Chapter 7

The Mundell–Fleming Open-Economy Model

> The classical theorists resemble Euclidean geometers in a non-Euclidean world who, discovering that in experience straight lines apparently parallel often meet, rebuke the lines for not keeping straight — as the only remedy for the unfortunate collisions which are occurring. Yet, in truth, there is no remedy except to throw over the axiom of parallels and to work out a non-Euclidean geometry.
>
> (John Maynard Keynes.[1])

Our impression of a complex phenomenon like an economy is influenced by our perspective. The conclusions we reach when we examine individual consumers, industries, or financial institutions in their immediate surroundings tend to be different from the conclusions we reach when we observe the collective economic outcomes from afar. Economists have, over the past three centuries, looked at economic activity from both perspectives, and the field of economics has divided itself into microeconomics and macroeconomics. The former analyzes the economic activities of consumers, firms, and other small groups and organizations, while macroeconomists focus on how the whole

[1] John Maynard Keynes (1936). p. 16.

"system" generates overall outcomes. Microeconomics looks at prices and quantities in individual markets and sectors of the economy, macroeconomics looks at gross domestic product (GDP) and total employment.

Our discussion of holism and scientific reductionism in Chapter 1 is relevant to this issue of perspective. Holism, of course, demands that economists understand the actions of the individuals and firms that make up human society. But holism also reminds us that the collective whole is not a simple sum of its parts. Or, as Keynes states in the quote above, the economic system is clearly not "Euclidean" or linear. This chapter details an open-economy macroeconomic model based on Keynes' well-known 1936 non-linear model from his *General Theory of Employment, Interest, and Money.*

Chapter Goals

1. Describe Keynes' revolutionary approach to analyzing the economy.
2. Detail how, in his 1936 model, Keynes broke the economy into separate aggregate sectors in order to build an economic model in which both the parts and the system could be analyzed.
3. Explain the simple graphic model of the product market from Keynes' complete model.
4. Extend this graphic approach to Hicks' interpretation of the Keynesian model, known as the IS-LM model.
5. Introduce Fleming and Mundell's extensions that turned the IS-LM model into an open-economy Keynesian model.
6. Compare the effects of fiscal and monetary policies in the closed-economy and open-economy versions of the model.

7.1 Keynes' Revolutionary Macroeconomic Model

To understand Keynes' criticism of the "classical theorists", one has to go back to the economic thinking of the late 19th century. At that

time, mainstream economists effectively embraced the unsound strategy of *scientific reductionism* by concentrating on individual markets and resource allocation, while ignoring the overall economic system within which those markets functioned. Most economists implicitly assumed that a good understanding of the system's component parts would be sufficient for designing the policies and institutions necessary to support the economic system. Economics textbooks by Alfred Marshall and other economists in the late 19th and early 20th centuries reflected the belief, and it was really a belief rather than a sound hypothesis, that an economy automatically tends to move toward a stable equilibrium.

7.1.1 *Walras' general equilibrium model*

Of special interest from a holistic macroeconomic perspective is the model of a complete economic system by the French-born, Swiss-based economist Léon Walras in the late 19th century. Walras' mathematical model specified the economy as a huge system of equations representing the product markets, factor markets, asset markets, and the market for money. In this system, prices and quantities of products, factors of production, assets, and money are all determined simultaneously. Although he was never able to actually solve his model mathematically, he intuitively reasoned that if all markets automatically tend to move toward their respective equilibria, then the entire system would also automatically move toward a stable overall systemic equilibrium.

From one perspective, Walras' model looks deceivingly holistic because everything is related to everything else. But, Walras' elaborate model does not leave open the possibility that the whole was greater than or less than its component parts. His system of linear equations with fixed parameters does not permit the relationships among the component parts to vary. The impossibility of actually solving Walras' system of equations further encouraged economists to focus on the system's individual markets and to refrain from trying to analyze how the overall economic system performed. Interestingly, it was only much later in the 20th century that mathematical economists proved

that a solution to Walras' rigid system even existed, and then only under rather extreme assumptions about how markets function. Ironically, the complex Walrasian model seems to have encouraged *scientific reductionism* and the focus on individual markets rather than the interconnections and the overall system.

7.1.2 *The great depression and Keynes' more holistic model*

It was only when the world economy plunged into the Great Depression during the 1930s that economic thought again began to recognize that a system of individual product markets, factor markets, asset markets, and money markets does not generally result in a general equilibrium that maximizes human welfare. The Great Depression made it all too clear that the economy's equilibrium could change quickly and drastically even though most of the component parts, such as the number of workers, the capital stock, technology, natural resource availability, etc. changed hardly at all over the short run. The Great Depression of the 1930s shifted economists' priorities away from the component parts to how the overall system performed. Keynes, effectively created the field that we know today as macroeconomics when in 1936 he published *The General Theory of Employment, Interest, and Money.* In it, he presented a model that explicitly showed how the major components of the economy interacted to affect economic aggregates such as gross domestic product and the level of employment. Keynes' model explained the failure of most of the world's major economies to achieve market-cleaning equilibria in the product and labour markets.

7.2 The Basic Keynesian Macroeconomic Model

The urgency of finding a solution to the very high levels of unemployment that plagued most economies during the Great Depression made Keynes' book an instant success. The *General Theory* pointed to clear policy prescriptions for dealing with economic recession

and high unemployment. Fundamentally, Keynes disputed the conventional wisdom that the whole economy always moves promptly toward a full-employment equilibrium. Keynes admitted that if we wait long enough, full employment might eventually be restored. But, "in the long run, we are all dead", he added. He used his model to show that the long run could be very long. Also, he showed that policymakers could do more than wait for markets to slowly adjust back toward full employment.

A weakness of early versions of the Keynesian model was its focus on an individual, closed economy. This may have been appropriate in 1936, but the post-World War II economy was characterized by what we now refer to globalization. The world economy recovered from World War II, and by 1960 international trade and investment were growing more than twice the rate of the equally impressive growth in real per capita GDP in most countries. This weakness of the Keynesian model was corrected by Fleming (1962) and Mundell (1963). Their expanded Keynesian model is now known as the Mundell–Fleming open-economy macroeconomic model. Since the latter is a straightforward extension of the closed-economy Keynesian model, this section begins with the latter, and subsequent sections then "open" the Keynesian model.

7.2.1 *Basic elements of the closed economy Keynesian model*

Keynes' key contribution to macroeconomics was to separate aggregate demand into a few aggregate categories of activity that could reasonably be described as functions of specific sets of explanatory variables peculiar to each category of activity. This was a more practical approach than Walras' huge model of countless equations representing all the microunits of an economy. Keynes then used his system of aggregate categories of economic activity to prescribe the broad macroeconomic policies to increase production and employment. Among the macroeconomic policies that Keynes suggested for stimulating economic activity at the depth of the Great Depression were increased government spending, tax reductions, and money supply expansion.

Keynes first specified total output, Υ, as the sum of three categories of products:

$$\Upsilon = C + I + G \tag{7.1}$$

The variable C represents consumption goods, I represents investment (capital) goods, and G represents the government purchases. Keynes then specified functions that determined each of these three components of aggregate demand.

7.2.2 *The consumption function*

Central to Keynes model is his *consumption function*. He reasoned that consumption is not only a component of aggregate demand, but because aggregate demand translates into aggregate income, it is itself a function of aggregate demand. But, an increase in income raises consumption by only a fraction of the increase in income.

Keynes defined the consumption function as $C = C(\Upsilon)$ in general, but in his book he specified a linear relationship

$$C = a + b\Upsilon \tag{7.2}$$

in which $a > 0$ and $0 < b < 1$. Keynes called the variable b, the slope of the line, the *marginal propensity to consume*, which is the percentage of each additional dollar of income spent on consumption. Figure 7.1 illustrates the consumption function $C = a + b\Upsilon$. When income is zero, consumption is equal to a. Keynes also hypothesized that an increase in income raises consumption by only a fraction of the increase in income.

