chapter

17

The Income Adjustment Mechanism and Synthesis of Automatic Adjustments

LEARNING GOALS:

After reading this chapter, you should be able to:

- Understand how the equilibrium level of income is determined in an open economy
- Understand the meaning of foreign repercussions
- Describe how the absorption approach works
- Understand how all the automatic adjustments work together in open economies

17.1 Introduction

In this chapter, we begin by examining the operation of the *automatic income adjustment mechanism*. This relies on induced changes in the level of national *income* of the deficit and the surplus nations to bring about adjustment in the balance of payments. The automatic income adjustment mechanism represents the application of Keynesian economics to open economies (i.e., to nations engaging in international transactions). This is distinguished from the traditional or classical adjustment mechanism (presented in Chapter 16), which relied on automatic price changes to bring about adjustment in the balance of payments.

As in Chapter 16, we assume here that the deficit or surplus arises in the current account of the nation. However, while we implicitly assumed in Chapter 16 that national income remained constant and adjustment was brought about by automatic price changes, we now assume that all prices remain constant and we examine how automatic income changes lead to balance-of-payments adjustment. Specifically, in order to isolate the automatic income adjustment mechanism, we begin by assuming that the nation operates under a fixed exchange rate system and that all prices, wages, and interest rates are constant. We also assume initially that nations operate at less than full employment. In the real world, balance-of-payments disequilibria not only affect national incomes but also exert pressure on exchange rates, prices, wages, and interest rates. Thus, to some extent, all automatic adjustments are likely to operate simultaneously. Such a synthesis is presented in the last two sections of this chapter.

In Section 17.2, we review (from principles of economics) the concept and the determination of the equilibrium national income and the multiplier in a closed economy. In Section 17.3, we extend the concept and examine the determination of the equilibrium level of national income and multiplier in a small open economy. Section 17.4 further extends the presentation to include foreign repercussions that arise when the nations are not small. Foreign repercussions arise because any change in a large nation's level of national income and trade affects the national income and trade of the partner, and these in turn have secondary effects (repercussions) on the first nation. Indeed, this is how business cycles are transmitted internationally. Section 17.5 examines the price and income adjustment mechanisms together. Finally, Section 17.6 discusses monetary adjustments and presents a synthesis of all automatic adjustments, pointing out the disadvantages of each automatic mechanism and the need for adjustment policies. In the appendix, we present the mathematical derivation of the foreign trade multipliers with foreign repercussions, and then we examine the transfer problem (building on the discussion in the appendix to Chapter 12).

17.2 Income Determination in a Closed Economy

In this section, we review the concept and determination of the equilibrium national income and the multiplier in a closed economy (i.e., an economy in autarky or without international trade). These concepts were covered in your principles of economics course and represent our point of departure for examining the equilibrium level of national income and the multiplier in a small open economy (in Section 17.3). Since in this chapter we examine the operation of the *automatic* income adjustment mechanism, we do not need to include the government sector in our model. The government sector will be added to our model in the next chapter, which deals with fiscal and other policies.

17.2A Determination of the Equilibrium National Income in a Closed Economy

In a closed economy without a government sector, the equilibrium level of national income and production (Y) is equal to the desired or planned flow of consumption (C) plus desired or planned investment expenditures (I), as indicated in Equation (17-1):

$$Y = C(Y) + I \tag{17-1}$$

Desired or planned investment (I) is *autonomous*, or independent of (i.e., it does not change with) the level of national income. On the other hand, desired consumption expenditures, $C(Y)$, are a function of, or depend on, the level of national income. That is, as income (Y) rises, desired consumption (C) also rises. The change in consumption (ΔC) associated with a change in income (ΔY) is called the marginal propensity to consume (MPC). Since consumers save part of their income, the increase in consumption is less than the increase in income so that $MPC < 1$. This is illustrated in Figure 17.1.

The top panel of Figure 17.1 measures consumption and investment expenditures along the vertical axis and national income along the horizontal axis. The consumption function is shown by line $C(Y)$. Desired consumption equals 100 when income is zero and rises as income rises. The positive level of consumption when income is zero indicates that the

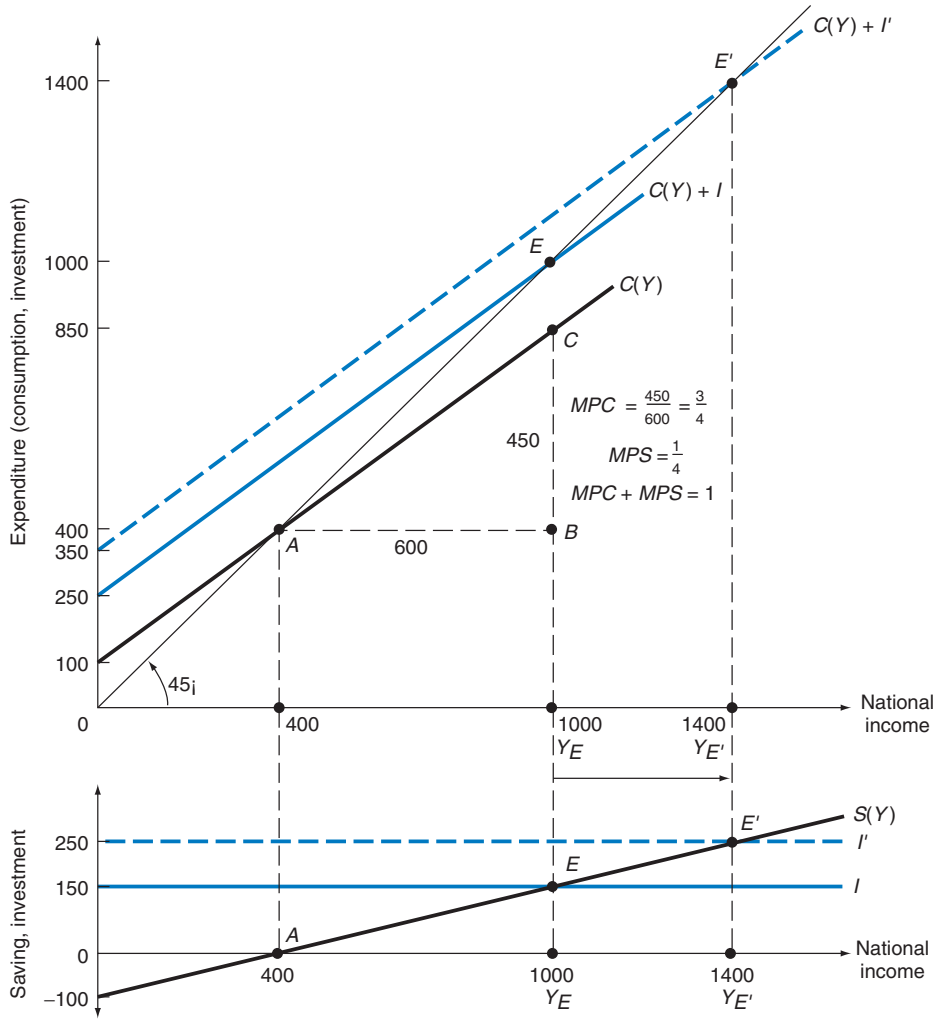

FIGURE 17.1. **National Income Equilibrium in a Closed Economy.**
In the top panel, $C(Y)$ is the consumption function and $C(Y) + I$ is the total expenditure function obtained by adding desired investment to the consumption function. The equilibrium level of national income is at point E, where the $C(Y) + I$ function crosses the 45° line. In the bottom panel, equilibrium is given by point E, where the saving function $S(Y)$ intersects the horizontal investment function. In both panels, the equilibrium level of income is 1000. If investment rises to $I' = 250$, the new equilibrium level of national income is 1400, given by point E', where broken-line $C(Y) + I'$ crosses the 45° line or where broken-line I' crosses $S(Y)$.

nation lives off its past savings, or dissaves. Then as income rises, desired consumption rises but by less than the rise in income. For example, an increase in income of 600 (from 400 to 1000, given by AB in the top panel) is associated with an increase in consumption of 450 (BC). Thus, the marginal propensity to consume, or MPC, equals $\Delta C / \Delta Y = 450/600 = \frac{3}{4}$, or 0.75. The equation of this linear consumption function is then $C = 100 + 0.75Y$, where 100 is the vertical intercept and 0.75 is the slope.

Adding to the consumption function a hypothetical desired investment expenditure of 150 at every level of income, we get the total expenditure function $C(Y) + I$ in the figure. The $C(Y) + I$ function crosses the 45° line at point E. Every point on the 45° line measures equal distances along the vertical and horizontal axes. Thus, at point E, the total of consumption and investment expenditures of 1000 (measured along the vertical axis) equals the level of production or income of 1000 (measured along the horizontal axis). $Y_E = 1000$ is then the equilibrium level of national income.

At $Y > 1000$, desired expenditures fall short of output, firms have an *unplanned* accumulation of inventories of unsold goods, and they cut production. On the other hand, at $Y < 1000$, desired expenditures exceed production, there is an unplanned reduction of inventories, and production is increased. Thus, the equilibrium level of national income $Y_E = 1000$ is stable in the sense that at any other level of national income, desired expenditures either exceed or fall short of the value of output, and the level of national income moves toward $Y_E = 1000$. The equilibrium level of income need not be, and we assume that it is not, the full-employment level of income (Y_F).

In the bottom panel of Figure 17.1, the vertical axis measures the level of saving and investment, and the horizontal axis measures the level of national income (as in the top panel). The level of desired investment is autonomous at $I = 150$ regardless of the level of income. On the other hand, desired saving is a function of income, so that the saving function is

$$S(Y) = Y - C(Y) \tag{17-2}$$

Thus, when $Y = 0$, $C = 100$ (see the top panel) and $S = -100$ (in the bottom panel). At $Y = 400$, $C = 400$ and $S = 0$ (point A in both panels). At $Y = 1000$, $C = 850$ and $S = 150$. Note that as income rises, desired saving rises. The change in desired saving (ΔS) associated with a change in income (ΔY) is defined as the marginal propensity to save (MPS). For example, an increase in income of 600 (from 400 to 1000) is associated with an increase in saving of 150 in the bottom panel. Thus, the marginal propensity to save, or MPS, equals $\Delta S/\Delta Y = 150/600 = 1/4$. Since any change in income (ΔY) always equals the change in consumption (ΔC) plus the change in saving (ΔS), $MPC + MPS = 1$, so that $MPS = 1 - MPC$. In the above example, $MPC + MPS = 3/4 + 1/4 = 1$, and $MPS = 1 - 3/4 = 1/4$.

