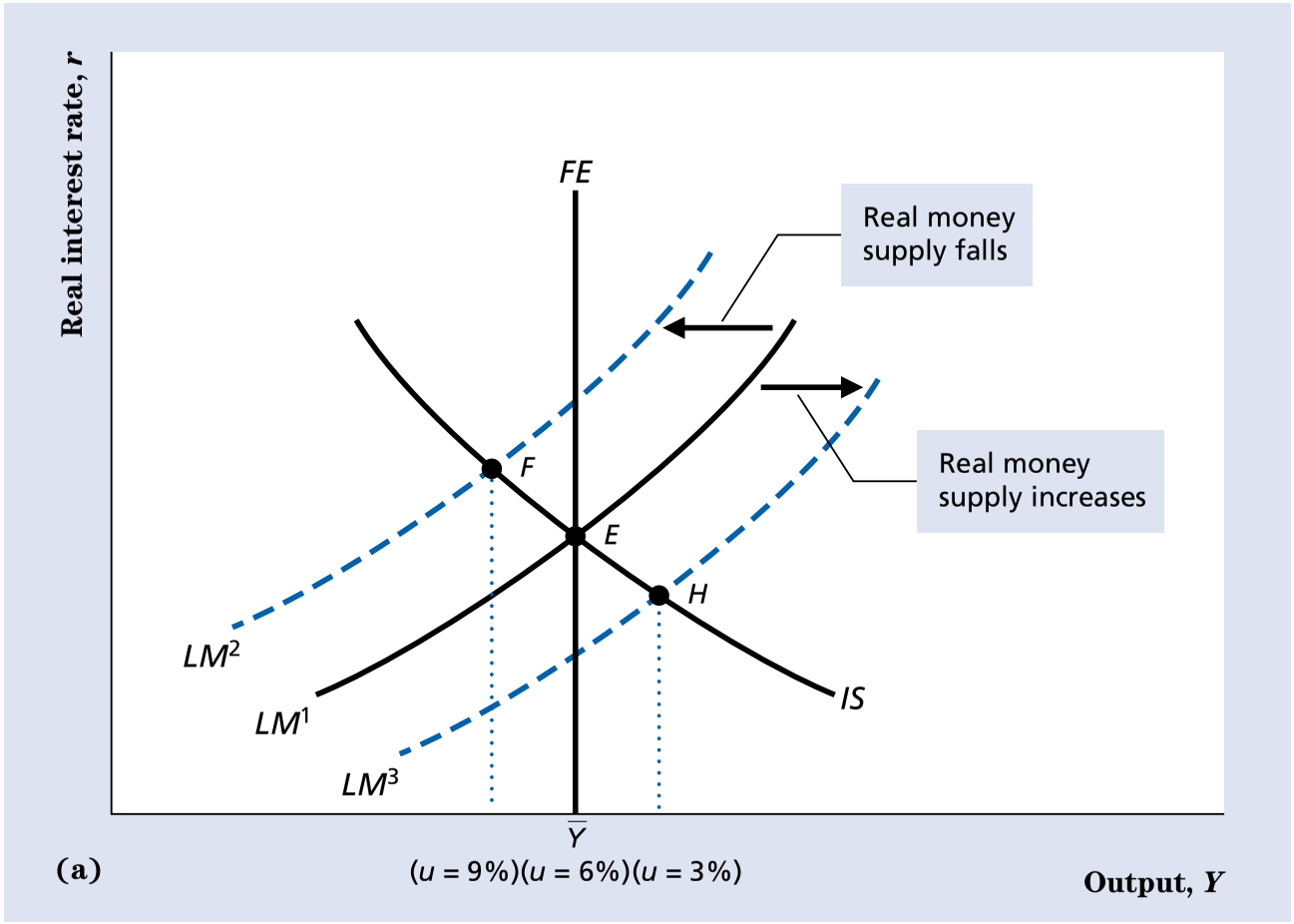


FIGURE 15.1

GOVERNMENT EXPENDITURE: FEDERAL, PROVINCIAL, AND LOCAL, 1926–2000

The figure shows the behaviour since 1926 of the three major components of government expenditure, as well as total current expenditure, for all levels of government combined and measured as a percentage of GDP. Government purchases rose most sharply during World War II. Transfer payments have risen steadily as a share of GDP, particularly during recessions. Interest payments have risen more recently as a share of GDP.

Source: Government expenditure, all levels, in millions of dollars, by categories: *Canadian Economic Observer, Historical Statistical Supplement*, Table 3; GDP in millions of dollars: Table 1.