7.2.3 *The* I *and* G *functions*

The demand for investment goods and services is usually assumed to be a decreasing function of the interest rate, i. That is, $I = I(i)$, and the derivative of I with respect to i is $I'(i) < 0$. The causal variable i is not shown on the axes in the two-dimensional diagram in Fig. 7.2, and therefore the investment function appears as a straight line, unrelated to the level of income. The level of the I line reflects a

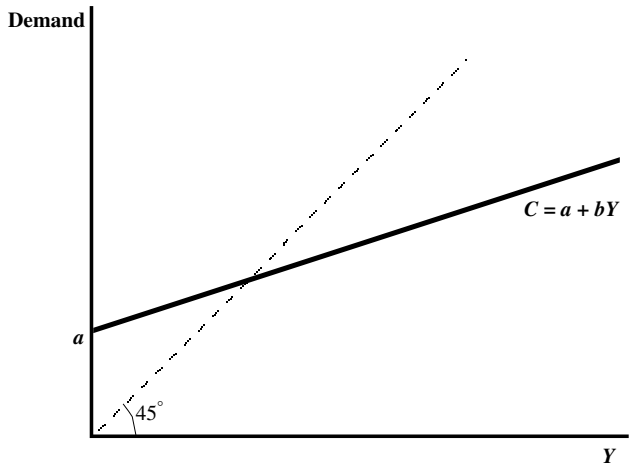

Figure 7.1 The simple Keynesian consumption function.

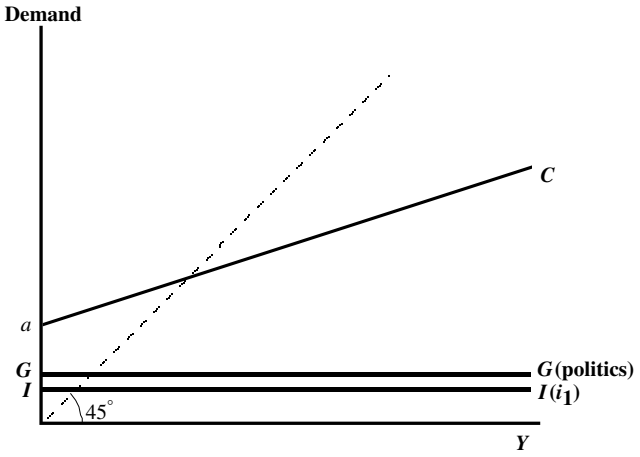

Figure 7.2 The demand for investment goods and government goods and services.

particular interest rate, say i_1. A rise in the interest rate to $i_2 > i_1$ would shift the investment function downward.

The demand for government goods and services is assumed to be a function of the complex political process, and here we accordingly specify the government purchases function as $G = G(\text{politics})$.

In Fig. 7.2, G is drawn as a straight line, unresponsive to Y but responsive to variables that lie in other dimensions.

The economy is in equilibrium when aggregate demand, $C(Y) + I(i) + G$, equals aggregate production, Y. In Fig. 7.3, equilibrium Y^* occurs at the level of output, where aggregate demand intersects the 45° line, which represents all the points that are equidistant from each axis. This diagram illustrates what is commonly referred to as the *Keynesian cross.*

The equilibrium level of output Y^* in Fig. 7.3 is a *stable equilibrium* in the sense that whenever the economy is not in equilibrium, variables will adjust so as to move the economy back to equilibrium. For example, when $Y < C + I + G$ and the aggregate demand curve lies above the 45° line, aggregate demand exceeds aggregate income and supply, and there will be shortages of goods and services. Keynes reasoned that such shortages will induce profit-seeking producers to employ available resources to increase production, and they will continue to increase production until the economy reaches Y^* and excess demand disappears. Similarly, if $Y > C + I + G$, aggregate demand is less than income and aggregate supply, and there will be an

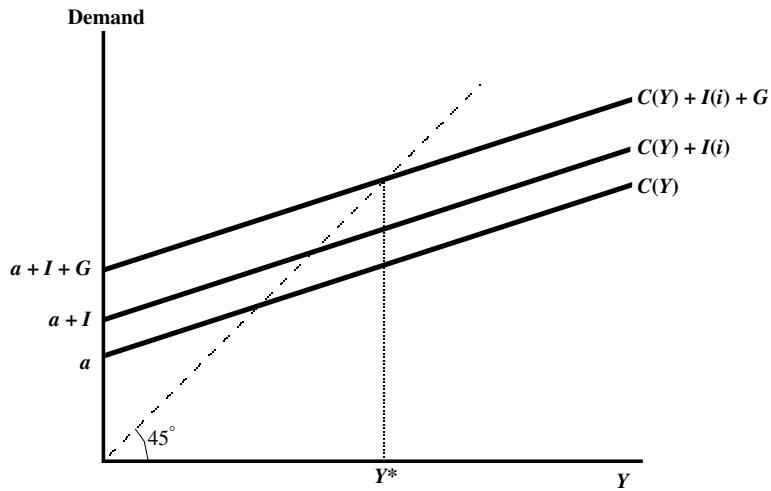

Figure 7.3 The Keynesian equilibrium, where $Y = C + I + G$.

unintended accumulation of inventory. Hence, producers will reduce output until the excess inventory is cleared.

By letting aggregate demand determine the equilibrium level of output in the economy, Keynes effectively assumed that there is no scarcity of resources and that producers can expand output at will and at constant marginal costs. This assumption of no supply constraints is what has led some critics of the Keynesian model to label it a "depression model". Clearly, in the Great Depression, there were few supply constraints when unemployment exceeded 20 percent of the labor force. In the long run, of course, economies are very much constrained by both the availability of resources and the prevailing level of technology. These issues are addressed in another model, the aggregate demand/aggregate supply model, discussed in Chapter 9.

7.3 Opening the Product Market to International Trade

An open economy differs from a closed economy in that goods and services can cross the border. That is, foreigners demand part of the economy's output, which results in exports. And, part of aggregate demand is satisfied by foreign production, that is, imports. The demand for imports consists of some mixture of consumption, investment, and government products, and it therefore depends on the level of income, the interest rate, and the other determinants of C, I, and G. Mundell and Fleming pointed out that in an open economy, foreign demand for exports and domestic demand for imports depend on the exchange rate, as well as foreign and domestic income, because the exchange rate translates the foreign currency prices of foreign products into domestic currency prices.

The Mundell–Fleming model assumes that, given the level of income and the interest rate, domestic demand for imported goods and services increases with a depreciation of the domestic currency. Hence, the import demand function is specified as $IM = IM(Y, i, e)$. In a two-dimensional diagram that relates only the level of domestic income, Y, to aggregate demand, the import demand function IM slopes upward, like the consumption function. The curve IM

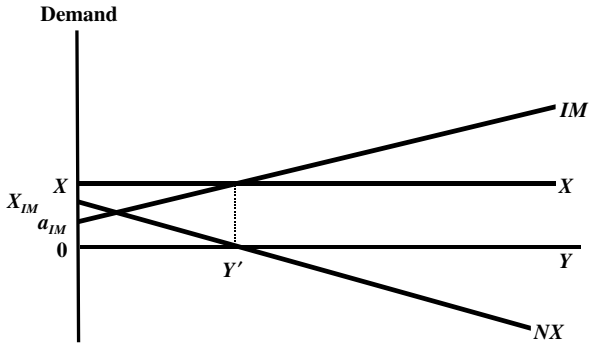

Figure 7.4 The demand for net exports: $NX = X - IM$.

shifts downward with an increase in the interest rate, i, and it shifts up when the exchange rate appreciates. Figure 7.4 illustrates the *IM* curve.

Exports, X, depend on foreign income, the foreign interest rate, and the exchange rate. That is, $X = X(\Upsilon^*, i^*, e)$, where the starred variables Υ^* and i^* are the foreign equivalents of Υ and i in earlier equations. Thus, the export function is a straight line in the Keynesian cross diagram. The X curve shifts down with an increase in i^* and up with an increase in Υ^* or e.