In the bottom panel, the desired investment of 150 (an injection into the system) equals desired saving (a leakage out of the system) at $Y = 1000$. Investment is an injection into the system because it adds to total expenditures and stimulates production. Saving is a leakage out of the system because it represents income generated but not spent. The equilibrium level of income is the one at which

$$S = I \tag{17-3}$$

Graphically, the equilibrium level of income is given at the intersection of the saving function and the investment function at point E. At $Y > 1000$, the excess of desired saving over desired investment represents an unintended or unplanned inventory investment. Thus, production and income fall toward $Y_E = 1000$. On the other hand, at $Y < 1000$, the excess of desired investment over desired saving represents an unintended or unplanned inventory disinvestment, and income and production rise toward $Y_E = 1000$.

Thus, the equilibrium level of national income is determined either at the intersection of the $C(Y) + I$ function with the 45° line in the top panel or by the intersection of the $S(Y)$

and I functions in the bottom panel. In either case, the equilibrium level of national income is $Y_E = 1000$, and we assume that it is smaller than the full-employment level of income.

17.2B Multiplier in a Closed Economy

If, for whatever reason, investment rises by 100 from $I = 150$ to $I' = 250$, the total expenditure function shifts up by 100 from $C(Y) + I$ to $C(Y) + I'$ (the broken line in the top panel of Figure 17.1) and defines equilibrium point E' at $Y'_E = 1400$. Equivalently, an autonomous increase in investment causes the investment function to shift up from $I = 150$ to $I' = 250$ (the broken line in the bottom panel) and intersect the saving function at point E', also defining the equilibrium level of national income at $Y'_E = 1400$.

Starting from the original equilibrium point E in the bottom panel, as investment increases from $I = 150$ to $I' = 250$, $I' > S$ and Y rises. The rise in Y induces S to rise. This continues until Y has risen sufficiently for induced S to equal the new and higher level of I'. For this to occur, Y must rise by 400, from $Y_E = 1000$ to $Y'_E = 1400$, as indicated by the new equilibrium point of E' in the bottom (and top) panel(s).

Thus, an increase in I of 100 results in an increase in Y of 400 in order to induce S to also rise by 100 and reach another equilibrium point. That is,

$$\Delta I = \Delta S = MPS \times \Delta Y$$

so that

$$\Delta Y = \left(\frac{1}{MPS}\right)\Delta I$$

Therefore, the multiplier (k) is

$$k = \frac{\Delta Y}{\Delta I} = \frac{1}{MPS} = \frac{1}{1 - MPC} \tag{17-4}$$

That is, the closed economy Keynesian multiplier (k) is equal to the inverse, or reciprocal, of the marginal propensity to save or to the reciprocal of 1 minus the marginal propensity to consume. Since $0 < MPS < 1$, the multiplier is larger than 1. For example, in Figure 17.1, $MPS = \frac{1}{4}$ and $k = 4$, so that the increase in I of 100 leads to an increase in Y of 400 and an induced rise in S also equal to 100.

The reason income rises more than investment is as follows. When investment expenditures rise, producers expand production, hire more workers, use more capital and other factors of production. Since the income generated in the process of production equals the value of the output produced, increasing investment expenditures by 100 has the immediate effect of also increasing income by the same amount. But the recipients of this 100 increase in income will spend $\frac{3}{4}$ (the MPC) of it. Thus, as incomes rise by 100, consumption expenditures rise by 75. This leads to a further expansion of production and generates an additional income of 75. This new increase in income leads to a further increase in consumption of 56.25 (from 0.75×75).

The process continues, with income rising by smaller and smaller amounts at every step, until the increase in income becomes zero. Thus, income increases by 100 in the first step, by 75 in the second step, by 56.25 in the third step, and so on, until the *sum total* of all the increases in income is 400. When income has risen by 400, from $Y_E = 1000$ to $Y'_E = 1400$, induced saving will have risen by 100, and once again $S = I' = 250$, and the process comes to an end.

17.3 Income Determination in a Small Open Economy

We now extend the discussion of the equilibrium level of national income and the multiplier from a closed economy to a small open economy (i.e., an economy whose international transactions do not perceptibly affect the national income of its trade partner or the rest of the world). We begin by defining the import function of the nation; then we show how the equilibrium level of national income is determined algebraically and graphically; finally, we derive the foreign trade multiplier. In Section 17.4, we will relax the assumption that the nation is small and extend the discussion to consider foreign repercussions. For simplicity, we continue to assume that there is no government sector and that the economy operates at less than full employment.

17.3A Import Function

The import function of a nation, $M(Y)$, shows the relationship between the nation's imports and national income. A hypothetical import function is shown in Figure 17.2. Note that $M = 150$ when $Y = 0$ and rises as Y rises. When income is zero, the nation purchases 150 of imports by borrowing abroad or with its international reserves. Then as income rises, imports also rise.

The change in imports (ΔM) associated with a change in income (ΔY) is called the marginal propensity to import (MPM). For example, a movement from point G to point H on the import function in Figure 17.2 involves an increase in imports from $M = 300$ to $M = 450$ for an increase in income from $Y = 1000$ to $Y = 2000$. Thus, $MPM = \Delta M/\Delta Y = 150/1000 = 0.15$. The MPM is equal to the slope of $M(Y)$ and is constant. On the other hand, the ratio of imports to income is called the average propensity to import (APM) and falls as

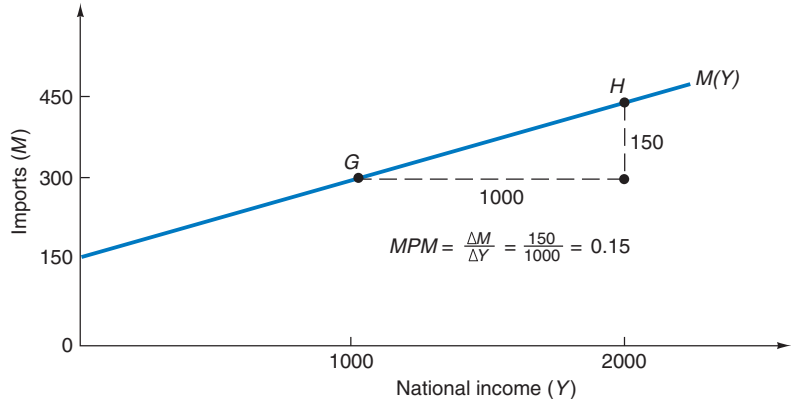

FIGURE 17.2. The Import Function.
Import function $M(Y)$ shows that imports are 150 when income is zero and rise as income rises. The slope of the import function (the change in imports resulting from a given change in income) is called the marginal propensity to import (MPM). For the import function shown here, $MPM = \Delta M/\Delta Y = 0.15$ and remains constant.

income rises (if the import function has a positive vertical intercept, as in Figure 17.2). Thus, at point G, $APM = M/Y = 300/1000 = 0.3$, while at point H, $APM = M/Y = 450/2000 = 0.225$. Then MPM/APM is the income elasticity of imports (n_Y). Specifically:

$$n_Y = \frac{\text{percentage change in imports}}{\text{percentage change in income}} = \frac{\Delta M/M}{\Delta Y/Y} = \frac{\Delta M/\Delta Y}{M/Y} = \frac{MPM}{APM} \qquad (17\text{-}5)$$

For the movement from point G to point H in Figure 17.2:

$$n_Y = \frac{150/1000}{300/1000} = \frac{0.15}{0.30} = 0.5$$

Being very large and well endowed with resources, the United States is less dependent on international trade and thus tends to have a smaller APM and MPM than most other nations. For example, for the United States, $APM = 0.15$ and $MPM = 0.27$, so that $n_Y = 1.8$ in the long run; for Germany, $APM = 0.33$, $MPM = 0.50$, so that $n_y = 1.5$; for the United Kingdom, $APM = 0.29$, $MPM = 0.64$, so that $n_y = 2.2$. Only for Japan among the G-7 countries are the APM and the MPM smaller than in the United States. Case Study 17-1 demonstrates the income elasticity of imports for the United States and other countries or groups of countries.

CASE STUDY 17-1 Income Elasticity of Imports

Table 17.1 gives the values of the income elasticity of imports of goods and services for the United States, Japan, Germany, France, the United Kingdom, Italy, and Canada calculated from the same data set used to estimate price elasticities in Table 16.3. From Table 17.1, we see that the income elasticity of imports ranges from 1.4 to 1.8 for the United States, Germany, France, Italy, and Canada. It is 2.2 for the United Kingdom and 0.9 for Japan. The low income elasticity of imports for Japan means that the MPM is smaller than the APM in Japan, whereas the opposite is true for the other industrial countries. This is because Japan imports proportionately more raw materials and spends proportionately more of the increase in its income on domestic products rather than on imports as compared with other industrial countries.

TABLE 17.1. Income Elasticity of Imports

Country/Group of Countries	Elasticities
United States	1.8
Japan	0.9
Germany	1.5
France	1.6
United Kingdom	2.2
Italy	1.4
Canada	1.4

Source: Hooper, Johnson, and Marquez (2008).

17.3B Determination of the Equilibrium National Income in a Small Open Economy

The analysis of the determination of the equilibrium national income in a closed economy can easily be extended to include foreign trade. In an open economy, exports, just like investment, are an injection into the nation's income stream, while imports, just like saving, represent a leakage out of the income stream. Specifically, exports as well as investment stimulate domestic production, while imports as well as saving constitute income earned but not spent on domestic output.

For a small open economy, exports are also taken to be *autonomous* or independent of the level of income of the nation (just like investment). Thus, the export function is also horizontal when plotted against income. That is, the exports of the nation are the imports of the trade partner or the rest of the world and, as such, depend not on the exporting nation's level of income but on the level of income of the trade partner or the rest of the world. On the other hand, imports (like saving) are a function of the nation's income. With this in mind, we can now proceed to specify the condition for the equilibrium level of national income for a small open economy.

In a small open economy, the equilibrium condition relating injections and leakages in the income stream is

$$I + X = S + M \tag{17-6}$$

Note that this condition for the equilibrium level of national income does not imply that the balance of trade (and payments) is in equilibrium. Only if $S = I$ will $X = M$, and the balance of trade will also be in equilibrium.