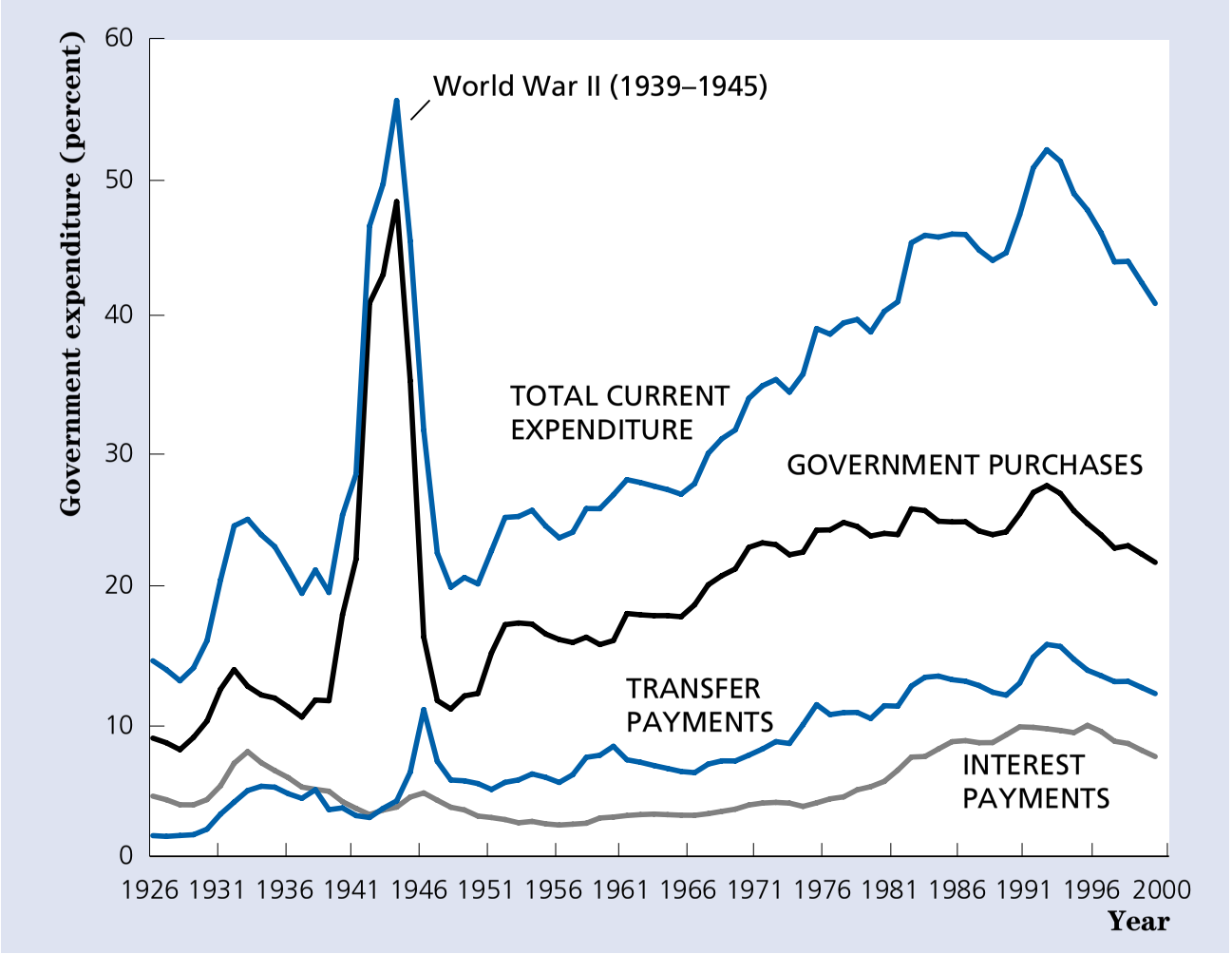


FIGURE 15.2

REVENUE: FEDERAL, PROVINCIAL, AND LOCAL, 1926–2000

The figure shows the history of revenues in several categories for all levels of government combined and measured as a percentage of GDP. Total revenue has risen over the past 75 years. Most of the increase is accounted for by increases in direct taxes.

Source: Government revenue, all levels, in millions of dollars, by categories: *Canadian Economic Observer, Historical Statistical Supplement*, Table 3; GDP in millions of dollars: Table 1.

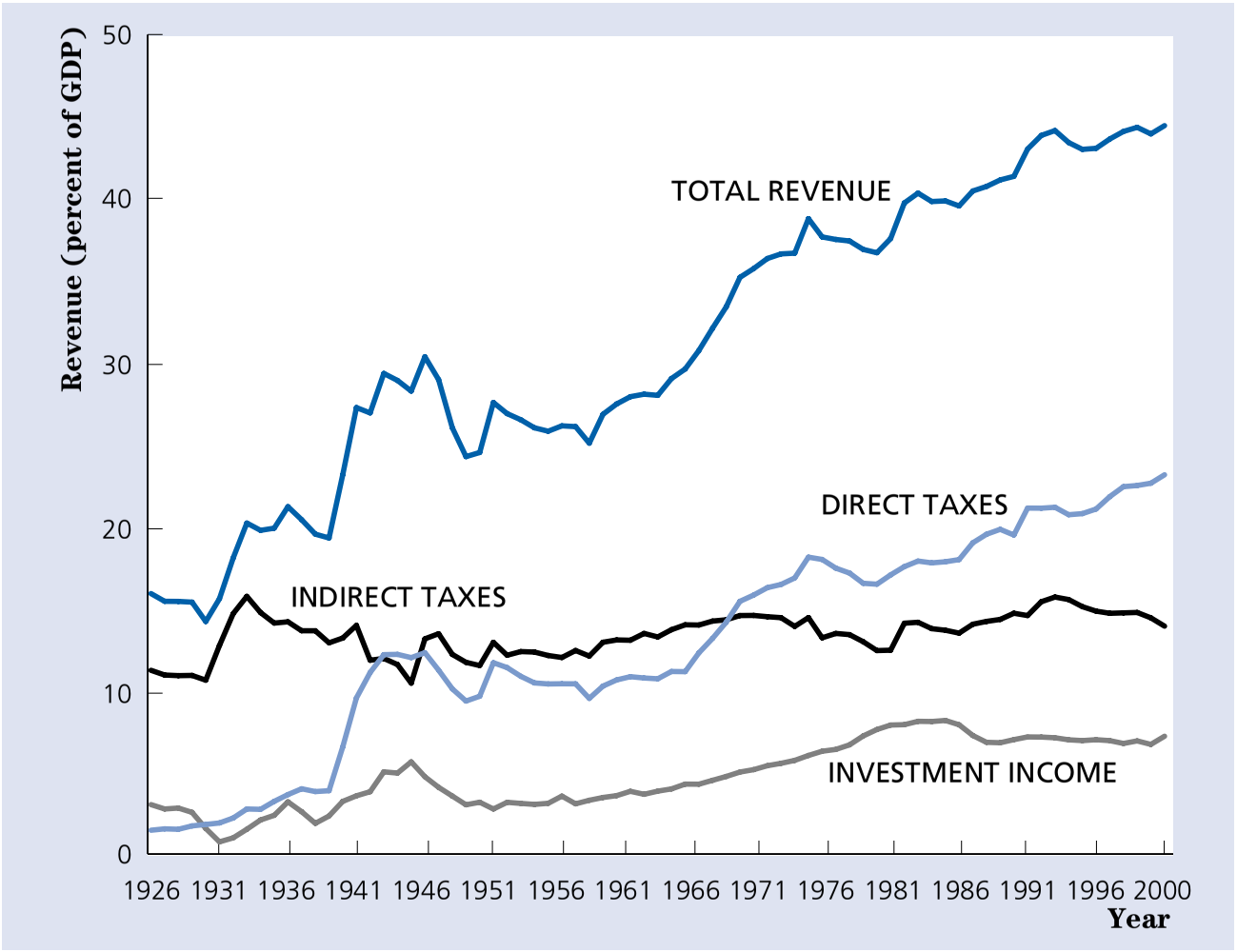


FIGURE 15.3

THE RELATIONSHIP BETWEEN THE TOTAL BUDGET SURPLUS AND THE PRIMARY BUDGET SURPLUS

The standard measure of the total government budget surplus is the amount by which revenue exceeds government expenditure. The primary surplus is the amount by which revenue exceeds government purchases plus transfers. The primary budget surplus equals the total budget surplus plus net interest payments.