The net export function, NX, represents the difference between the horizontal X function and the upward sloping IM function:

$$NX = X(\Upsilon^*, i^*, e) - IM(\Upsilon, i, e) = NX(\Upsilon, \Upsilon^*, i, i^*, e) \qquad (7.3)$$

The NX function is the downward sloping NX line shown in Fig. 7.4. Imports grow as income rises while exports are unaffected by domestic income; hence, net exports accordingly decreases with domestic income Υ. NX crosses the horizontal axis at Υ' where $X - IM = 0$. Technically, the exchange rate should be depicted as the real exchange rate, or eP^*/P, but because the simple Keynesian model assumes prices remain constant in the short run, changes in the real exchange rate are

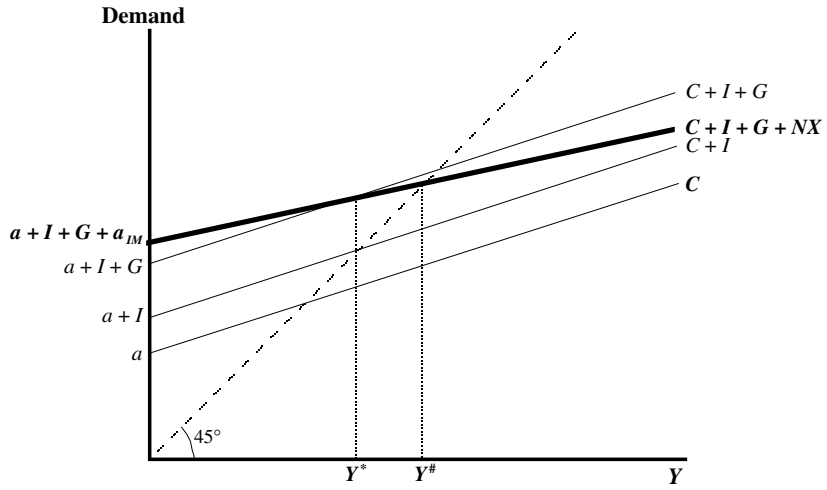

Figure 7.5 Aggregate demand in an open economy: $\Upsilon = C + I + G + NX$.

caused by only changes in e; hence, we show only e in equation (7.3). In an open economy, therefore, total product demand is equal to

$$\Upsilon = C(\Upsilon) + I(i) + G + NX(\Upsilon, i, \Upsilon^*, i^*, e) \tag{7.4}$$

The open-economy Keynesian cross diagram in Fig. 7.5 shows that the product market is in equilibrium at $\Upsilon^{\#}$, where the $C + I + G + NX$ curve intersects the 45° line. The open-economy aggregate demand curve, $C + I + G + NX$, crosses the closed economy $C + I + G$ curve at Υ', where NX is equal to zero.

7.4 The Mundell–Fleming Open-Economy Keynesian Model

The "Keynesian cross" diagram does not represent the complete macroeconomic model developed by Keynes. Rather, it depicts only the product market in the macroeconomic model Keynes developed in *The General Theory of Employment, Interest and Money*. In his

complete model, Keynes specified the economy as consisting of three aggregate markets: (1) the *product market* of the economy, (2) the *money market*, and (3) the *asset market*. Mundell and Fleming added the *foreign market*, which is represented by the balance of payments.

7.4.1 *The product market and the IS curve*

It is inaccurate to talk about an equilibrium in the Keynesian cross diagram, which illustrates only the *product market*, without also taking into consideration the money market, the asset market, and the foreign market. Each of these markets tends toward its respective equilibrium, subject to its peculiar shocks and the determining variables. All four markets are interrelated, and equilibrium in one market depends on the equilibria in the other three markets. Figure 7.6 illustrates how, for example, changes in the interest rate, caused by shifts in the asset market and the money market, shift the equilibrium in the product market.

Figure 7.6 depicts three levels of aggregate demand, each related to one of three interest rates: $i_1 < i_2 < i_3$. For example, where i_1 is associated with the equilibrium level of output/income Y_3, the higher

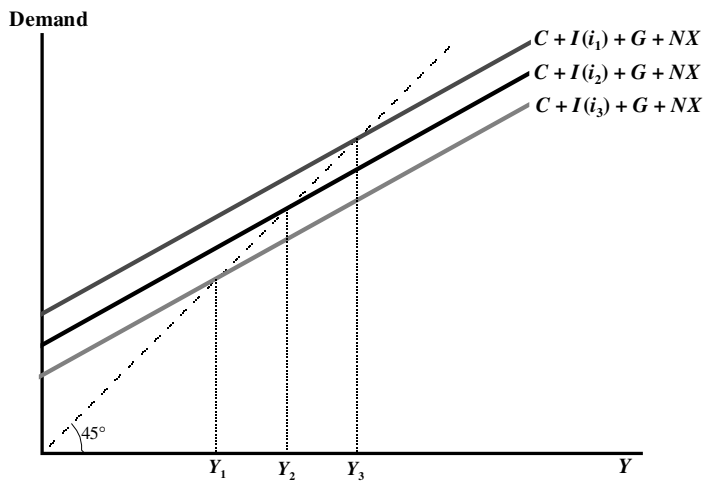

Figure 7.6 Aggregate product demand under different interest rates.

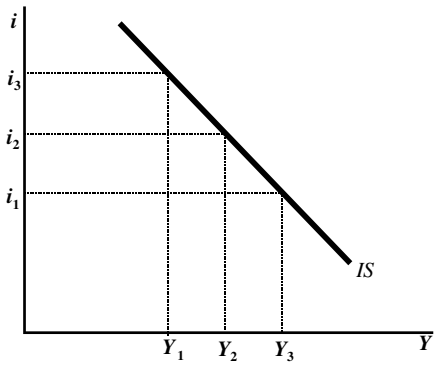

Figure 7.7 The IS curve.

interest rate i_2 implies lower investment, and thus lower aggregate demand and a lower equilibrium level of income Υ_2. The highest interest rate i_3 is related to the lowest of the three levels of output/income Υ_1. The relationship between interest rates and output in the product market is depicted in Fig. 7.7 as the *IS* curve, whose name is derived from the equality of saving and investment that implicitly holds at the level of output where the aggregate demand curve intersects the 45° line.

For example, suppose the domestic currency depreciates. All other things equal, this shifts the *NX* function from *NX* to *NX′*, which, in turn, shifts up aggregate demand in the Keynesian cross diagram. That is, the rise in the *NX* component of aggregate demand increases the equilibrium level of output at each interest rate. In Fig. 7.8, currency depreciation means each of the three interest rates $i_1 < i_2 < i_3$ now corresponds to the equilibrium output levels Υ'_3, Υ'_2, and Υ'_1, respectively, where $\Upsilon'_3 > \Upsilon_3$, $\Upsilon'_2 > \Upsilon_2$, and $\Upsilon'_1 > \Upsilon_1$.

Figure 7.9 details the effect a currency depreciation on the IS curve. A depreciation changes the sets of matching the pairs of interest rates and equilibrium output levels. After the depreciation, the foreign trade balance function *NX′* traces out the *IS′* curve, which lies to the right of the original *IS* curve, as illustrated in Fig. 7.9. That is, a depreciation of the domestic currency shifts the *IS* curve to the right. An appreciation would, of course, shift the *IS* curve to the left.