By rearranging the terms of Equation (17-6), we can restate the condition for the equilibrium level of national income as

$$X - M = S - I \tag{17-7}$$

This points out that at the equilibrium level of national income, the nation could have a surplus in its trade balance (a net injection from abroad) equal to the excess of saving over domestic investment (a net domestic leakage). On the other hand, a deficit in the nation's trade balance must be accompanied by an equal excess of domestic investment over saving at the equilibrium level of national income.

By transposing I from the right to the left side of Equation (17-7), we get still another useful and equivalent form of the equilibrium condition:

$$I + (X - M) = S \tag{17-8}$$

The expression $(X - M)$ in Equation (17-8) refers to net foreign investment, since an export surplus represents an accumulation of foreign assets. Thus, Equation (17-8) indicates that at the equilibrium level of national income, domestic investment plus net foreign investment equals domestic saving (see Case Study 17-2). If imports exceed exports, the term $(X - M)$ is negative so that domestic investment exceeds domestic saving by the amount of net foreign disinvestment (i.e., the amount by which foreigners are investing in the nation).

CASE STUDY 17-2 Private Sector and Current Account Balances

Table 17.2 shows the average private-sector balance (S-I) and the trade or current account balance (X-M) as a percentage of gross domestic product (GDP) of the leading (G-7) industrial countries over the 1996–2000 period and their values in 2001. The table shows that, as a percentage of GDP, the United States had the largest private sector and current account deficits, while Japan had the largest private sector and current account surpluses (only Canada in 2001 had a higher current account surplus than Japan). The equilibrium condition in Equation (17-7) $(X - M = S - I)$ does not hold because of the missing government sector (discussed in the next chapter).

TABLE 17.2. Private Sector and Current Account Balances in the G-7 Countries, 1996–2001

	Private Sector Balances: 1996–2000		Current Account Balances: 1996–2000	
Country	Average	2001	Average	2001
United States	−2.7	−4.7	−2.7	−4.1
Japan	7.9	8.5	2.3	2.1
Germany	1.2	1.8	−0.6	−0.7
United Kingdom	−0.6	−2.9	−1.2	−1.8
France	4.7	3.0	2.2	1.6
Italy	4.6	1.5	1.6	0.1
Canada	−0.4	0.9	0.1	3.7

Source: Organization for Economic Cooperation and Development, *Economic Outlook* (Paris: OECD, December 2001), p. 134.

17.3c Graphical Determination of the Equilibrium National Income

The above algebraic statement of the equilibrium level of national income in a small open economy is shown graphically and clarified in Figure 17.3. The top panel of Figure 17.3 represents the determination of the equilibrium level of national income in terms of Equation (17-6), while the bottom panel determines the equilibrium level of national income in terms of Equation (17-7). Exports are autonomous and are assumed to be equal to 300, and $Y_E = 1000$ in both panels. Specifically, the top panel measures investment plus exports and saving plus imports on the vertical axis, and national income along the horizontal axis. With investment of $I = 150$ (as in Figure 17.1) and exports of $X = 300$, the investment plus exports function is $I + X = 150 + 300 = 450$. The saving plus imports function, $S(Y) + M(Y)$, is obtained by the vertical addition of the import function of Figure 17.2 to the saving function of Figure 17.1. For example, at $Y = 0$, $S = -100$ and $M = 150$, so that $S + M = -100 + 150 = +50$. At $Y = 1000$, $S + M = 150 + 300 = 450$. Note that the slope of the saving plus imports function is equal to the MPS (the slope of the saving function) plus the MPM (the slope of the import function). That is, the slope of $S(Y) + M(Y) = MPS + MPM = 0.25 + 0.15 = 0.40$.

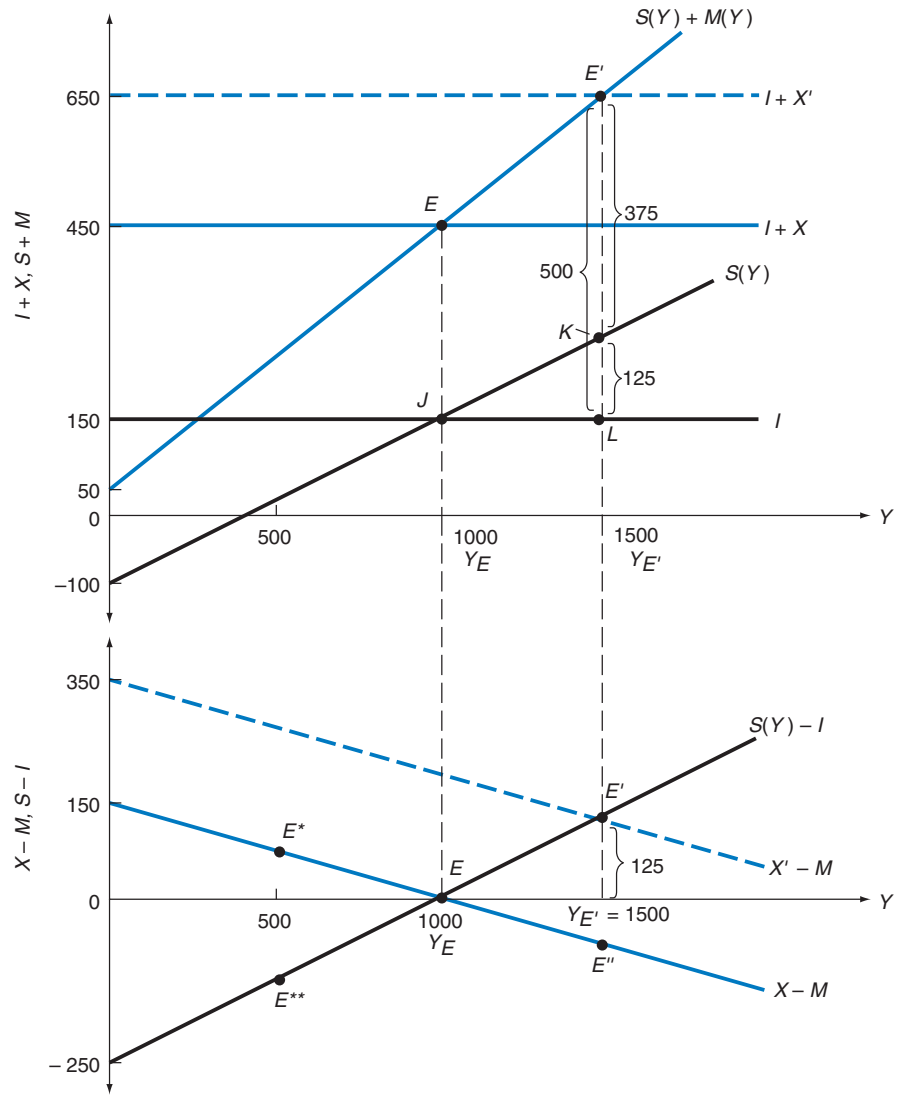

FIGURE 17.3. National Income Determination in a Small Open Economy.
The top panel measures saving plus imports and investment plus exports on the vertical axis and national income along the horizontal axis. The equilibrium level of national income is $Y_E = 1000$ and is determined at point E, where the $I + X$ function crosses the $S(Y) + M(Y)$ function. At $Y_E = 1000$, $S = I = 150$ so that $X = M = 300$. The bottom panel measures $(X - M)$ and $(S - I)$ on the vertical axis and Y on the horizontal axis. The $X - M(Y)$ function falls because we subtract rising M from a constant X as Y rises. The $S(Y) - I$ function rises because we subtract a constant I from rising S as Y rises. $Y_E = 1000$ and is determined at point E, where the $X - M(Y)$ function crosses the $S(Y) - I$ function and $X - M = S - I = 0$. An autonomous increase in X of 200 (broken-line $I + X'$ in the top panel and $X' - M(Y)$ in the bottom panel) results in $Y_{E'} = 1500$ and $X' - M = 125$ and $S - I = 125$.

The equilibrium level of national income is $Y_E = 1000$ and is determined where the $(I + X)$ function crosses the $S(Y) + M(Y)$ function (point E in the top panel). That is, equilibrium is determined where

$$\text{INJECTIONS} = \text{LEAKAGES}$$
$$I + X = S + M$$
$$150 + 300 = 150 + 300$$
$$450 = 450$$

Note that in this case, $I = S = 150$ so that $X = M = 300$ (EJ in the figure). Thus, the trade balance is also in equilibrium at the equilibrium level of national income of $Y_E = 1000$. Y_E is also stable in the sense that if injections did not equal leakages, the economy would automatically gravitate toward Y_E.

The bottom panel of Figure 17.3 measures $(X - M)$ and $(S - I)$ on the vertical axis, and Y along the horizontal axis. Since $X = 300$ and $M = 150$ at $Y = 0$, $X - M = 300 - 150 = 150$ at $Y = 0$. The $X - M(Y)$ function declines because we subtract rising M from a constant X as Y rises. That is, the balance of trade deteriorates as Y rises. On the other hand, since $S = -100$ at $Y = 0$ and $I = 150$, $S - I = -100 - 150 = -250$ at $Y = 0$. The $S(Y) - I$ function rises because we subtract a constant I from rising S as Y rises. The equilibrium level of national income is $Y_E = 1000$ (as in the top panel) and is determined where the $X - M(Y)$ function crosses the $S(Y) - I$ function (point E in the bottom panel).

The advantage of using the bottom panel (and Equation (17-7)) is that the trade balance can be read directly from the figure. Since the $X - M(Y)$ function crosses the $S(Y) - I$ function on the horizontal axis, $X - M = S - I = 0$ at $Y_E = 1000$. That is, the trade balance happens to be in equilibrium at the equilibrium level of national income. This is a convenient point of departure to analyze how a disturbance (such as an autonomous change in exports or investment) affects the nation's equilibrium level of income and the operation of the automatic income adjustment mechanism.