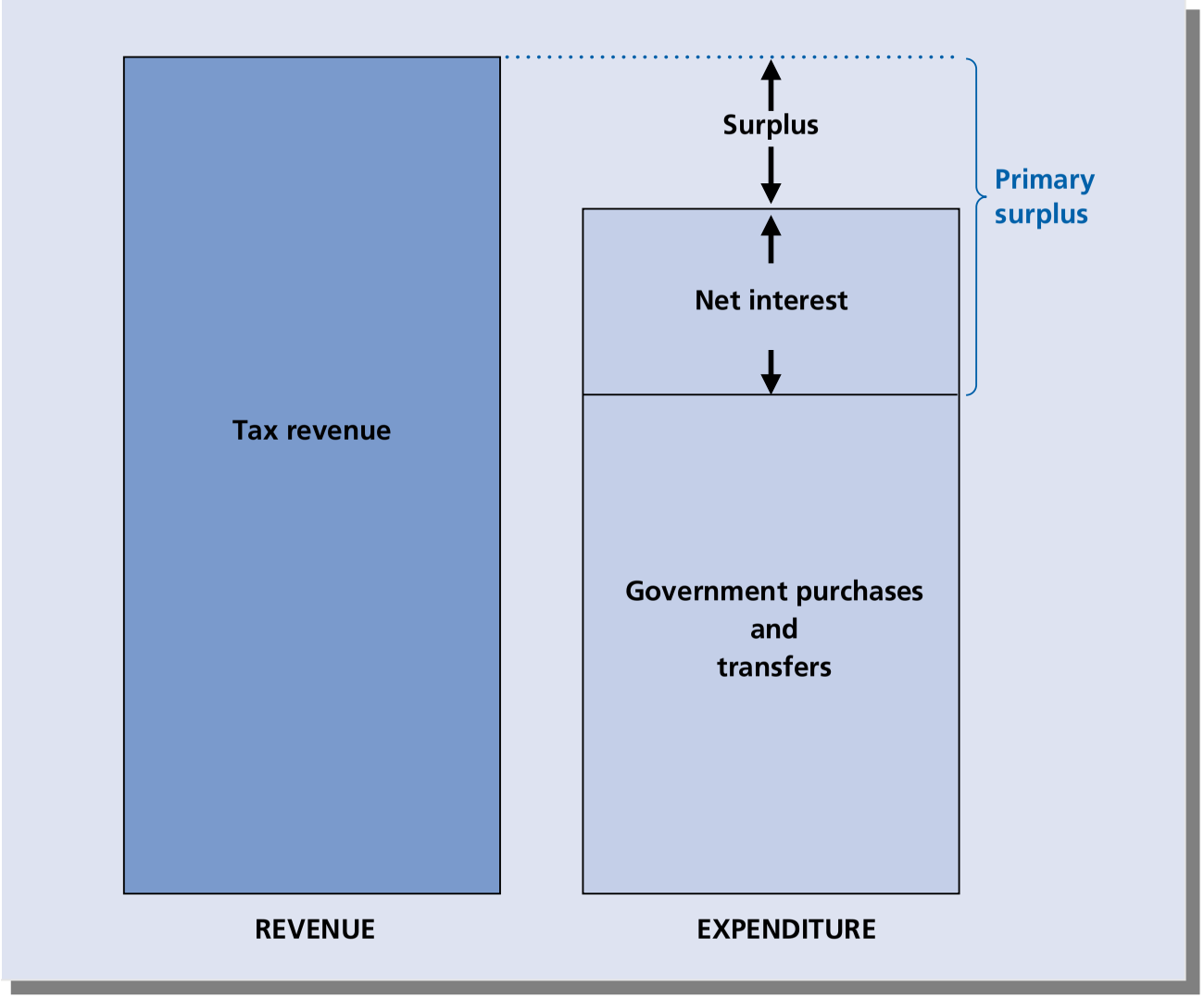


FIGURE 15.4

SURPLUS AND PRIMARY SURPLUS: FEDERAL, PROVINCIAL, AND LOCAL, 1926–2000

The figure shows the total government budget surplus and the primary surplus, both measured as a percentage of GDP, since 1926. The government ran large deficits during World War II. Deficits and primary deficits also were large during the early 1980s and early 1990s. Primary surpluses re-appeared in 1995, and total surpluses followed in 1997.

Source: Same as Figures 15.1 and 15.2.

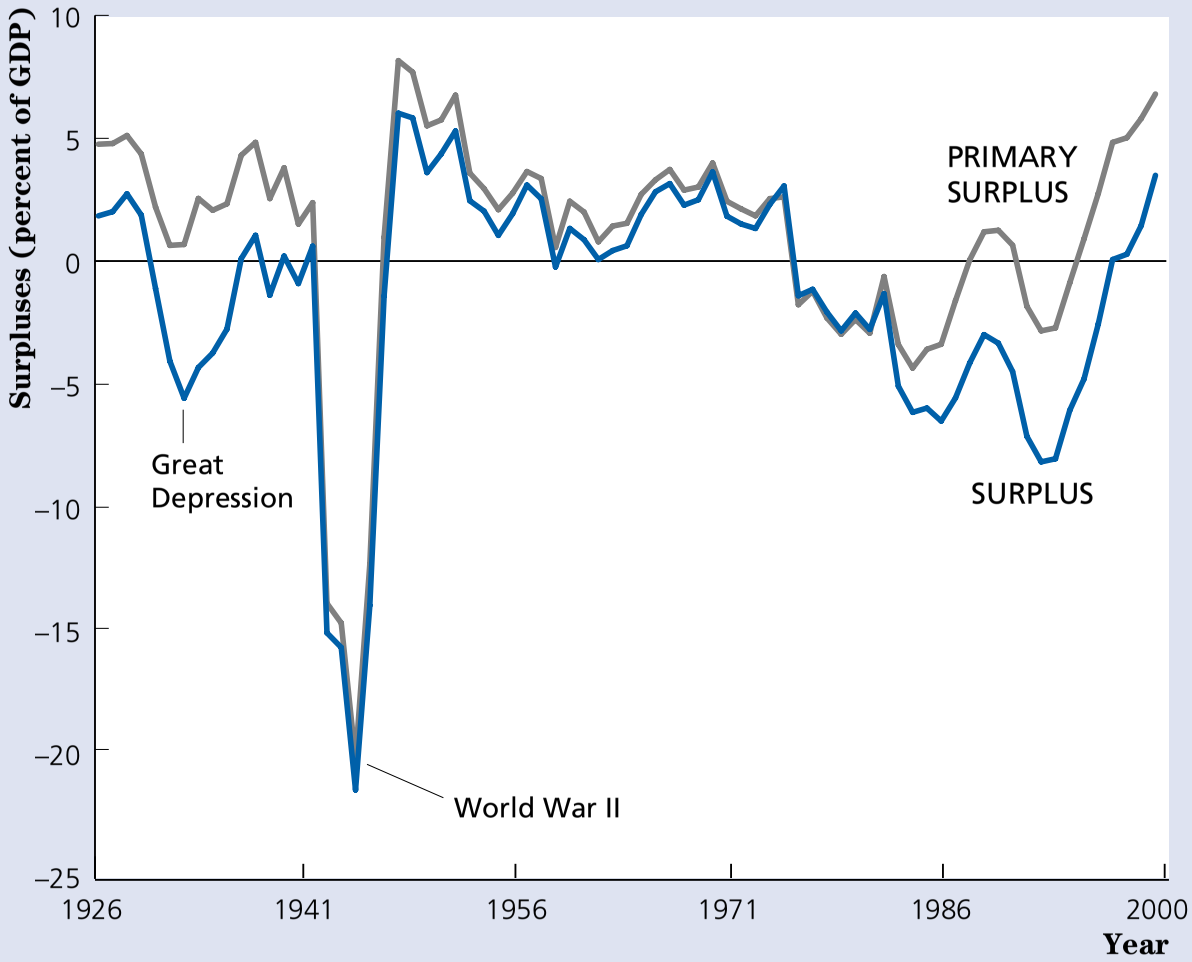


FIGURE 15.5

FULL-EMPLOYMENT AND ACTUAL BUDGET SURPLUSES, 1970–2000

The actual and full-employment budget surpluses for all levels of government are shown as a percentage of GDP. The actual budget surplus (the blue line) was less than the full-employment surplus (the black line) by substantial amounts during the 1981–1982 and 1990–1992 recessions, reflecting the importance of automatic stabilizers.

Source: Department of Finance, *Fiscal Reference Tables*, 2001, Table 46. Reproduced with the permission of the Minister of Public Works and Government Services Canada, 2002.