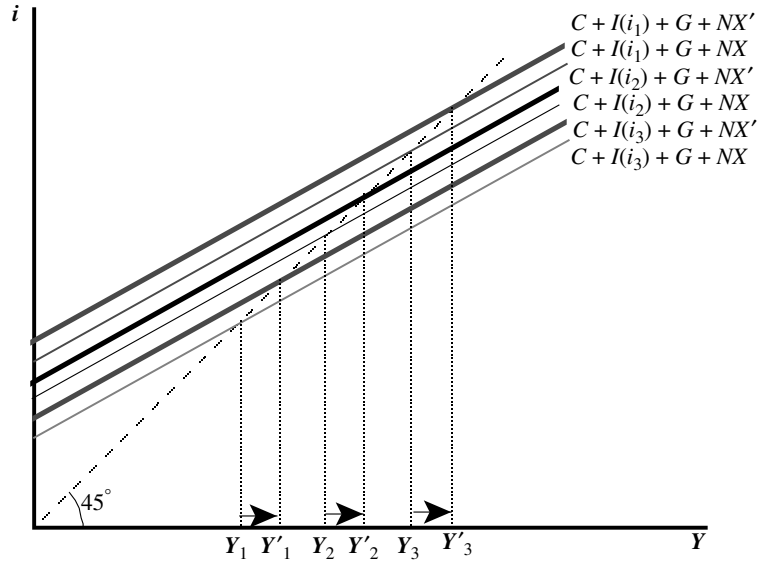

Figure 7.8 An increase in the trade balance.

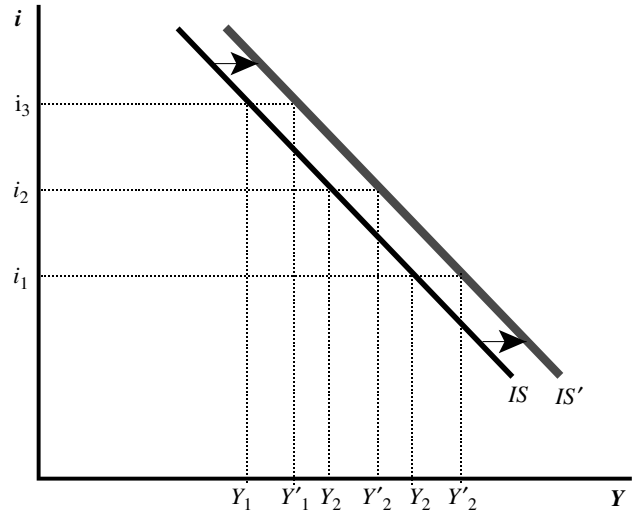

Figure 7.9 The IS curve after a shift in the consumption function.

7.4.2 *The money market and the LM curve*

The money market is in equilibrium when the supply of money, M, is equal to the demand for money, L. The supply of nominal money, M, is a policy decision, put into effect by the central bank. Here, the demand for money is assumed to reflect two principal motives for holding money: the *transactions motive* for holding money and the *store of wealth motive* for holding money.

The transactions motive for holding money means that the demand for money rises with the level of output Y. The store of wealth motive for holding money is more complex. People store wealth because there are welfare gains from satisfying wants as they actually occur rather than only when income happens to arrive. A store of wealth allows people to engage in what is often referred to as *consumption smoothing*, but this requires the transfer of purchasing power from one period of time to another. Money is unique in satisfying the transactions motive (assuming barter is not a viable option), but it competes with other assets as a store of wealth. Holding money has an opportunity cost, namely the rate of return paid by other assets that also serve as a store of wealth. The demand for money is thus inversely related to the rate of return paid by other assets. The demand for money is thus specified by the function $L(Y, i)$; demand rises with income and falls with the interest rate (the return to other assets).

Figure 7.10 relates money demand and the interest rate. The demand curve for money is downward-sloping with respect to the interest rate i, and the entire curve shifts up as Y increases from Y_1 to Y_2 to Y_3.

Combining the interest rates and output levels at which the money market is shown to be in equilibrium in Fig. 7.10 gives us the *LM* curve in Fig. 7.11. All other things equal, higher output levels require more money to carry out the increased level of transactions. If the real money supply, M/P, is held constant by the central bank, the price of assets falls (the interest rate rises) as individuals attempt to sell the assets to increase their money holdings. The interest rate must rise until the opportunity cost of holding money has increased

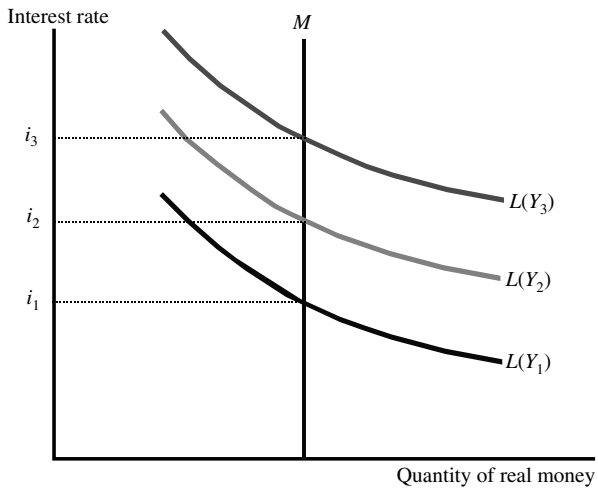

Figure 7.10 Equilibrium in the money market.

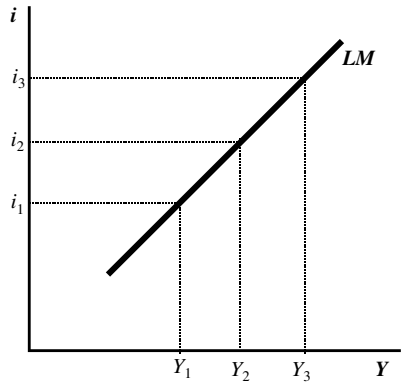

Figure 7.11 The *LM* curve: balancing the opportunity cost of holding money with transactions motive for holding money.

enough to raise the velocity of money to where the larger number of transactions can be carried out with the fixed stock of real money.

Monetary policy determines the supply of money, *M*. If prices remain unchanged, then a shift in *M* changes the real money supply

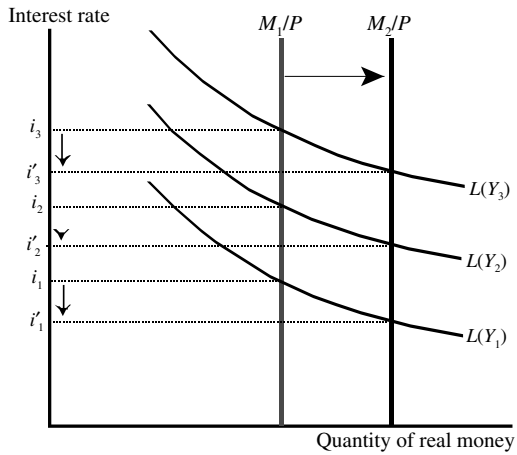

Figure 7.12 An expansion of the money supply.

M/P, and this will, in turn, cause the *LM* curve to shift. For example, an increase in the nominal money supply from M_1 to M_2 will establish a new set of combinations of output and interest rates where the money market is in equilibrium. This case is illustrated in Fig. 7.12. At the real money supply M_1/P, the money market will be in equilibrium at interest rates $i_1 < i_2 < i_3$ when equilibrium output in the product market is Y_1, Y_2, and Y_3, respectively. But if the central bank increases the real money supply to M_2, the money market will be in equilibrium when interest rates $i'_1 < i_1$, $i'_2 < i_2$, and $i'_3 < i_3$ are matched with equilibrium output levels Y_1, Y_2, and Y_3.

By matching the pairs of interest rates and equilibrium output levels when the real money supply is M_2/P, we define an *LM* curve that lies to the right of the *LM* curve that represents the equilibrium combinations of interest rates and output levels when the real money supply is M_1/P. As shown in Fig. 7.13, an increase in the supply of real money shifts the *LM* curve to the right. Specifically, at each level of output, an increase in the money supply lowers the interest rate required to balance the money demand and money supply.