17.3D Foreign Trade Multiplier

Starting from the equilibrium point E in the top and bottom panels of Figure 17.3, an autonomous change in exports or investment (the left side of Equation (17-6)) disturbs the nation's equilibrium level of income. The change in the equilibrium level of national income then induces changes in the amount of saving and imports (the right side of Equation (17-6)) until the sum of the induced changes in saving and imports equals the sum of the autonomous changes in investment and exports. That is, another equilibrium level of national income is determined where

$$\Delta I + \Delta X = \Delta S + \Delta M \tag{17-9}$$

The *induced* changes in saving and imports when income changes are given by

$$\Delta S = (MPS)(\Delta Y)$$
$$\Delta M = (MPM)(\Delta Y)$$

Substituting these for ΔS and ΔM in Equation (17-9), we get

$$\Delta I + \Delta X = (MPS)(\Delta Y) + (MPM)(\Delta Y)$$

$$\Delta I + \Delta X = (MPS + MPM)(\Delta Y)$$

$$\Delta Y = \frac{1}{MPS + MPM}(\Delta I + \Delta X)$$

where the foreign trade multiplier (k') is

$$k' = \frac{1}{MPS + MPM} \tag{17-10}$$

For example, starting from equilibrium point E in Figure 17.3, if exports rise autonomously by 200 from $X = 300$ to $X' = 500$,

$$k' = \frac{1}{MPS + MPM} = \frac{1}{0.25 + 0.15} = \frac{1}{0.40} = 2.5$$

$$\Delta Y = (\Delta X)(k') = (200)(2.5) = 500$$

$$Y_{E'} = Y_E + \Delta Y = 1000 + 500 = 1500$$

$$\Delta S = (MPS)(\Delta Y) = (0.25)(500) = 125$$

$$\Delta M = (MPM)(\Delta Y) = (0.15)(500) = 75$$

Therefore, at $Y_{E'}$,

$$\text{CHANGE IN INJECTIONS} = \text{CHANGE IN LEAKAGES}$$

$$\Delta I + \Delta X = \Delta S + \Delta M$$

$$0 + 200 = 125 + 75$$

$$200 = 200$$

At the new equilibrium level of national income of $Y_{E'} = 1500$, exports exceed imports by 125 per period. That is, the automatic change in income induces imports to rise by less than the autonomous increase in exports, so that the adjustment in the balance of payments is incomplete. The foreign trade multiplier $k' = 2.5$ found above is smaller than the corresponding closed economy multiplier $k = 4$ found in Section 17.2B because in an open economy, domestic income leaks into both saving and imports. This is a fundamental result of open-economy macroeconomics.

In the top panel of Figure 17.3, the new higher (broken-line) $I + X'$ function crosses the unchanged $S(Y) + M(Y)$ function at point E'. At $Y_{E'} = 1500$, $X' = 500(E'L)$ and $M = 375(E'K)$ so that $X' - M = 125(KL)$. The same outcome is shown in the bottom panel of Figure 17.3 by point E', where the new and higher (broken-line) $X' - M(Y)$ function crosses the unchanged $S(Y) - I$ function at $Y_{E'} = 1500$ and defines the trade surplus of $X' - M = 125$.

Note that the smaller $MPS + MPM$ is, the flatter is the $S(Y) + M(Y)$ function in the top panel of Figure 17.3, and the larger would be the foreign trade multiplier and the increase

CASE STUDY 17-3 Growth in the United States and the World and U.S. Current Account Deficits

Table 17.3 shows the growth of real GDP in the United States and in the world as a whole, and their effect on the U.S. current account (CA) balance and on the ratio of the U.S. current account balance to the U.S. GDP (i.e., CA/GDP) from 1994 to 2011. Because we are interested in the *sustainability* of the U.S. current account deficit over time, we will concentrate on changes in the value of CA/GDP rather than the absolute value of the U.S. current account deficits.

The table shows that the U.S. CA/GDP worsened from 2004 to 2006 and from 2010 to 2011 as U.S. growth declined (the opposite of what we would expect), but (as expected) it improved from 2007 to 2009 as U.S. growth declined. This only points to the fact that the U.S. CA/GDP depends on the interaction of many economic forces (such as growth in the rest of the world, changes in the dollar exchange rate, relative inflation rates, and not just on U.S. growth), which often pull in opposite directions (as examined in the rest of this chapter and in Chapter 18). Since U.S. current accounts deficits are financed by capital or financial inflows from abroad, the question arises as to the sustainability of the U.S. current accounts deficits over time. A sudden withdrawal or drying up of financial inflows could lead to a sharp depreciation of the dollar and a big increase in U.S. interest rates, which could plunge the United States into a deep recession. Thus, it is important for the United States to reduce and keep its current account deficits to sustainable levels (say in the range of 2 to 3 percent of GDP).

TABLE 17.3. Growth in the United States and the World and the U.S. Current Account Balance, 1994–2011

	Average 1994–2003	2004	2005	2006	2007	2008	2009	2010	2011
Growth of US Real GDP (%)	3.3	3.5	3.1	2.7	1.9	−0.3	−3.5	3.0	1.7
Growth of World Real GDP (%)	3.4	4.9	4.5	5.2	5.4	2.8	−0.6	5.3	3.9
CA Balance of U.S. (billions of dollars)	−279	−630	−748	−803	−718	−669	−378	−470	−473
CA/GDP of U.S.	−3.1	−5.3	−5.9	−6.0	−5.1	−4.7	−2.7	−3.2	−3.1

Source: International Monetary Fund, *International Financial Statistics* (Washington, D.C.: IMF, 2012).

in income for a given autonomous increase in investment and exports. Also to be noted is that Y rises as a result of the autonomous increase in X, and I remains unchanged (i.e., $\Delta I = 0$).

If I instead of X rises by 200,

$$\Delta I + \Delta X = \Delta S + \Delta M$$

$$200 + 0 = 125 + 75$$

and the nation faces a continuous trade deficit of 75, equal to the increase in imports. This could be shown graphically by a downward shift in the $S(Y) - I$ function by 200 so as to

CASE STUDY 17-4 Growth and Current Account Balance in Developing Economies

Table 17.4 shows the growth of real GDP and the current account balance as a percentage of GDP in some of the most important and dynamic developing economies from 2006 to 2011. From the table, we see the very high average growth rate of China, India, Argentina, Singapore, and Indonesia from 2006 to 2011. The table also shows that there seems to be little relationship between the growth of the economy and the nation's current account balance. Some countries, such as China, experienced high growth and a large surplus in its current account; others, such as India, experienced rapid growth and a current account deficit, while still others nations, such as Indonesia, grew very rapidly and their current account was more or less in balance. Conversely, Mexico and the Czech Republic experienced relatively slow growth and current account deficits. This shows, once again, that although domestic and international economic growth affects a nation's current account, there are also other forces (such as exchange rates, relative inflation rates, structural imbalances, etc.) at work.

TABLE 17.4. Growth and Current Account Balances in Some Developing Economies, 2006–2011

	Growth of Real GDP		Current Account Balance as % of GDP	
Economy	Average 2006–2010	2011	Average 2006–2010	2011
Asia				
China	11.2	9.2	7.6	2.8
Hong Kong SAR	4.0	5.0	10.6	4.1
India	8.5	7.2	−1.8	−2.8
Korea	3.8	3.6	2.1	2.4
Singapore	6.5	4.9	21.6	21.9
Taiwan, P.C.	4.2	4.0	8.7	8.8
Indonesia	5.7	6.5	1.7	0.2
Malaysia	4.5	5.1	15.6	11.5
Thailand	3.6	0.1	4.2	3.4
Latin America				
Argentina	6.8	8.9	2.0	−0.5
Brazil	4.4	2.7	−0.8	−2.1
Mexico	1.8	4.0	−0.8	−0.8
Central Europe				
Czech Republic	2.7	1.7	−2.7	−2.9
Poland	4.7	4.3	−5.0	−4.3
Turkey	3.3	8.5	−5.3	−9.9
Russia	3.6	4.3	6.1	5.5
Africa				
South Africa	3.1	3.1	−5.3	−3.3

Source: International Monetary Fund, *International Financial Statistics* (Washington, D.C.: IMF, 2012).

cross the unchanged $X - M(Y)$ function at point E' (see the bottom panel of Figure 17.3) and define $Y_{E''} = 1500$ and $X - M = -75$.

On the other hand, starting from equilibrium point E in the bottom panel of Figure 17.3, an *autonomous* increase of 200 in saving would shift the $S(Y) - I$ function upward by 200 and define (at point E^*) $Y_E{}^* = 500$ and a trade surplus of $X - M = 75$. Finally, an *autonomous* increase in imports of 200 would shift the $X - M(Y)$ function downward by 200 and define equilibrium point E^{**} (see the bottom panel of Figure 17.3), at which $Y^{**} = 500$ and the nation would have a trade deficit of $X - M = -125$. The reduction in the equilibrium level of national income results because imports replace domestic production. Case Study 17-3 examines the relationship between the current account balance and growth in the United States, while Case Study 17-4 does the same for some of the most important developing economies.

17.4 Foreign Repercussions

In this section, we relax the assumption that the nation is small and extend the analysis to consider foreign repercussions. In a two-nation world (Nation 1 and Nation 2), an autonomous increase in the exports of Nation 1 arises from and is equal to the *autonomous increase* in the *imports of Nation 2*. If the autonomous increase in the imports of Nation 2 replaces domestic production, Nation 2's income will fall. This will induce *Nation 2's imports to fall*, thus neutralizing part of the original autonomous increase in its imports. This represents a foreign repercussion on Nation 1 that neutralizes part of the original autonomous increase in its exports. As a result, the foreign trade multiplier for Nation 1 with foreign repercussions is smaller than the corresponding foreign trade multiplier without foreign repercussions, and its trade balance will not improve as much.

Assuming that all of the autonomous increase in the exports of Nation 1 replaces domestic production in Nation 2, *the foreign trade multiplier of Nation 1 with foreign repercussions for an autonomous increase in exports* (k'') is

$$k'' = \frac{\Delta Y_1}{\Delta X_1} = \frac{1}{MPS_1 + MPM_1 + MPM_2(MPS_1/MPS_2)} \tag{17-11}$$

where the subscripts 1 and 2 refer, respectively, to Nation 1 and Nation 2. (This and the following formulas are derived in the appendix.) For example, if $MPS_1 = 0.25$ and $MPM_1 = 0.15$ for Nation 1 (as in Section 17.3), and $MPS_2 = 0.2$ and $MPM_2 = 0.1$ for Nation 2,

$$k'' = \frac{\Delta Y_1}{\Delta X_1} = \frac{1}{0.25 + 0.15 + 0.10(0.25/0.20)} = \frac{1}{0.525} = 1.90$$

Thus, the original autonomous increase of 200 in the exports of Nation 1 leads to an increase in the equilibrium national income of Nation 1 of (200)(1.90) = 380 with foreign repercussions, as compared with (200)(2.5) = 500 without foreign repercussions. As a result, $\Delta M_1 = (\Delta Y_1)(MPM_1) = (380)(0.15) = 57$ and $\Delta S_1 = (\Delta Y_1)(MPS_1) = (380)(0.25) = 95$ with foreign repercussions.