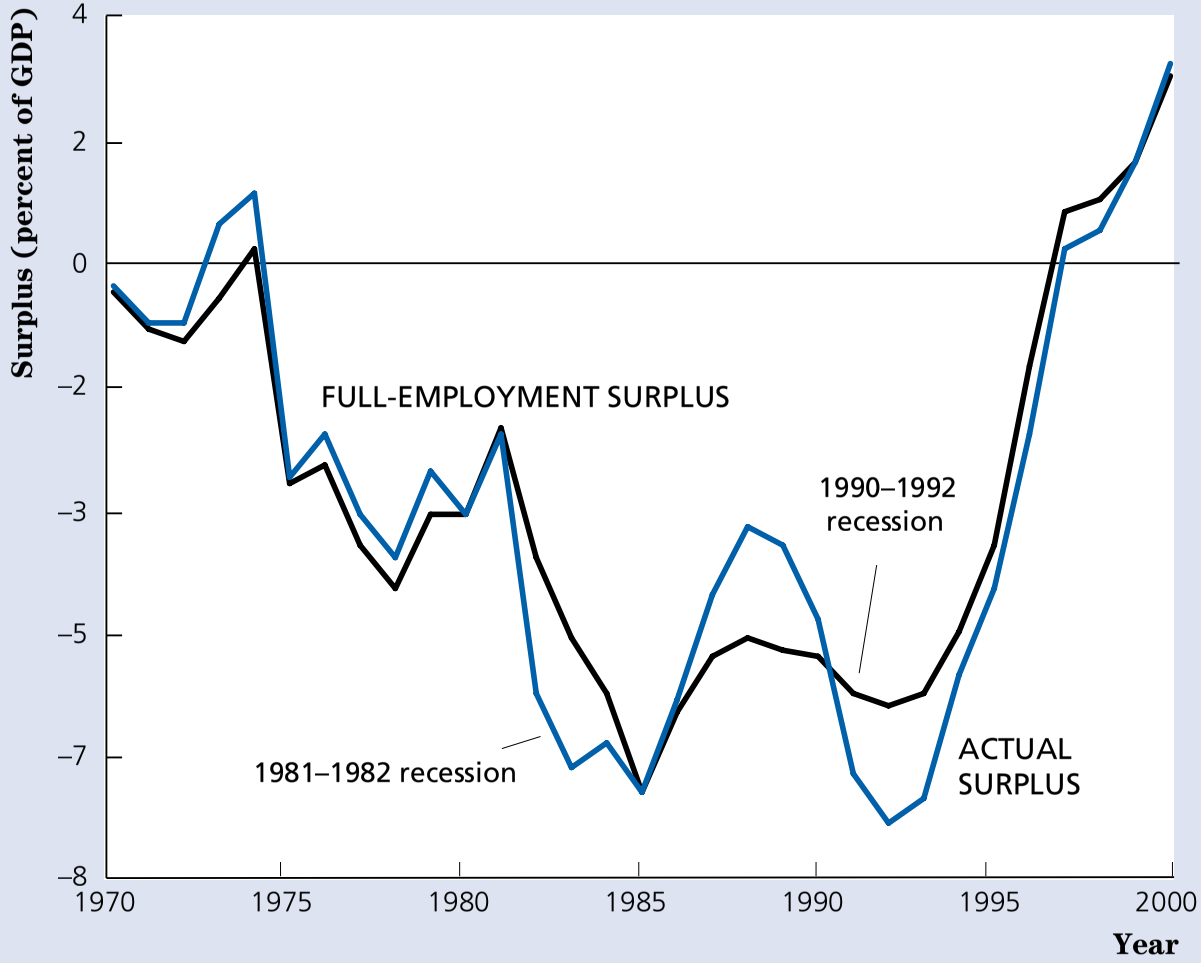


FIGURE 15.6

THE POVERTY TRAP

The figure shows the effective marginal tax rate for a one-earner couple with two children, in Ontario in 2000, graphed against family income. As earnings rise, eligibility for benefits declines so that marginal tax rates may be very high even at low levels of income. Labour supply is discouraged because only skilled workers can enter the labour force to the right of the highest marginal tax rates.

Source: Department of Finance. Reproduced with the permission of the Minister of Public Works and Government Services Canada, 2002.