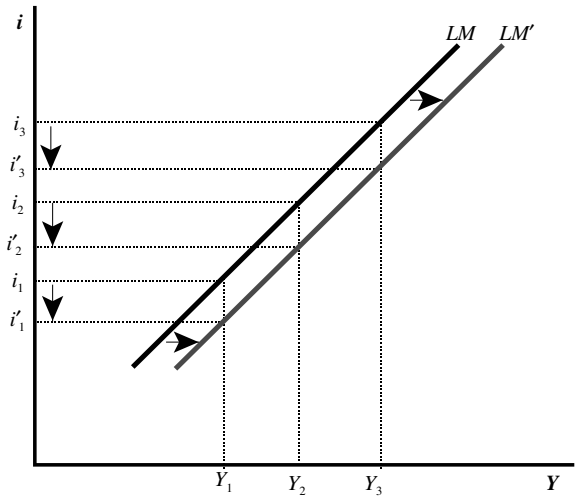

Figure 7.13 Expanding the money supply shifts the *LM* curve to the right.

7.4.3 *The financial account balance*

At this point, we begin applying the innovations brought into the model by Mundell and Fleming. Specifically, we introduce the foreign exchange market into the model. Supply and demand in the foreign exchange market is generated by the international transactions detailed in the balance of payments account. The Mundell–Fleming model focuses on two broad categories of international payments: (1) the trade balance in the current account and (2) the net international exchange of assets in the financial account. The Mundell–Fleming model simplifies by ignoring the smaller flows of international transfers, factor income payments, and asset returns.

Investors seeking to maximize the returns on their wealth are assumed to weigh the relative returns at home and abroad. Asset purchases and sales are part of the process of intertemporal arbitrage, which clearly reflects the variables in the interest parity condition, including the spot, forward, and/or expected future exchange rates. Therefore, the asset purchases and sales registered in the financial account (*FAB*) of the balance of payments depend on the domestic

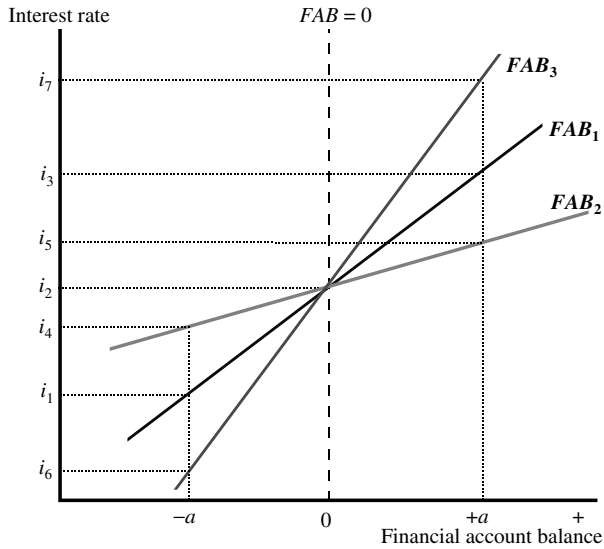

Figure 7.14 The financial account balance (*FAB*) depends on capital mobility.

and foreign interest rates (rates of return) as well as the spot and the expected future exchange rate:

$$FAB = FAB(i, i^*, e_t, E_t e_{t+n}) \tag{7.4}$$

Figure 7.14 depicts alternative graphic representations of the financial account balance, *FAB*, in a two-dimensional diagram relating the *FAB* to the domestic interest rate. In general, the *FAB* curve slopes up in relation to the interest rate, and the steepness of the slope depends on how strongly capital flows are influenced by changes in interest rates. If it only takes slight increases in the interest rate to induce the large new inflows of foreign capital or the repatriation of domestic capital previously sent abroad, then the *FAB* curve will be relatively flat, like FAB_2 in Fig. 7.14. On the other hand, if there are many restrictions on international capital flows, such as restrictions of foreign ownership, poor protection of property rights, foreign restrictions on capital outflows, etc., then the *FAB* curve may look more like FAB_3. FAB_1 represents the intermediate case. When capital is *mobile*,

the financial account increases from a to $+a$ with an interest rate rise from i_4 to i_5. However, if capital flows are relatively *immobile*, it takes the much larger increase in the interest rate from i_6 to i_7 to achieve the same increase in the financial account balance from a to $+a$.

The vertical dotted line in Fig. 7.14, $FAB = 0$, depicts the extreme case of complete capital immobility. This implies the case where a country or countries do not permit asset trade to vary and respond to changes in relative rates of return. Later chapters will detail cases where financial account transactions were tightly controlled. There is also the case of perfect capital mobility; such a case implies a near-horizontal *FAB* curve so that a very small rise in the interest rate generates a seemingly unlimited capital inflow. Such a case is only relevant to a small economy whose capital inflows or outflows have no discernable affect on world interest rates. For large economies like China, Japan, Germany, or the United States, changes in international capital inflows or outflows will almost always have some noticeable effect on interest rates elsewhere in the world. This is not to say that capital flows do not temper the effect of domestic imbalances on interest rates; for example, many studies have shown that US interest rates have remained surprisingly low despite the huge gap between savings and investment. But neither do these studies show that interest rates did not rise at all; some interest rate increases were likely to have been necessary to induce the net capital inflows shown on the US financial account over the past two decades.

7.4.4 *The current account balance*

The Mundell–Fleming model assumes the current account balance is equivalent to the trade balance, defined as NX in the aggregate demand equation (7.4). The model specifies the current account balance as a direct function of the level of domestic output, Y, and the exchange rate, e_t and a negative function of foreign income, Y^*. All other things equal, the higher the level of domestic output, the smaller is the current account balance.

Figure 7.15 depicts the current account *deficit*, *CAB*, as an increasing function of the level of Y. The slope of this function

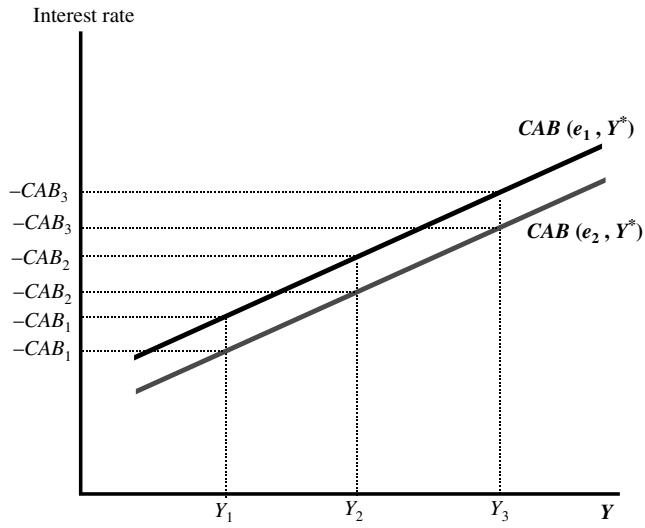

Figure 7.15 The *CAB* curve: The higher Υ, the greater the *CAB* deficit.

depends on how imports react to domestic income changes. All other things equal, the greater the propensity to consume imports, the steeper the slope of the *CAB* curve. Other variables behind the *CAB* curve affect the position of the curve in the i/Υ space. For example, a depreciation of the exchange rate will shift the entire *CAB* curve downward and to the right because depreciation is assumed to cause exports to rise and imports to fall, all other things equal, thus causing the current account deficit to shrink. Figure 7.15 depicts the case of a rise in e from e_1 to e_2. Such a depreciation shifts the *CAB* curve down, so that the current account deficit is smaller for each level of output/income Υ.