Substituting these values into the equilibrium equation $\Delta I_1 + \Delta X_1 = \Delta S_1 + \Delta M_1$, we get $0 + \Delta X_1 = 95 + 57 = 152$. Therefore, the net increase in X_1 is 152 with foreign repercussions as compared with 200 without. With M_1 rising by 57, Nation 1's trade surplus

is $152 - 57 = 95$ with foreign repercussions, as compared with 125 (point E' in Figure 17.3) without.

Starting from the equilibrium level of national income and equilibrium in the trade balance (point E in the bottom panel of Figure 17.3), an autonomous increase in investment in Nation 1 (I_1) causes its income (Y_1) to rise and induces its imports (M_1) to rise also, thus opening a deficit in Nation 1's balance of trade (for example, see equilibrium point E'' in the bottom panel of Figure 17.3). In the absence of foreign repercussions, this is the end of the story. With foreign repercussions, the increase in M_1 is equal to an increase in the exports of Nation 2 (X_2) and induces an increase in Y_2 and M_2. This increase in M_2 is an increase in X_1 (a foreign repercussion on Nation 1) and moderates the original trade deficit of Nation 1.

The *foreign trade multiplier in Nation 1 with foreign repercussions for an autonomous increase in investment* $(k)^*$ is

$$k^* = \frac{\Delta Y_1}{\Delta I_1} = \frac{1 + MPM_2/MPS_2}{MPS_1 + MPM_1 + MPM_2(MPS_1/MPS_2)} \tag{17-12}$$

Since the denominator of Equation (17-12) is identical to the denominator of Equation (17-11), using the same information, we get

$$k^* = \frac{\Delta Y_1}{\Delta I_1} = \frac{1 + 0.10/0.20}{0.525} = \frac{1.50}{0.525} = 2.86$$

Thus, $k^* > k' > k''$ and the autonomous increase in I_1 of 200 causes Y_1 to rise by (200)(2.86) = 572, instead of 500 in the absence of foreign repercussions. As a result, M_1 rises by $(\Delta Y_1)(MPM_1) = (572)(0.15) = 85.8$ and $\Delta S_1 = (\Delta Y_1)(MPS_1) = (572)(0.25) = 143$ with foreign repercussions.

Substituting these values into the equilibrium equation $\Delta I_1 + \Delta X_1 = \Delta S_1 + \Delta X_1$, we get $200 + \Delta X_1 = 143 + 85.8 = 228.8$. Therefore, the *induced* rise in $X_1 = 28.8$. With M_1 rising by 85.8 and X_1 increasing by 28.8, Nation 1's trade deficit is $85.8 - 28.8 = 57$ with foreign repercussions, as compared with 75 (point E'' in Figure 17.3) without. Thus, foreign repercussions make the trade surplus and deficit smaller than they would be without foreign repercussions.

Finally, if there is an autonomous increase in investment in *Nation 2, the foreign trade multiplier in Nation 1 with foreign repercussions for the autonomous increase in* $I_2(k^{**})$ is

$$k^{**} = \frac{\Delta Y_1}{\Delta I_2} = \frac{MPM_2/MPS_2}{MPS_1 + MPM_1 + MPM_2(MPS_1/MPS_2)} \tag{17-13}$$

Note that $k^* = k^{**} + k''$. The effect of an autonomous increase in I_2 on Y_1 and the trade balance of Nation 1 is left as an end-of-chapter problem. The mathematical derivations of the foreign trade multipliers with foreign repercussions given by Equations (17-11), (17-12), and (17-13) are presented in Section A17.1 in the appendix.

Note that this is how business cycles are propagated internationally. For example, an expansion in economic activity in the United States spills into imports. Since these are the exports of other nations, the U.S. expansion is transmitted to other nations. The rise in the exports of these other nations expands their economic activity and feeds back to the United States through an increase in their imports from the United States. Another example is provided by the Great Depression of the 1930s. The sharp contraction in U.S. economic activity that started in the early 1930s greatly reduced the U.S. demand for imports. This tendency was reinforced by passage of the Smoot–Hawley Tariff, which was

the highest tariff in U.S. history and led to retaliation by other nations (see Section 9.5A). The sharp reduction in U.S. imports had a serious deflationary effect (through the multiplier) on foreign nations, which then reduced their imports from the United States, causing a further reduction in the national income of the United States. Foreign repercussions were an important contributor to the spread of the depression to the entire world. Only a very small nation can safely ignore foreign repercussions from changes occurring in its own economy. Case Study 17-5 examines the impact, through trade linkages, of the financial crisis that started in Asia in July 1997 on the United States, Japan, and the European Union.

CASE STUDY 17-5 Effect of the Asian Financial Crisis of the Late 1990s on OECD Countries

Table 17.5 provides estimates of the effect of the financial crisis that started in Asia in July 1997 on the United States, Japan, the European Union, Canada, Australia, and New Zealand, which were made by the Organization of Economic Cooperation and Development (OECD) using its INTERLINK model. The financial crisis in Asia was transmitted through trade linkages to other nations and regions of the world. Specifically, the depreciation of the currencies of the nations in crisis stimulated their exports, while the reduction in their GDP reduced the demand for their imports. The effects are given in terms of reduced growth and worsened current account balance of other nations from what they would have had in the absence of the crisis.

The table shows that the financial crisis in Asia reduced the growth of real GDP in the United States by 0.4 percentage points in both 1998 and 1999 (from 4.7 percent to 4.3 percent in 1998 and from 4.2 percent to 3.8 percent in 1999). This amounted to about $34–$35 billion reduction in the GDP of the United States in 1998 and 1999. The reduction in growth (in percentage points) was similar in the European Union, but much greater for Japan, Australia, and New Zealand, and smaller in Canada. The table also shows that the crisis increased the current account deficit of the United States by $13 billion in 1998 and by $27 billion in 1999. The effect was similar in Japan and the European Union, but much smaller in Canada, Australia, and New Zealand. Thus, we can see that economic crises in some large nation or economic area can easily spread to other nations and areas through trade linkages and have a significant impact on them. This is even more evident from the financial crisis that started in the U.S. subprime mortgage market in 2007 and then spread to the entire financial and economic sectors of the United States and the rest of the world in 2008 (discussed in detail in Section 21.6E).

TABLE 17.5. Effect of the Asian Financial Crisis on Growth and Current Account of OECD Countries, 1998–1999

	Growth of Real GDP (Percent)		Current Account Balance (Billions of Dollars)	
	1998	1999	1998	1999
United States	−0.4	−0.4	−13	−27
Japan	−1.3	−0.7	−12	−22
European Union	−0.4	−0.2	−19	−28
Canada	−0.2	−0.3	−2	−3
Australia and New Zealand	−0.9	−0.1	−3	−4
OECD	−0.7	−0.4	−26	−55

Source: Organization for Economic Cooperation and Development, *OECD Economic Outlook* (Paris: OECD, June 1998), p. 17.

17.5 Absorption Approach

In this section, we integrate the automatic price and income adjustment mechanisms and examine the so-called absorption approach. Specifically, we examine the effect of induced (automatic) income changes in the process of correcting a deficit in the nation's balance of payments through a depreciation or devaluation of the nation's currency. These automatic income changes were omitted from Chapter 16 in order to isolate the automatic price adjustment mechanism.

We saw in Chapter 16 that a nation can correct a deficit in its balance of payments by allowing its currency to depreciate or by a devaluation (if the foreign exchange market is stable). Because the improvement in the nation's trade balance depends on the price elasticity of demand for its exports and imports, this method of correcting a deficit is referred to as the *elasticity approach*. The improvement in the deficit nation's trade balance arises because a depreciation or devaluation stimulates the nation's exports and discourages its imports (thus encouraging the domestic production of import substitutes). The resulting increase in production and in the real income of the deficit nation induces imports to rise, which neutralizes part of the original improvement in the nation's trade balance resulting from the depreciation or devaluation of its currency.

However, if the deficit nation is already at full employment, production cannot rise. Then, only if *real domestic absorption* (i.e., expenditures) is reduced will the depreciation or devaluation eliminate or reduce the deficit in the nation's balance of payments. If real domestic absorption is not reduced, either automatically or through contractionary fiscal and monetary policies, the depreciation or devaluation will lead to an increase in domestic prices that will completely neutralize the competitive advantage conferred by the depreciation or devaluation without any reduction of the deficit.

In terms of the bottom panel in Figure 17.3, a depreciation or devaluation of the deficit nation's currency shifts the $X - M(Y)$ function up (because X rises and M falls) and improves the nation's trade balance if the nation operated at less than full employment to begin with (and the Marshall–Lerner condition is satisfied). Note that the net final improvement in the nation's trade balance is less than the upward shift in the $X - M(Y)$ function because domestic production rises and induces imports to rise, thus neutralizing part of the original improvement in the trade balance. However, if the nation started from a position of full employment, the depreciation or devaluation leads to domestic inflation, which then shifts the $X - M(Y)$ function back down to its original position without any improvement in the trade balance. Only if domestic absorption is somehow reduced will some improvement in the trade balance of the deficit nation remain (i.e., the $X - M(Y)$ function will not shift all the way back to its original position).

The above analysis was first introduced in 1952 by *Alexander*, who named it the absorption approach. Alexander began with the identity that production or income (Y) is equal to consumption (C) plus domestic investment (I) plus foreign investment or the trade balance $(X - M)$, all in real terms. That is,

$$Y = C + I + (X - M) \tag{17-14}$$

But then letting A equal domestic absorption $(C + I)$ and B equal the trade balance $(X - M)$, we have

$$Y = A + B \tag{17-15}$$

By subtracting A from both sides, we get

$$Y - A = B \tag{17-16}$$

That is, domestic production or income minus domestic absorption equals the trade balance. For the trade balance *(B)* to improve as a result of a depreciation or devaluation, Y must rise and/or A must fall. If the nation was at full employment to begin with, production or real income *(Y)* will not rise, and the depreciation or devaluation can be effective only if domestic absorption *(A)* falls, either automatically or as a result of contractionary fiscal and monetary policies.