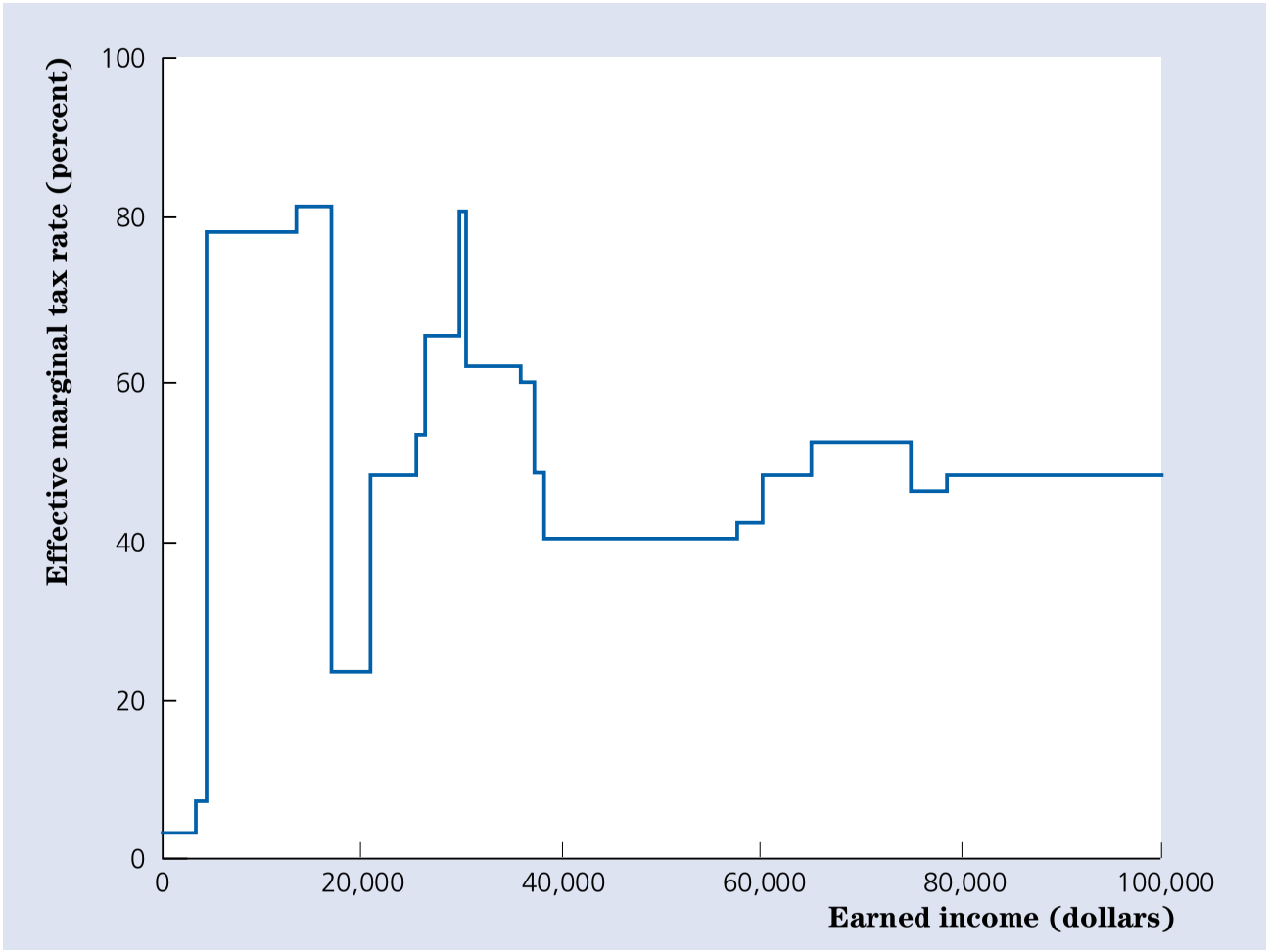


FIGURE 15.7

RATIOS OF FEDERAL AND PROVINCIAL DEBT TO GDP

The upper curve shows the ratio of federal government net debt to GDP, for the period 1926–2001. The lower curve shows the ratio of debt to GDP for provincial governments, for the period 1977–2000. The federal debt–GDP ratio was high during the Great Depression, rose dramatically during World War II, then rose again after 1976, peaking in 1996. The provincial ratio rose rapidly during the 1990–1992 recession.

Source: GDP: *Canadian Economic Observer, Historical Statistical Supplement*, Table 1 or CANSIM D14816; net federal debt: CANSIM D469420; net provincial debt: CANSIM D465851.

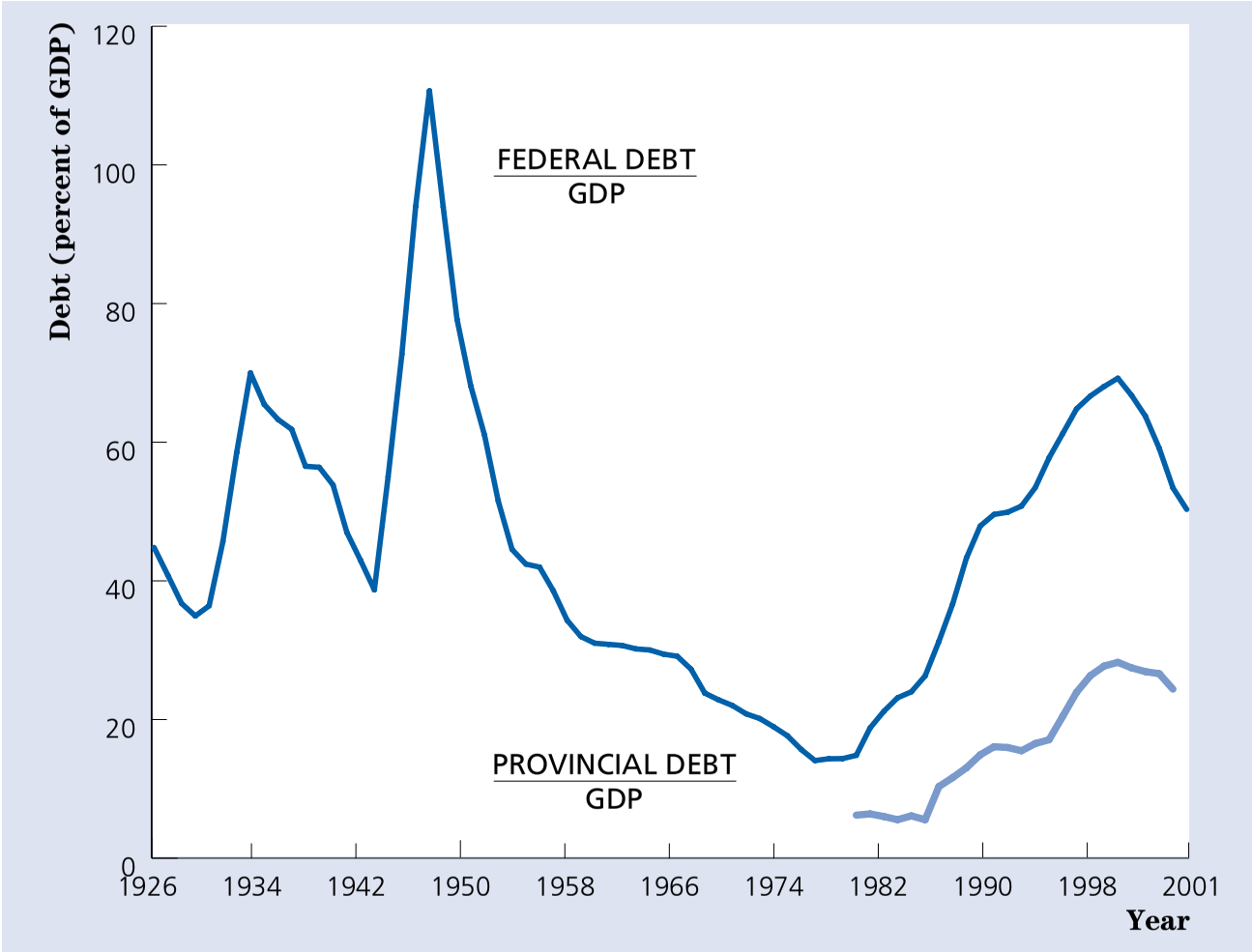
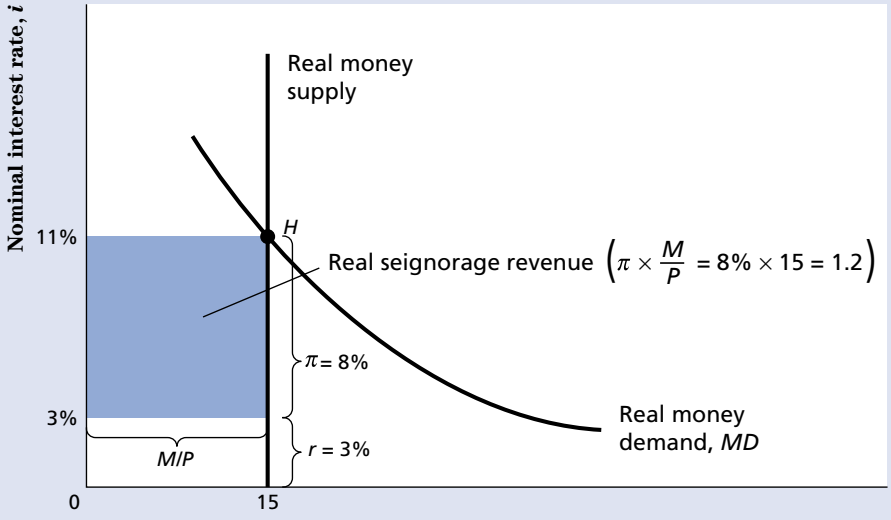