7.4.5 *The BOP curve*

Having now specified both the financial account balance and current account balance functions, it is possible to derive a full balance of payments (*BOP*) function to represent the fourth market, the *foreign market*, in the Mundell–Fleming open-economy

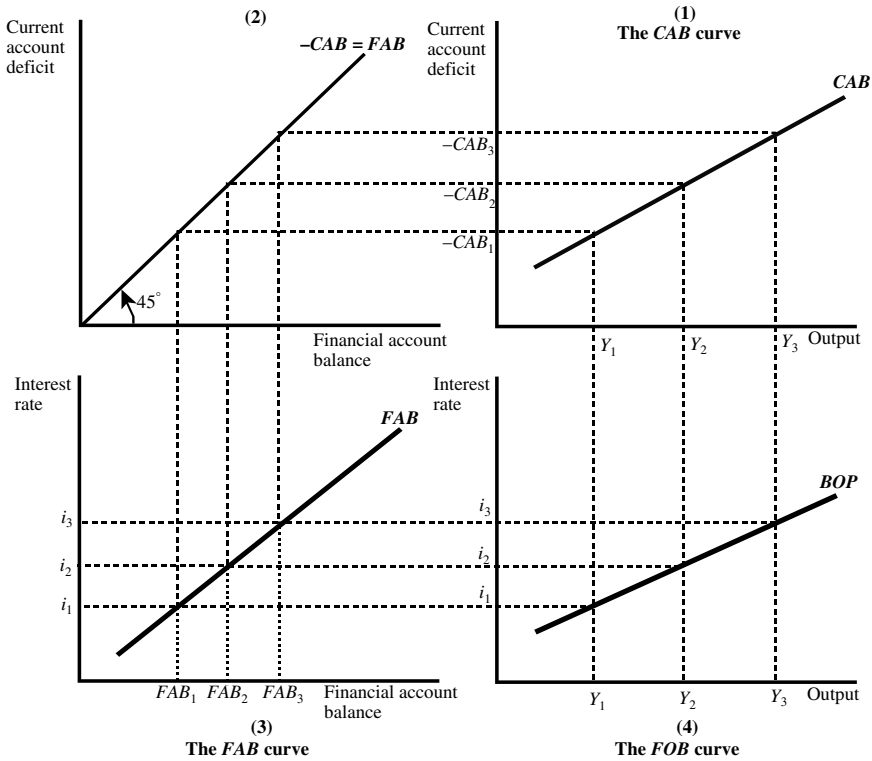

Figure 7.16 Equilibrium in the foreign market: The *BOP* curve.

macroeconomic model. The four diagrams in Fig. 7.16 show how the *BOP* function is related to the *CAB* and *FAB* curves. The *CAB* function in diagram (1), the accounting identity $CAB = FAB$ in diagram (2), and the *FAB* function in diagram (3) combine to trace out the *BOP* curve in diagram (4). The *BOP* curve relates the levels of output Υ and interest rates i compatible with the balance of payments where $BOP = CAB + FAB = 0$.

The slope of the *BOP* curve depends on how capital flows react to interest rate changes and how net exports react to changes in income. Figure 7.17 presents three alternative scenarios. All other things equal, if capital does not move easily between countries so that it takes a large change in interest rates to induce a change in the financial

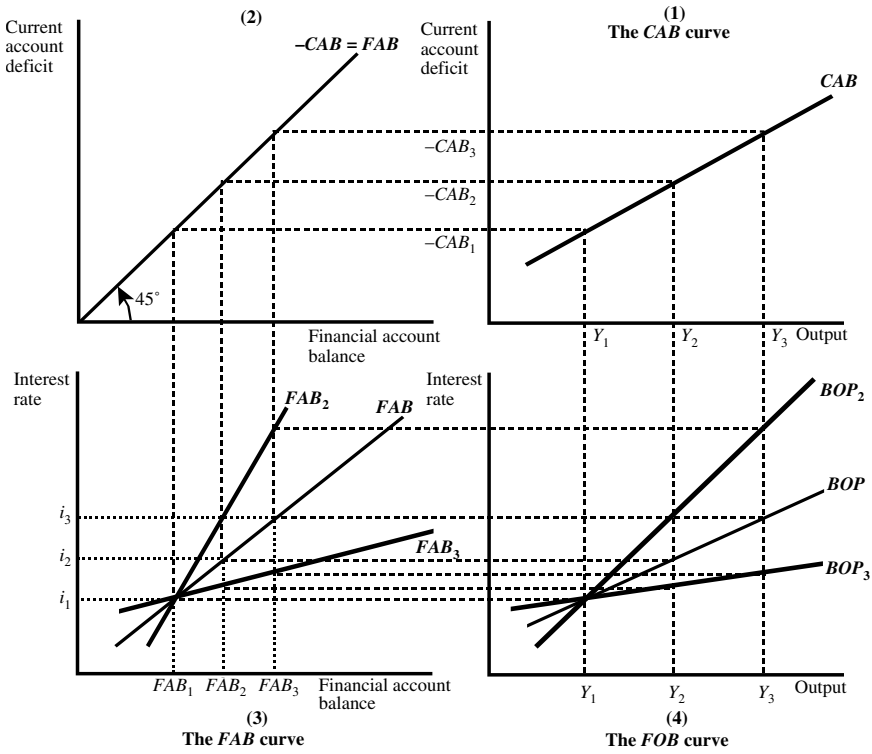

Figure 7.17 Capital mobility and the *FAB* curve.

account balance, then the *FAB* curve will tend to be relatively steep. This case is represented by the relatively steep curve FAB_2 in Fig. 7.17 and the corresponding relatively steep BOP_2 curve. On the other hand, if capital moves easily between countries, then a small change in interest rates induces a large enough change in the financial account balance to offset the effects on the current account of a rise in Y. This case is represented in Fig. 7.17; a flatter FAB_3 curve translates into the flatter BOP_3 curve.

Different slopes of the *CAB* curve similarly translate into changes in the steepness of the *BOP* curve. As shown in Fig. 7.18, a country that is open to trade and spends a high proportion of its marginal income abroad will tend to have a steep *BOP* curve, all other things equal.

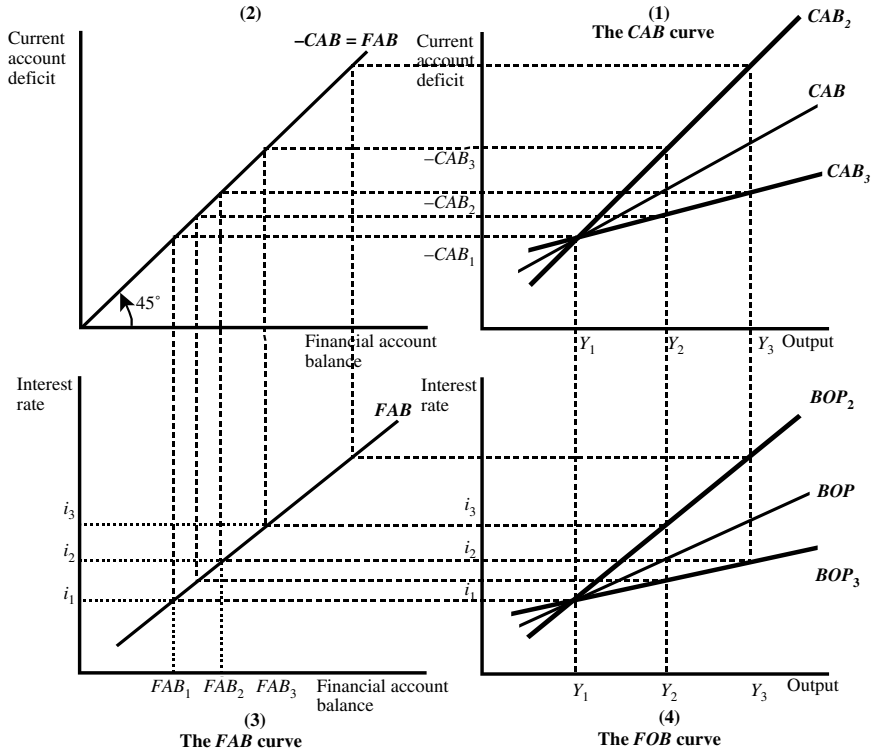

Figure 7.18 The propensity to import, the *CAB* curve, and the *BOP* curve.

The slope of the *BOP* curve is important because it helps to determine how an economy adjusts to shifts in economic circumstances. For example, when output rises from Y_1 to the full employment level Y_3 in Fig. 7.19, a relatively flat BOP_M curve implies that a modest rise in the interest rate from i_2 to i_4 is enough to offset the declining current account balance caused by the rise in income. But, if capital is immobile and the steeper BOP_{IM} curve applies, it takes a large increase in the interest rate from i_1 to i_5 to offset the same decline in the current account balance when income rises to Y_3.