A depreciation or a devaluation of the deficit nation's currency automatically reduces domestic absorption if it redistributes income from wages to profits (since profits earners usually have a higher marginal propensity to save than wage earners). In addition, the increase in domestic prices resulting from the depreciation reduces the value of the real cash balances that the public wants to hold. To restore the value of real cash balances, the public must reduce consumption expenditures. Finally, rising domestic prices push people into higher tax brackets and also reduce consumption. Since we cannot be certain as to the speed and size of these automatic effects, contractionary fiscal and monetary policies may have to be used to cut domestic absorption adequately. These are discussed in the next two chapters.

Thus, while the elasticity approach stresses the demand side and implicitly assumes that slack exists in the economy that will allow it to satisfy the additional demand for exports and import substitutes, the absorption approach stresses the supply side and implicitly assumes an adequate demand for the nation's exports and import substitutes. It is clear, however, that both the elasticity approach and the absorption approach are important and both must be considered simultaneously.

Related to the automatic income adjustment mechanism and the absorption approach is the so-called *transfer problem*. This is discussed in Section A17.2 in the appendix.

17.6 Monetary Adjustments and Synthesis of the Automatic Adjustments

In this section, we first examine monetary adjustments to balance-of-payments disequilibria. We then present a synthesis of the automatic price, income, and monetary adjustments, and examine how they work in the real world. Finally, we conclude with a discussion of the disadvantages of automatic adjustment mechanisms.

17.6A Monetary Adjustments

Up to now, monetary adjustments have been omitted. However, when the exchange rate is not freely flexible, a deficit in the balance of payments tends to reduce the nation's money supply because the excess foreign currency demanded is obtained by exchanging domestic money balances for foreign exchange at the nation's central bank. Under a fractional-reserve banking system, this loss of reserves causes the nation's money supply to fall by a multiple of the trade deficit. Unless sterilized, or neutralized, by the nation's monetary authorities, the reduction in the money supply induces interest rates to rise in the deficit nation.

The rise in interest rates in the deficit nation discourages domestic investment and reduces national income (via the multiplier process), and this induces a decline in the nation's imports, which reduces the deficit. Furthermore, the rise in interest rates attracts foreign capital, thus helping the nation to finance the deficit. The opposite occurs in the surplus nation. Indeed, it is through these international capital flows and automatic income changes that adjustment seems actually to have occurred under the gold standard (rather than through the price-specie-flow mechanism described in Section 16.6B).

The reduction in its money supply and income also tends to reduce prices in the deficit nation relative to the surplus nation, further improving the trade balance of the deficit nation. This adjustment through changes in internal prices is *theoretically* most pronounced and direct under the gold standard, but it also occurs under other international monetary systems.

Indeed, as shown in Chapter 19, this automatic monetary-price adjustment mechanism could by itself eliminate the nation's trade deficit and unemployment, but only in the long run. In what follows, we assume that a change in the money supply affects the balance of payments, to some extent, through both interest rate changes and changes in internal prices.

17.6B Synthesis of Automatic Adjustments

Let us now integrate the automatic price, income, and monetary adjustments (i.e., provide a synthesis of automatic adjustments) for a nation that faces unemployment and a deficit in its balance of payments at the equilibrium level of income.

Under a freely flexible exchange rate system and a stable foreign exchange market, the nation's currency will depreciate until the deficit is entirely eliminated. Under a managed float, the nation's monetary authorities usually do not allow the full depreciation required to eliminate the deficit completely. Under a fixed exchange rate system (such as the one that operated during most of the postwar period until 1973), the exchange rate can depreciate only within the narrow limits allowed so that most of the balance-of-payments adjustment must come from elsewhere.

A depreciation (to the extent that it is allowed) stimulates production and income in the deficit nation and induces imports to rise, thus reducing part of the original improvement in the trade balance resulting from the depreciation. Under a freely flexible exchange rate system, this simply means that the depreciation required to eliminate a balance-of-payments deficit is larger than if these automatic income changes were not present.

Except under a freely flexible exchange rate system, a balance-of-payments deficit tends to reduce the nation's money supply, thus increasing its interest rates. This, in turn, reduces domestic investment and income in the deficit nation, which induces its imports to fall and thereby reduces the deficit. The increase in interest rates also attracts foreign capital, which helps the nation finance the deficit. The reduction in income and in the money supply also causes prices in the deficit nation to fall relative to prices in the surplus nation, thus further improving the balance of trade of the deficit nation.

Under a fixed exchange rate system, most of the automatic adjustment would have to come from the monetary adjustments discussed above, unless the nation devalues its currency. On the other hand, under a freely flexible exchange rate system, the national economy is to a large extent supposed to be insulated from balance-of-payments disequilibria, and most of the adjustment in the balance of payments is supposed to take place through

exchange rate variations. (The fixed and flexible exchange rate systems are evaluated and compared in Chapter 20.)

When all of these automatic price, income, and monetary adjustments are allowed to operate, the adjustment to balance-of-payments disequilibria is likely to be more or less complete even under a fixed exchange rate system. The problem is that automatic adjustments frequently have serious disadvantages, which nations often try to avoid by the use of adjustment policies. These are examined in Chapters 18 and 19.

In the real world, income, prices, interest rates, exchange rates, the current account, and other variables change as a result of an autonomous disturbance (such as an increase in expenditures) in one nation, and a disturbance in one nation affects other nations, with repercussions back to the first nation. It is very difficult to trace all of these effects in the real world because of the very intricate relationships that exist among these variables and also because, over time, other changes and disturbances occur, and nations also adopt various policies to achieve domestic and international objectives.

With the advent of large computers, large-scale models of the economy have been constructed, and they have been used to estimate foreign trade multipliers and the net effect on income, prices, interest rates, exchange rates, current account, and other variables that would result from an autonomous change in expenditures in one nation or in the rest of the world. Although these models are very complex, they do operate according to the general principles examined in this chapter (see Case Study 17-6).

■ CASE STUDY 17-6 Interdependence in the World Economy

Table 17.6 shows the effect of an autonomous increase in government expenditures on gross national product (GNP), consumer price index (CPI), interest rate, currency value, and current account in the nation or group of nations where the increase in government expenditures takes place, and their repercussions on the trade partner(s). These simulation results were obtained using the Multi-Country Model of the Federal Reserve Board. Although the effects of an increase in government expenditures are felt over several years, the results reported in Table 17.6 show the effect in the second year after government expenditures increased. Part A of the table shows the effect of an increase in U.S. government expenditures of 1 percent on the United States and on the rest of the OECD. OECD refers to the Organization for Economic Cooperation and Development, which included all 24 of the world's industrial countries at the time of the exercise.

Part A of the table shows that the increase in U.S. government expenditures equal to 1 percent of its GNP results (through the multiplier process) in an increase of 1.8 percent in the U.S. GNP in the second year after the United States increased its expenditures. A longer period of time would show a larger total effect. It also leads to a 0.4 percent increase in U.S. prices, a 1.7 percentage point increase (say from 4 percent to 5.7 percent) in U.S. short-term interest rates, a 2.8 percent increase in the international value of the dollar (appreciation), and a (−)$16.5 billion deterioration in the U.S. current account balance. The dollar appreciates because the increase in capital inflows attracted by the increase in the U.S. interest rate exceeds the induced rise in imports resulting from the increase in U.S. GNP.

The top right part of the table shows that the increase in U.S. imports resulting from the increase in its expenditures and income stimulates the growth of GNP in the rest of OECD by 0.7 percent. This, in turn, leads to an increase of 0.4 percent in prices and a 0.4 percentage point increase in short-term interest rates in the other

(continued)

CASE STUDY 17-6 Continued

TABLE 17.6. Estimated Effect in Second Year of an Increase in Government Expenditures Equal to 1 Percent of GNP

A. Increase in Government Expenditures in United States

	Effect in United States	Effect in Rest of OECD
GNP	1.8%	0.7%
CPI	0.4%	0.4%
Interest rate	1.7%[a]	0.4%[a]
Currency value	2.8%	–
Current account	−$16.5 billion	$8.9 billion

B. Increase in Government Expenditures in Rest of OECD

	Effect in Rest of OECD	Effect in United States
GNP	1.4%	0.5%
CPI	0.3%	0.2%
Interest rate	0.6%[a]	0.5%[a]
Currency value	0.3%	–
Current account	−$7.2 billion	$7.9 billion

[a] = percentage point change.

Source: R. Bryant, D. Henderson, G. Holtham, P. Hooper, and S. Symansky, eds., *Empirical Macroeconomics for Interdependent Economies* (Washington, D.C.: Brookings Institution, 1988), p. 21.

OECD countries. The appreciation of the dollar means a depreciation of the currencies of the other OECD countries and an improvement of $8.9 billion in their current account balance. The average depreciation of the other OECD countries was not estimated, and the improvement in their current account is smaller than the increase in the U.S. current account *deficit* because a great deal of U.S. imports also come from OPEC (Organization of Petroleum Exporting Countries) and LDCs (less developed countries).

Part B of the table shows that an autonomous increase in government expenditures in the rest of OECD would lead to a 1.4 percent increase in their average GNP, a 0.3 percent increase in prices, a 0.6 percentage point increase in short-term interest rates, a 0.3 percent appreciation of their currencies, and a (−)$7.2 billion deterioration in the current account balance. These changes have repercussions in the United States, where GNP increases by 0.5 percent, prices increase by 0.2 percent, short-term interest rates increase by 0.5 percentage points, and the U.S. current account improves by $7.9 billion. Other models of the world economy give similar results (see *McKibbin*, 1997). The strong interdependence in the world economy today could also be shown by other changes taking place in the United States or in its trade partners.

17.6c Disadvantages of Automatic Adjustments

The disadvantages facing a freely flexible exchange rate system may be overshooting and erratic fluctuations in exchange rates. These interfere with the flow of international trade (even though foreign exchange risks can often be hedged at a cost) and impose costly

adjustment burdens (in the form of shifts in the use of domestic resources and in the pattern of specialization) that might be entirely unnecessary in the long run.

Under a managed floating exchange rate system, erratic exchange rate fluctuations can be avoided, but monetary authorities may manage the exchange rate so as to keep the domestic currency undervalued to stimulate the domestic economy at the expense of other nations (thus inviting retaliation). Such competitive depreciations or devaluations (beggar-thy-neighbor policies) proved very disruptive and damaging to international trade in the period between the two world wars (see Section 21.2B).