FIGURE 15.8

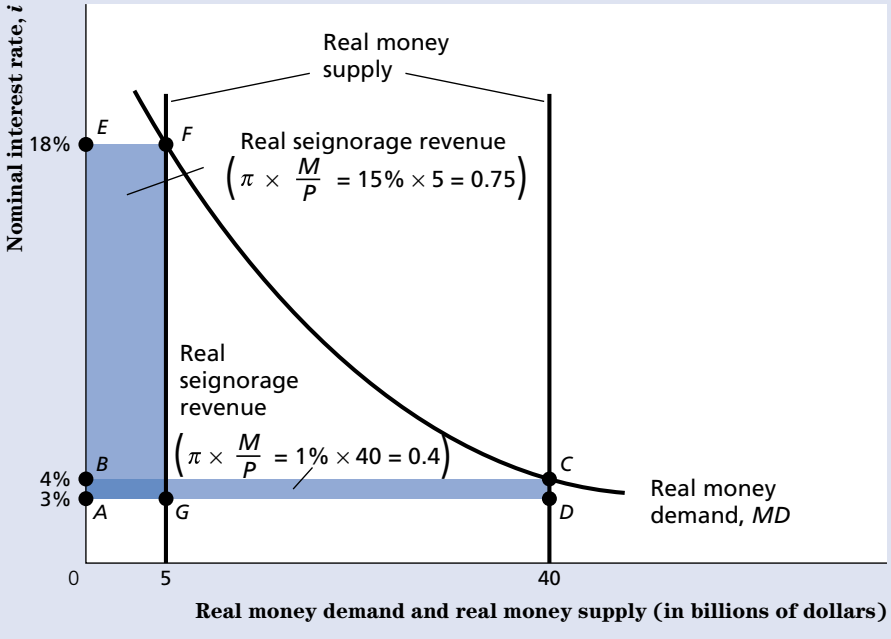
THE DETERMINATION OF REAL SEIGNORAGE REVENUE

(a) The downward-sloping curve *MD* is the money demand function for any level of real income. The real interest rate is assumed to be 3%. When the rate of inflation is 8%, the nominal interest rate is 11%, and the real quantity of money held by the public is $15 billion (point *H*). Real seignorage revenue collected by the government, represented by the area of the shaded rectangle, equals the rate of inflation (8%) times the real money stock ($15 billion), or $1.2 billion.

(b) The money demand function *MD* is the same as in (a), and the real interest rate remains at 3%. When the inflation rate is 1%, the nominal interest rate is 4%, and the real quantity of money held by the public is $40 billion. In this case real seignorage revenue equals the area of the rectangle, *ABCD*, or $0.4 billion. When the rate of inflation is 15%, the nominal interest rate is 18%, and the real money stock held by the public is $5 billion. Real seignorage revenue in this case equals the area of the rectangle *AEFG*, or $0.75 billion.



(a) Determination of real seignorage revenue for π = 8%

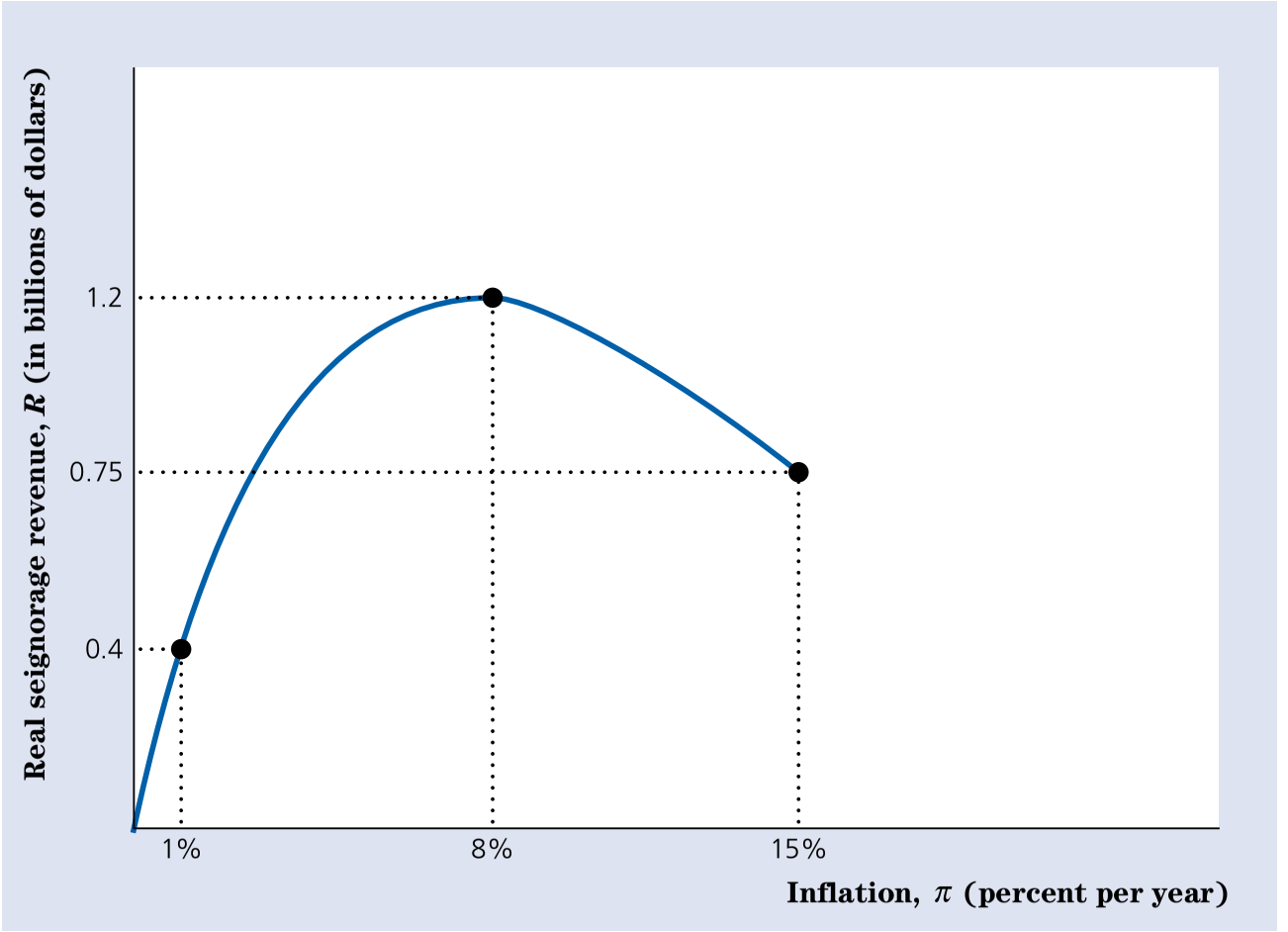


(b) Determination of real seignorage revenue for π = 1% and π = 15%

FIGURE 15.9

THE RELATION OF REAL SEIGNORAGE REVENUE TO THE RATE OF INFLATION

Continuing the example of Figure 15.8, this figure shows the relation of real seignorage revenue *R*, measured on the vertical axis, to the rate of inflation π, measured on the horizontal axis. From Figure 15.8(a), when inflation is 8% per year, real seignorage revenue is $1.2 billion. From Figure 15.8(b), real seignorage is $0.4 billion when inflation is 1% and $0.75 billion when inflation is 15%. At low rates of inflation, an increase in inflation increases seignorage revenue. At high rates of inflation, increased inflation can cause seignorage revenue to fall. In this example, the maximum amount of seignorage revenue the government can obtain is $1.2 billion, which occurs when the inflation rate is 8%.