In the extreme case when there are rigid capital controls on capital flows or there is a state monopoly on asset trade, changes in the interest rate cannot cause changes in the financial account to offset

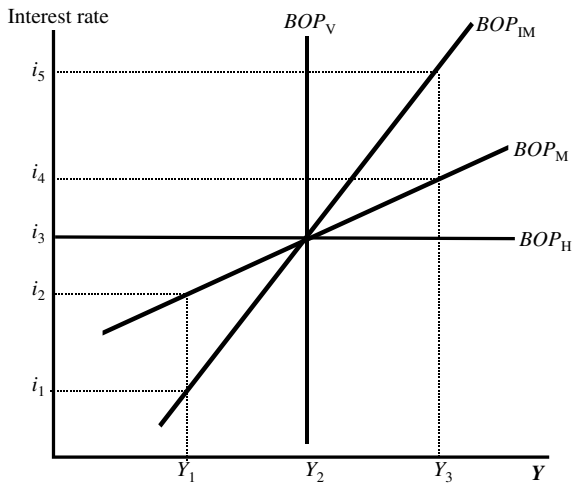

Figure 7.19 How steep is the *BOP* curve?

changes in the current account. When the *BOP* curve is perfectly vertical, as BOP_V in Fig. 7.19, any increase in output/income that increases the trade deficit necessarily pushes the overall *BOP* into a deficit. Contrast this with perfectly mobile capital represented by the horizontal BOP_H curve; in this case, a minuscule increase in the interest rate generates sufficient additional capital inflows to offset any decline in the current account caused by an increase in Y.

Note that points not on the *BOP* curve represent the combinations of i and Y that result in imbalances in international payments flows. A point above the *BOP* curve, such as the point a in Fig. 7.20, implies a balance of payments surplus because the interest rate is higher than what is necessary to generate the net financial account balance necessary to offset the current account balance related to the level of output/income Y_2. Under a regime of floating exchange rates, point a will cause the exchange rate to appreciate. A point below the *BOP* curve triggers an exchange rate depreciation. Under a fixed exchange rate regime, policies to stop such changes in the exchange rate will be called for.

Recall that the exchange rate e determines the height of the *CAB* curve, which in turn determines the height of the *BOP* curve.

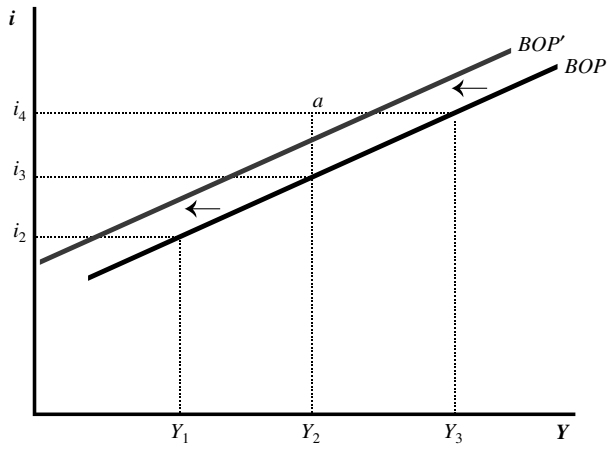

Figure 7.20 The *BOP* curve: adjustment to disequilibrium.

Appreciation changes the relationship between the interest rate and the output level by reducing the net exports at every level of income, thus shifting the *BOP* curve. Specifically, currency appreciation shifts the *BOP* curve to the left, as in the case of *BOP′* in Fig. 7.20, toward the disequilibrium point *a*. But will the exchange rate change enough to restore equilibrium in the foreign exchange market and the balance of payments? It may not have to.

The currency appreciation does more than shift the *BOP* curve. The *IS* curve also shifts because net exports, *NX*, are part of aggregate demand. Therefore, appreciation shifts both the *BOP* and *IS* curves. But now we are getting a bit ahead of the development of the model. To determine the complete set of adjustments necessary to restore the equilibrium in the economy when the product market undergoes a change, we must combine the money market, the asset market, and the foreign market into one model.

7.5 The Complete Mundell–Fleming Model

Figure 7.21 depicts the Mundell–Fleming model in its usual graphic form. Only three of the Keynesian model's four aggregate markets are

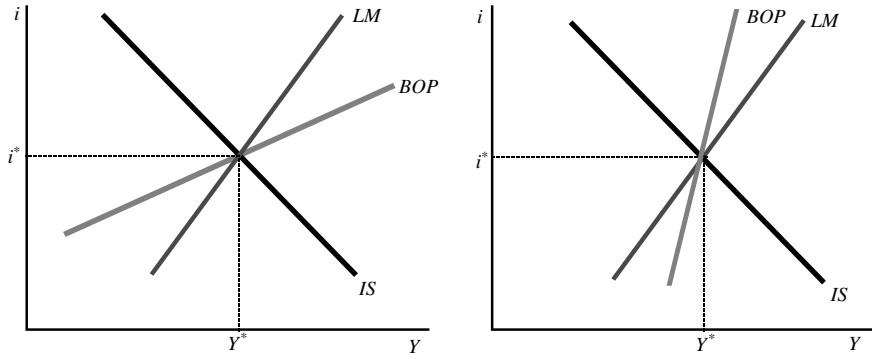

Figure 7.21 The full *IS*, *LM*, and *BOP* model: the two cases of mobile and immobile capital flows.

shown: (1) the goods market, (2) the money market, and (3) the *BOP* curve representing the foreign market. The fourth market distinguished by Keynes, the asset market, is not explicitly shown in the Mundell–Fleming model. The justification for this omission is *Walras' law* (named in honor of the 19th century French economist whom we earlier pointed out as having pioneered the use of mathematics for building large-scale economic models), which states that if n–1 interrelated markets are in equilibrium, then it must be the case that the nth market is also in equilibrium. The Keynesian model developed here thus leaves the asset market unobserved in the background. The asset market influences the other three markets by effectively providing the opportunity cost for holding money, which determines the demand for money in the money market and, therefore, the interest rate that influences the financial account in the foreign market and investment in the product market.

Recall that the slope of the *BOP* curve depends, in large part, on how easily money flows across borders in order to buy and sell foreign assets. Hence, Fig. 7.21 depicts two diagrams: the one on the left shows the Mundell–Fleming model when capital is relatively mobile, the other on the right shows a steep *BOP* curve representing the immobile capital. The analysis that follows will make it clear that an economy's adjustment to certain policy shifts depends on the

steepness of the *BOP* curve. In other words, the mobility of capital has important consequences for the effectiveness of economic policy.

Figure 7.21 shows all of the economy's markets in equilibrium at the interest rate i^* and the level of output/income Y^*. Is the intersection of three curves at the identical combination of interest rate i^* and output level Y^* just a fortuitous coincidence, or are there economic forces at work to maintain an overall equilibrium across all four markets? Further analysis shows that the Mundell–Fleming model is indeed stable in the sense that every disequilibrium triggers forces that shift one or more curves to make them all again intersect at a common point like the ones at i^* and Y^* in Fig. 7.21.

7.5.1 *The adjustment process*

For example, suppose that the interest rate is i^* and the level of output is Y^* in Fig. 7.22. Assume, also, that exchange rates are permitted to float. Notice that the product and money markets are in equilibrium at i^* and Y^*, but the balance of payments is in surplus. Recall that a combination of i and Y above the *BOP* curve causes the domestic currency to appreciate. As Fig. 7.20 showed, appreciation

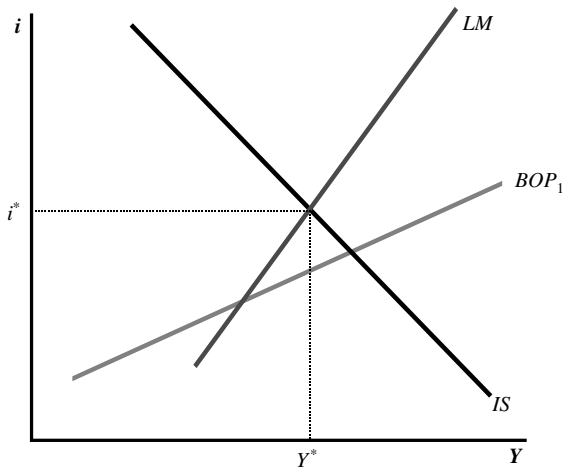

Figure 7.22 When the *BOP* is not in equilibrium.