On the other hand, the possibility of a devaluation under a fixed exchange rate system can lead to destabilizing international capital flows, which can also prove very disruptive. A fixed exchange rate system also forces a nation to rely primarily on monetary adjustments.

Automatic income changes can also have serious disadvantages. For example, a nation facing an autonomous increase in its imports at the expense of domestic production would have to allow its national income to fall in order to reduce its trade deficit. Conversely, a nation facing an autonomous increase in its exports from a position of full employment would have to accept domestic inflation to eliminate the trade surplus.

Similarly, for the automatic monetary adjustments to operate, the nation must passively allow its money supply to change as a result of balance-of-payments disequilibria and thus give up its use of monetary policy to achieve the more important objective of domestic full employment without inflation. For all of these reasons, nations often will use adjustment policies to correct balance-of-payments disequilibria instead of relying on automatic mechanisms.

SUMMARY

1. The income adjustment mechanism relies on induced changes in the national income of the deficit and surplus nations to bring about adjustment in the balance of payments. To isolate the income adjustment mechanism, we initially assume that the nation operates under a fixed exchange rate system and that all prices, wages, and interest rates are constant. We also begin by assuming that the nation operates at less than full employment.

2. In a closed economy without a government sector, the equilibrium level of national income (Y_E) is equal to the desired flow of consumption expenditures (C) plus desired investment expenditures (I). That is, $Y = C(Y) + I$. Equivalently, Y_E occurs where $S = I$. If $Y \neq Y_E$, desired expenditures do not equal the value of output and $S \neq I$. The result is unplanned inventory investment or disinvestment, which pushes the economy toward Y_E. An increase in I causes Y_E to rise by a multiple of the increase in I. The ratio of the increase in Y_E to the increase in I is called the multiplier (k), which is given by the reciprocal of the marginal propensity to save (MPS). The increase in Y_E induces S to rise by an amount equal to the autonomous increase in I.

3. In a small open economy, exports (X) are exogenous, or independent of the nation's income, just as I is. On the other hand, imports (M) depend on income, just as S does. The ratio of the change in M for a given change in Y is the marginal propensity to import (MPM). Y_E is determined where the sum of the injections $(I + X)$ equals the sum of the leakages $(S + M)$. The condition for Y_E can also be rewritten as $X - M = S - I$ and as $I + (X - M) = S$. The foreign trade multiplier $k' = 1/(MPS + MPM)$ and is smaller than the corresponding closed economy multiplier (k). An autonomous increase in I and/or X causes Y_E to change by k' times ΔI and/or ΔX. The change in Y_E induces S to change by $(MPS)(\Delta Y)$ and

M to change by *(MPM)* (ΔY), but adjustment in the trade balance is incomplete.

4. If the nations are not small, foreign repercussions cannot be safely ignored. In a two-nation world, an autonomous increase in the exports of Nation 1 arises from and is equal to the autonomous increase in the imports of Nation 2. If occurring at the expense of domestic production, this reduces the income and imports of Nation 2 and represents a foreign repercussion of Nation 1 that neutralizes part of the original autonomous increase in the exports of Nation 1. Thus, the foreign trade multiplier and trade surplus of Nation 1 with foreign repercussions is smaller than that without foreign repercussions (see Equation (17-11)). We can also calculate the foreign trade multiplier for Nation 1 with foreign repercussions for an autonomous increase in investment in Nation 1 (see Equation (17-12)) and in Nation 2 (see Equation (17-13)). Foreign repercussions explain how business cycles are transmitted internationally.

5. The absorption approach integrates the automatic price and income adjustment mechanisms. For example, a depreciation or devaluation stimulates the domestic production of exports and import substitutes and increases the level of real national income. This induces an increase in the nation's imports, which neutralizes part of the original improvement in its trade balance. But if the nation is at full employment to begin with, production cannot rise, and the depreciation or devaluation will instead increase domestic prices so as to leave the trade balance completely unchanged, unless real domestic absorption is somehow reduced.

6. When the exchange rate is not freely flexible, a depreciation of the deficit nation's currency will correct part, but not all, of the deficit. The deficit then leads to a reduction in the nation's money supply and an increase in its interest rate. This induces a fall in investment, income, and imports, which reduces the deficit. It also induces a capital inflow. In addition, the reduction in the money supply and incomes reduces prices in the deficit nation relative to prices in the surplus nation, and this further improves the former's trade balance. All of these automatic adjustment mechanisms together are likely to bring about a complete balance-of-payments adjustment, but they sacrifice internal to external balance.

A LOOK AHEAD

Chapters 18 and 19 deal with adjustment policies. Specifically, we will examine how a change in the exchange rate, together with monetary and fiscal policies, can be used to achieve balance-of-payments equilibrium as well as full employment without inflation. If the nation is unwilling to change its exchange rate or allow it to vary, the government could use monetary policy to achieve balance-of-payments equilibrium and fiscal policy to achieve full employment but would have no policy, except price controls, to fight inflation.

KEY TERMS

Absorption approach, p. 558
Average propensity to import (APM), p. 546
Closed economy, p. 542
Consumption function, p. 542
Desired or planned investment, p. 542
Equilibrium level of national income, p. 542
Export function, p. 548
Foreign repercussions, p. 555
Foreign trade multiplier (k'), p. 552
Import function, p. 546
Income elasticity of demand of imports (n_Y), p. 547
Investment function, p. 544
Marginal propensity to consume (MPC), p. 542
Marginal propensity to import (MPM), p. 546
Marginal propensity to save (MPS), p. 544
Multiplier (k), p. 545
Saving function, p. 544
Synthesis of automatic adjustments, p. 560

QUESTIONS FOR REVIEW

1. How does the automatic income adjustment mechanism operate to bring about adjustment in a nation's balance of payments? What are the variables that we hold constant to isolate the income adjustment mechanism?
2. What is meant by a closed economy? by desired or planned investment, consumption, and saving? What is meant by investment being exogenous? What are a consumption function, a saving function, and an investment function?
3. What do the MPC and the MPS measure?
4. How is the equilibrium level of national income determined in a closed economy? How is the size of the closed economy multiplier *(k)* determined?
5. What is meant by exports being exogenous? What is meant by MPM, APM, and n_Y?
6. How is the equilibrium level of national income determined in a small open economy? What is the value of the foreign trade multiplier *(k′)*?
7. What is meant when we say that the automatic income adjustment mechanism brings about incomplete adjustment in the balance of trade or payments?
8. What is meant by foreign repercussions? When is it not safe to ignore them?
9. What is the multiplier formula for Nation 1 with foreign repercussions for an autonomous increase in its exports that replaces domestic production in Nation 2?
10. What is the multiplier formula for an autonomous increase in investment in Nation 1? in Nation 2? How are foreign repercussions related to international business cycles?
11. What is meant by the elasticity approach? the absorption approach? In what way does the absorption approach integrate the automatic price and income adjustment mechanisms?
12. What happens to the trade balance of a deficit nation if it allows its currency to depreciate or devalue from a position of full employment? How can real domestic absorption be reduced?
13. What is meant by automatic monetary adjustments? How do they help to adjust balance-of-payments disequilibria?
14. How do all the automatic adjustment mechanisms operate together to correct a deficit in a nation's balance of payments under a fixed or managed exchange rate system when the nation operates at less than full employment? What is the disadvantage of each automatic adjustment mechanism?

PROBLEMS

1. Given $C = 100 + 0.8Y$ and autonomous investment $I = 100$, draw a figure showing the equilibrium level of national income.
2. For the given in Problem 1:

   (a) Write the equation of the saving function.

   (b) Draw a figure showing the equilibrium level of national income in terms of desired saving and investment.
3. Starting from the given and figure of Problem 1, and assuming that autonomous investment expenditures increase from $I = 100$ to $I' = 200$, draw a figure in terms of total expenditures showing the new equilibrium level of national income.
4. Starting from the given and figure of Problem 2, and assuming that autonomous investment expenditures increase from $I = 100$ to $I' = 200$:

   (a) Draw a figure in terms of desired saving and investment showing the new equilibrium level of national income.

   (b) Determine the value of the multiplier.

***5.** Given $C = 100 + 0.8Y$, $M = 150 + 0.20Y$, $I = 100$, and $X = 350$:

(a) Determine Y_E algebraically.

(b) Show the determination of Y_E graphically as in the top panel of Figure 17.3.

***6.** For the same given as in Problem 5, show the determination of Y_E graphically as in the bottom panel of Figure 17.3.

7. Starting with the algebraic and graphical results of Problems 5 and 6, determine algebraically and determine graphically the effect on Y_E of an autonomous:

(a) Increase in X of 200.

(b) Increase in I of 200.

(c) Increase in X and I of 200.

8. Starting with the algebraic and graphical results of Problems 5 and 6, determine algebraically and determine graphically the effect on Y_E of an autonomous:

(a) Decrease in S of 100.

(b) Decrease in M of 100.

(c) Decrease in S and M of 100.

***9.** Assuming that Nations 1 and 2 are both large, and starting from the equilibrium level of national income and equilibrium in the trade balance in Nation 1, and given that $MPS_1 = 0.20$, $MPS_2 = 0.15$, $MPM_1 = 0.20$, and $MPM_2 = 0.10$, find the change in the equilibrium level of national income and the trade balance in Nation 1 for:

(a) An autonomous increase in the exports of Nation 1 of 200 that replaces domestic production in Nation 2.

(b) An autonomous increase in investment of 200 in Nation 1.

10. Do the same as in Problem 9 for an autonomous increase in investment of 200 in Nation 2.

11. Do the same as in Problem 9 for the numerical example in Section 17.4.

12. Starting from your graphical results of Problem 7b, show graphically the effect on Y_E and on $X - M$ of a depreciation of the nation's currency from a position of full employment and a trade deficit.

13. Under what conditions would Equation (17-8) not hold in the real world?

14. Identify the advantages of automatic over policy adjustments to correct a trade disequilibrium.

*= Answer provided at www.wiley.com/college/salvatore.

APPENDIX

In this appendix, Section A17.1 presents the mathematical derivation of the foreign trade multipliers with foreign repercussions, and Section A17.2 examines the transfer problem.