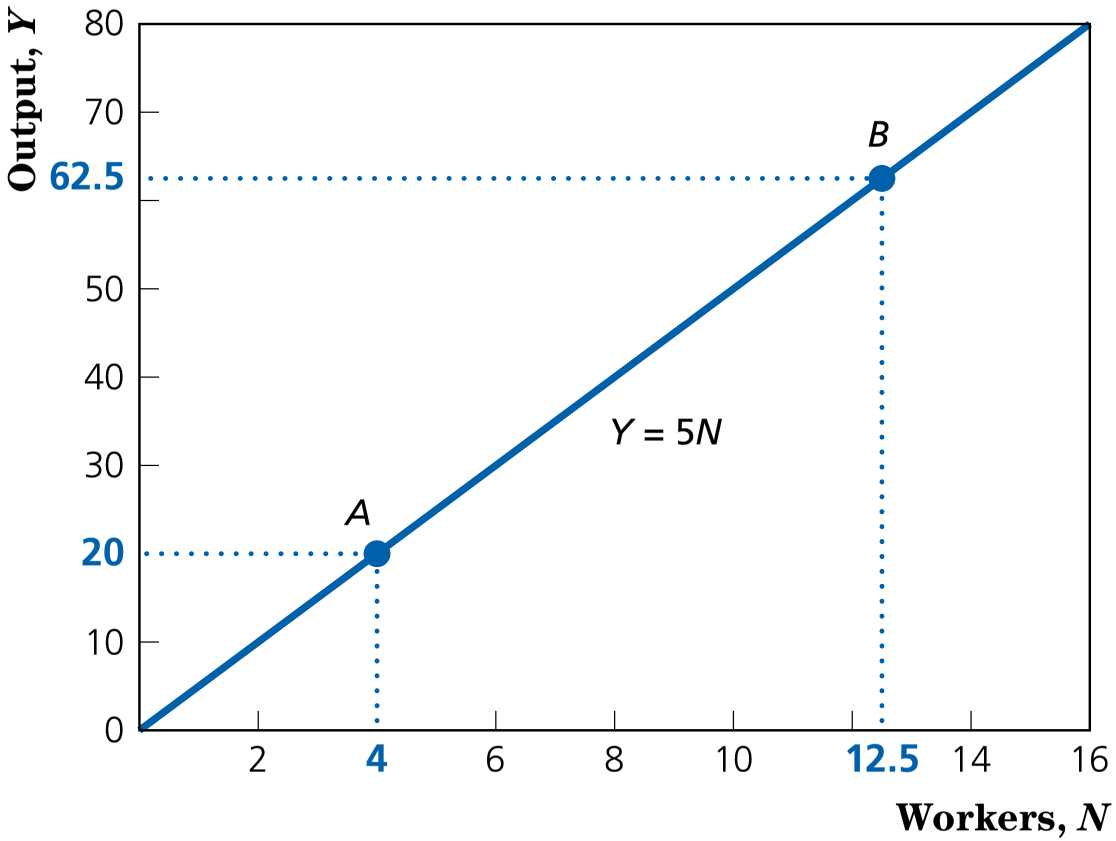


FIGURE A.1

Points on the line *0AB* satisfy the relationship $Y = 5N$. Because the graph of the function $Y = 5N$ is a straight line, this function is called a linear function.

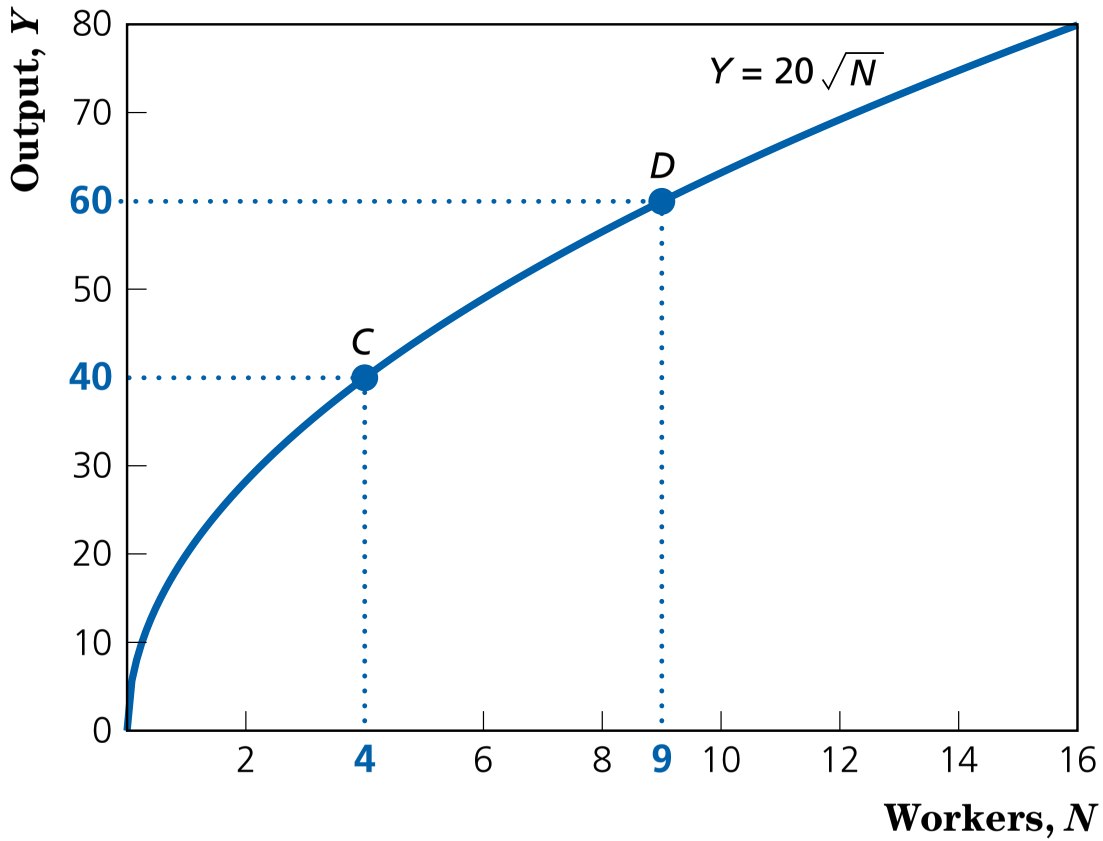


FIGURE A.2

The function $Y = 20\sqrt{N}$, whose graph is shown in this figure, is an example of a nonlinear function.