A17.1 Derivation of Foreign Trade Multipliers with Foreign Repercussions

For the purpose of deriving foreign trade multipliers with foreign repercussions, we will simplify the notations by letting nonasterisked symbols refer to Nation 1 and asterisked symbols refer to Nation 2. Furthermore, we will let $s = MPS$ and $m = MPM$.

The changes in the equilibrium level of national income for Nation 1 and Nation 2 (from Equation (17-9)) are

$$\begin{aligned} \Delta I + \Delta X &= \Delta S + \Delta M \\ \Delta I^* + \Delta X^* &= \Delta S^* + \Delta M^* \end{aligned} \tag{17A-1}$$

We know that $\Delta S = s\Delta Y$, $\Delta M = m\Delta Y$, $\Delta S^* = s^*\Delta Y^*$, and $\Delta M^* = m^*\Delta Y^*$. We also know that the change in Nation 1's exports (ΔX) equals the change in Nation 2's imports ($\Delta M^* = m^*\Delta Y^*$), and the change in Nation 2's exports (ΔX^*) equals the change in Nation 1's imports ($\Delta M = m\Delta Y$). Substituting these values into Equation (17A-1), we get

$$\begin{aligned} \Delta I + m^*\Delta Y^* &= s\Delta Y + m\Delta Y \\ \Delta I^* + m\Delta Y &= s^*\Delta Y^* + m^*\Delta Y^* \end{aligned} \tag{17A-2}$$

From Equation (17A-2), we can derive the foreign trade multipliers with foreign repercussions. We begin by deriving the foreign trade multiplier with foreign repercussions for Nation 1 for an autonomous increase in investment in Nation 1 (k^* given by Equation (17-12)). Since there is no autonomous change in investment in Nation 2, $\Delta I^* = 0$. Solving the second equation of (17A-2) for ΔY^* and substituting into the first equation, we get

$$m\Delta Y = s^*\Delta Y^* + m^*\Delta Y^*$$

$$m\Delta Y = (s^* + m^*)\Delta Y^*$$

$$\frac{m\Delta Y}{s^* + m^*} = \Delta Y^*$$

$$\Delta I + m^*\frac{(m\Delta Y)}{s^* + m^*} = s\Delta Y + m\Delta Y$$

$$\Delta I = (s + m)\Delta Y - \frac{(m^*m)}{s^* + m^*}\Delta Y$$

$$\Delta I = \left[(s + m) - \frac{m^*m}{s^* + m^*}\right]\Delta Y$$

$$\Delta I = \left[\frac{(s + m)(s^* + m^*) - m^*m}{s^* + m^*}\right]\Delta Y$$

$$\Delta I = \left[\frac{ss^* + m^*m + ms^* + m^*s + m^*m}{s^* + m^*}\right]\Delta Y$$

$$\frac{\Delta I}{\Delta Y} = \left[\frac{ss^* + ms^* + m^*s}{s^* + m^*}\right]$$

$$\frac{\Delta Y}{\Delta I} = \frac{s^* + m^*}{ss^* + ms^* + m^*s}$$

Dividing numerator and denominator by s^*, we get

$$k^* = \frac{\Delta Y}{\Delta I} = \frac{1 + (m^*/s^*)}{s + m + (m^*s/s^*)}$$

This is Equation (17-12) given in Section 17.4.

Starting once again with Equation (17A-2), we can similarly derive the foreign trade multiplier for Nation 1 for an autonomous increase in investment in Nation 2 (k^{**} given by Equation (17-13)). Since there is no autonomous change in investment in Nation 1,

$\Delta I = 0$. Solving the first equation of (17A-2) for ΔY^* and substituting into the second equation, we get

$$\Delta Y^* = \frac{(s+m)}{m^*}\Delta Y$$

$$\Delta I^* + m\Delta Y = s^*\frac{(s+m)}{m^*}\Delta Y + m^*\frac{(s+m)}{m^*}\Delta Y$$

$$\Delta I^* = \left[s^*\frac{(s+m)}{m^*} + m^*\frac{(s+m)}{m^*} - m\right]\Delta Y$$

$$\Delta I^* = \left[\frac{s^*s + s^*m}{m^*} + \frac{m^*s + m^*m}{m^*} - \frac{mm^*}{m^*}\right]\Delta Y$$

$$\Delta I^* = \left[\frac{s^*s + s^*m + m^*s}{m^*}\right]\Delta Y$$

$$\frac{\Delta Y}{\Delta I^*} = \frac{m^*}{s^*s + s^*m + m^*s}$$

$$k^{**} = \frac{\Delta Y}{\Delta I^*} = \frac{(m^*/s^*)}{s + m + (m^*s/s^*)}$$

This is Equation (17-13) in Section 17.4.

We can now derive the foreign trade multiplier with foreign repercussions for Nation 1 for an autonomous increase in the exports of Nation 1 that replaces production in Nation 2 (so that the total combined expenditures in both nations remain unchanged). The autonomous increase in the exports of Nation 1 has the same effect on the equilibrium level of income of Nation 1 as an equal autonomous increase in investment in Nation 1 ($\Delta Y/\Delta I$ given by Equation (17-12)). The equal decrease in expenditures in Nation 2 has the same effect on the equilibrium level of income of Nation 1 as a decrease in investment in Nation 2 by the same amount ($-\Delta Y/\Delta I^*$ given by Equation (17-13)). Thus,

$$k'' = \frac{\Delta Y}{\Delta X} = \frac{\Delta Y}{\Delta I} - \frac{\Delta Y}{\Delta I^*}$$

That is, k'' is given by Equation (17-12) minus Equation (17-13). This gives Equation (17-11).

Problem (a) Starting from Equation (17A-2), derive k'' for Nation 1 in the same way that k^* and k^{**} were derived. (b) What is the value of the foreign trade multiplier with foreign repercussions for Nation 1 if the autonomous increase in the exports of Nation 1 represents entirely an increase in expenditures in Nation 2?

A17.2 The Transfer Problem Once Again

This presentation builds on the discussion of the transfer problem in the appendix to Chapter 12. The transfer problem is discussed here because it is related to the automatic

income and price adjustment mechanisms. It deals with the conditions under which a large and unusual capital transfer is actually accomplished by an export surplus of the paying nation and an equal import surplus of the receiving nation.

Attention was first focused on this problem in connection with the reparations that Germany had to pay to France after World War I, which gave rise to the now famous debate on the subject between *Keynes* and *Ohlin* (see the Selected Bibliography for the references). A more recent concern was the transfer problem that arose between petroleum-importing and petroleum-exporting nations because of the sharp increase in petroleum prices during the 1970s.

We examine the transfer problem by assuming that both the paying and the receiving nation are operating under a fixed exchange rate system and full employment. The transfer of real resources occurs only if expenditures in the paying and/or the receiving country are affected. If the financial transfer is effected out of idle balances (say, idle bank balances) in the paying nation and goes into idle balances (saving) in the receiving nation, expenditures are not affected in either nation and there is no transfer of real resources. For the transfer of real resources to take place, either taxes must be increased in the paying nation so as to reduce expenditures and/or expenditures must rise in the receiving nation through a reduction in taxes or an increase in services.

The reduction in expenditures in the paying nation will induce its imports to fall, while the increase in expenditures in the receiving nation will induce its imports to rise. In a two-nation world (the paying and the receiving nation), this leads to a trade surplus in the paying nation and an equal trade deficit in the receiving nation (if both nations had a zero trade balance before the transfer). It is only through the trade surplus of the paying nation and the corresponding trade deficit of the receiving nation that the transfer of real resources can be accomplished.

If the *sum* of the *MPM* in the paying nation and the *MPM* in the receiving nation equals 1, the entire financial transfer is accomplished with an equal transfer of real resources (through the change in trade balance). In this case, we say that the adjustment is *complete*. If, on the other hand, the sum of the *MPM*s in the two nations is less than 1, the transfer of real resources falls short of the transfer of financial resources. In this case, we say that the adjustment is *incomplete*. If the sum of the *MPM*s in the two nations is greater than 1, the transfer of real resources (i.e., the net change in the trade balance in each nation) is greater than the financial transfer, and the adjustment is said to be *over-complete*. Finally, if the trade balance of the paying nation deteriorates instead of improving (so that the trade balance of the receiving nation improves), the adjustment is said to be *perverse*. In this case, there is a transfer of real resources from the receiving to the paying country instead of the opposite, as is required.

If adjustment via income changes alone is incomplete, the terms of trade of the paying nation will have to deteriorate (and those of the receiving nation improve) to complete the adjustment. A deterioration in the paying nation's terms of trade will further reduce its real national income and imports. The reduction in its export prices in relation to its import prices will discourage the nation's imports and encourage its exports still further, thus contributing to completion of the transfer. On the other hand, if adjustment via income changes is overcomplete, the terms of trade of the paying nation must *improve* to make the adjustment merely complete.

For example, suppose that Nation A has to transfer (or lend) $100 million to Nation B, and in the process the income of Nation A falls by $100 million while the income of Nation

B increases by the same amount. If $MPM = m = 0.4$ for Nation A and $MPM = m^* = 0.6$ for Nation B, Nation A's imports will fall by \$40 million while Nation B's imports (equal to Nation A's exports) will rise by \$60 million, for a net improvement of \$100 million in Nation A's trade balance. As a result, the transfer is complete without any need for the terms of trade to change. If instead $m = 0.2$ and $m^* = 0.5$, Nation A's imports will fall by \$20 million while Nation B's imports (A's exports) will rise by \$50 million, for a net improvement of only \$70 million in Nation A's balance of trade. A deficit of \$30 million remains in Nation A's balance of payments (because of the \$100 million capital outflow and \$70 million trade balance surplus), and we say that the transfer is incomplete. The terms of trade of Nation A must then deteriorate and Nation B's terms of trade improve to complete the transfer. Finally, if $m = 0.5$ and $m^* = 0.7$, Nation A's trade balance will improve by \$120 million and the adjustment will be overcomplete. Then Nation A's terms of trade will have to improve sufficiently to make the adjustment merely complete.

In the real world, we can expect $m + m^* < 1$ and adjustment through income changes alone to be incomplete. A "secondary burden" of adjustment then falls on the terms of trade; that is, the terms of trade of the paying nation must deteriorate (and those of the receiving nation improve) for the transfer to be complete.

Problem Discuss how the transfer arising from the sharp increase in petroleum prices during the 1970s was accomplished. What happened during the 1980s?

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