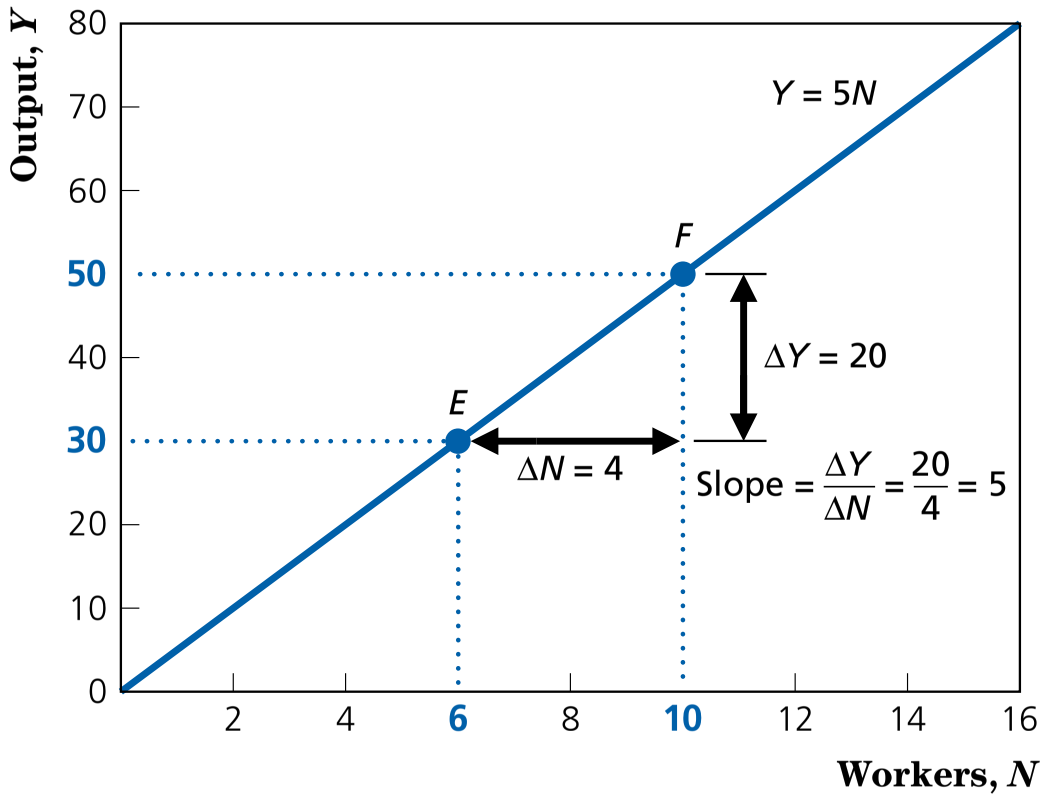


FIGURE A.3

The slope of a function equals the change in the variable on the vertical axis (Y) divided by the change in the variable on the horizontal axis (N). For example, between points E and F, the increase in N, ΔN, equals 4 and the increase in Y, ΔY, equals 20. Therefore, the slope of the function between E and F, $\Delta Y/\Delta N$, equals 5. In general, the slope of a linear function is constant, so the slope of this function between any two points is 5.

FIGURE A.4

Between points G and D, the change in N (ΔN) is 8 and the change in Y (ΔY) is 40, so the slope of the function between points G and D is $\Delta Y/\Delta N$ = 40/8 = 5. This slope is the same as the slope of the line GD. Similarly, the slope of the function between points G and C is $\Delta Y/\Delta N$ = 20/3 = 6.67. The slope of the line tangent to point G, which equals 10, approximates the slope of the function for very small changes in N. Generally, when we refer to the slope of a nonlinear function at a specific point, we mean the slope of the line tangent to the function at that point.

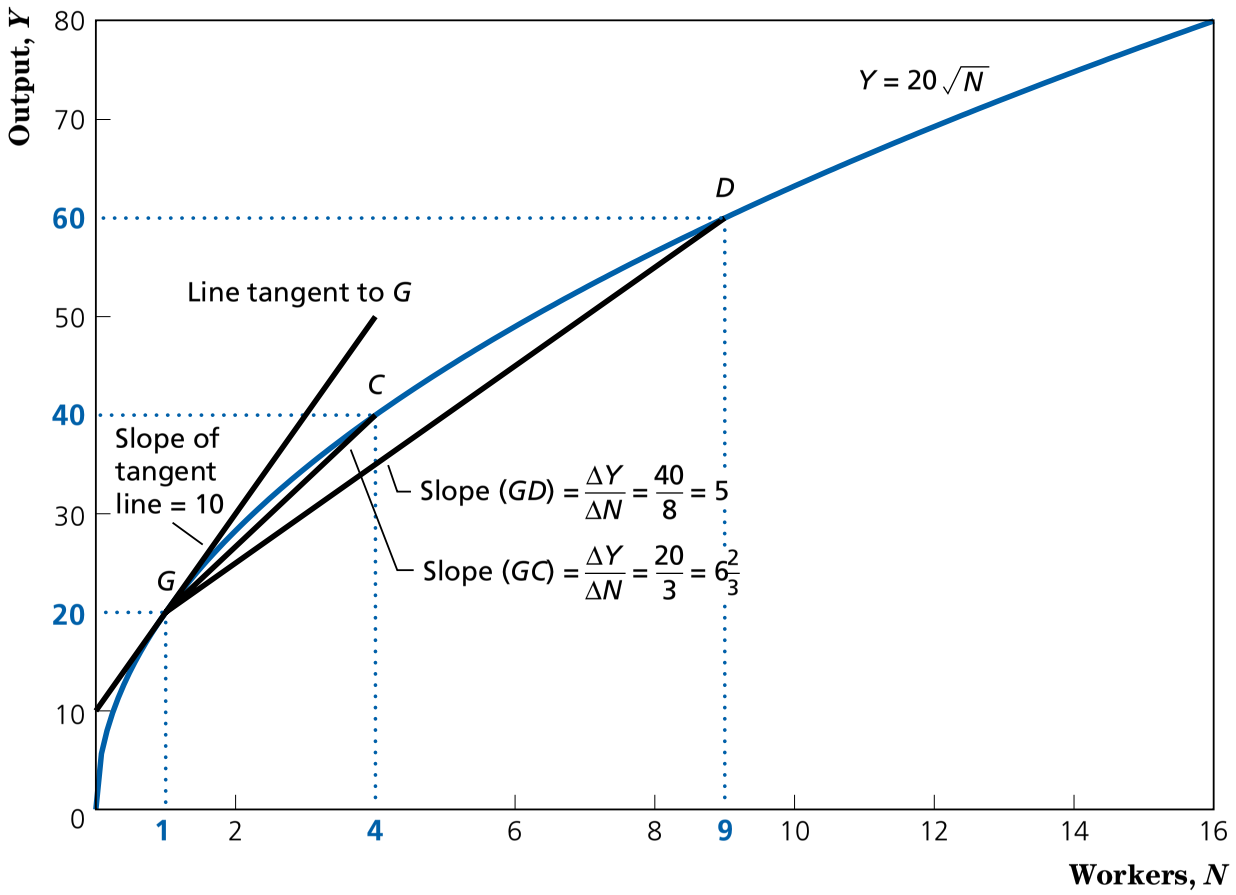


FIGURE A.5

Suppose that output Y depends on capital K and workers N, according to the function in Eq. (A.5). If we hold K fixed at 100, the relationship between Y and N is shown by the solid curve. If K rises to 225 so that more output can be produced with a given number of workers, the curve showing the relationship between Y and N shifts upward, from the solid curve to the dashed curve. In general, a change in any right-hand-side variable that does not appear on an axis of the graph causes the curve to shift.