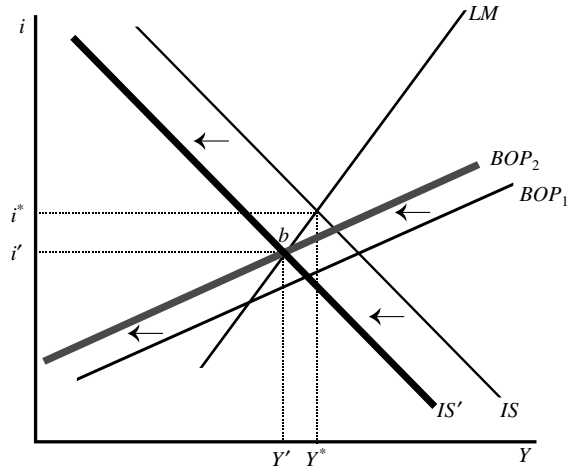

Figure 7.23 Returning to equilibrium by letting the exchange rate change.

shifts the *BOP* curve to the left because, for at every level of income, exports will be smaller and imports larger than before the appreciation. The *IS* curve also shifts because appreciation causes a decline in $X - IM = NX$, and this reduction in aggregate demand shifts the *IS* curve to the left.

The exchange rate appreciation caused by the disequilibrium in Fig. 7.22 shifts the *BOP* curve from BOP_1 curve to BOP_2 and the *IS* curve to *IS′* in Fig. 7.23. Currency appreciation continues until the *BOP* and *IS* curves have shifted far enough to restore equilibrium in all markets. Such equilibrium occurs at a lower interest rate and level of output/income than the unsustainable combination of i^* and Y^*. In the process, the lower interest rate causes investment to increase, but that decline only partially offsets the decline in net exports caused by the currency appreciation. Therefore, Y falls.

7.5.2 *Adjustment with pegged exchange rates*

The adjustment described in the previous paragraph assumed that exchange rates were allowed to float freely in response to changes in the supply and demand for foreign exchange. Suppose instead that

the government keeps the exchange rate pegged to a specific value by intervening in the foreign exchange market. Such currency market intervention was standard operating procedure for 25 years after the Bretton Woods Conference, when countries agreed to keep their currencies pegged to all other currencies. In this case, there is a different adjustment process.

Now, the central bank responds to the tendency for the currency to appreciate by buying the excess foreign exchange. In the process, the central bank supplies its own currency in the foreign exchange market to purchase the foreign currency. This intervention effectively increases the domestic money supply, and the *LM* curve shifts to the right, as in Fig. 7.24. The *IS* and *BOP* curves remain unchanged because the foreign exchange market intervention keeps the exchange rate the same. Note in Fig. 7.24 that, with only the *LM* curve shifting to correct the imbalance in the foreign market, the interest rate declines and the level of output/income increases. Output increases because the expansion of the money supply lowers the interest rate and stimulates investment activity, which is reflected by the economy's movement down along the stationary *IS* curve. The *IS* curve does not shift, however, because the other potential driver of aggregate demand, net exports, remains unchanged with the constant exchange rate.

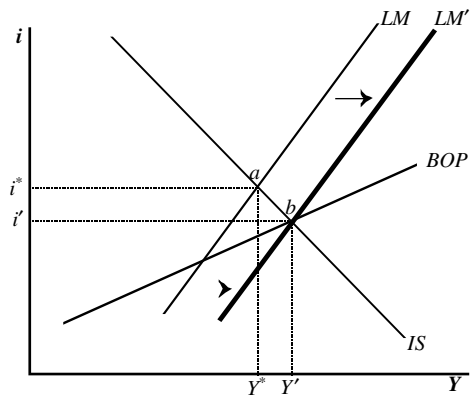

Figure 7.24 Adjustment under a fixed exchange rate.

In sum, the Mundell–Fleming model shows that an economy's adjustment to a disequilibrium depends on the type of exchange rate regime in which policymakers operate. In general, traditional macroeconomic policy tools such as fiscal and monetary policy had different effects on interest rates, output, and employment under the Bretton Woods-pegged exchange rate regime than they do in today's floating exchange rate environment. In the next section, we use the model to neatly categorize these different policy effects.

7.6 Fiscal and Monetary Policies in an Open Economy

The Mundell–Fleming open-economy macroeconomic model provides for a convenient analysis of how the two principal types of macroeconomic policy, *fiscal policy* and *monetary policy*, influence an open economy. The former encompasses the government's spending and taxation. The latter refers to the central bank's management of the economy's money supply. The analysis that follows shows that the macroeconomic consequences of fiscal and monetary policies depend critically on whether (1) exchange rates are permitted to float or the central bank intervenes to keep the exchange rate fixed and (2) the degree of international capital mobility. The two macroeconomic policies, fiscal policy, and monetary policy are analyzed across all combinations of floating exchange rates, fixed exchange rates, mobile capital, and immobile capital. There are, therefore, eight cases in all.

7.6.1 *Foreign exchange market intervention*

The Bretton Woods Agreement at the end of World War II mandated that every country's central bank carry out *foreign exchange market intervention* to keep the exchange rates fixed. Under the Bretton Woods system, as it actually came into practice, each of the world's central banks bought or sold US dollars in order to keep their currency within one percent of their currency's agreed-to target exchange rate with the dollar. Recall from Chapter 3 that when there are n currencies, there are only n–1 "fundamental" exchange rates, and triangular arbitrage keeps all other exchange rates compatible

with these n–1 rates. Under the Bretton Woods system, the dollar was designated as the nth currency; the US Federal Reserve Bank remained inactive, thus effectively letting the remaining central banks peg their currencies to the dollar. The Bretton Woods system was able to keep the exchange rates more or less constant among all major world currencies for the 25 years between 1946 and 1971.

A simple example illustrates market intervention. Recall the example of US dollars and Swiss francs from Chapter 3, illustrated here in Fig. 7.25. Suppose that instead of the equilibrium exchange rate of \$.50 shown in Fig. 7.25, policymakers in the United States and Switzerland want to keep the exchange rate at \$.40 per franc. This can be accomplished by having the Swiss central bank create 300 million francs and use them to buy the dollars. Figure 7.25 shows how such an increase in the supply of francs in the foreign exchange market drives the exchange rate down to \$.40.

Figure 7.26 shows the intervention from the Swiss perspective, with the exchange rate stated in terms of francs per dollar. The free market equilibrium exchange rate without intervention would take the exchange rate to $1/e = 1/0.50 =$ SFr2.00 per dollar in the market for dollars. The sale of francs by the Swiss central bank appears in Fig. 7.26 as an increase in demand for dollars, which keeps the demand curve intersecting supply at the target rate of SFr2.50.

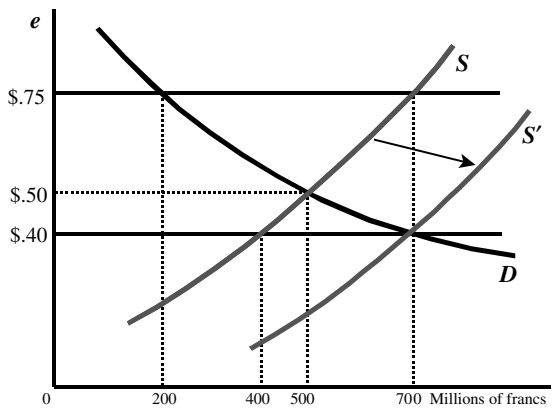

Figure 7.25 The foreign exchange market.

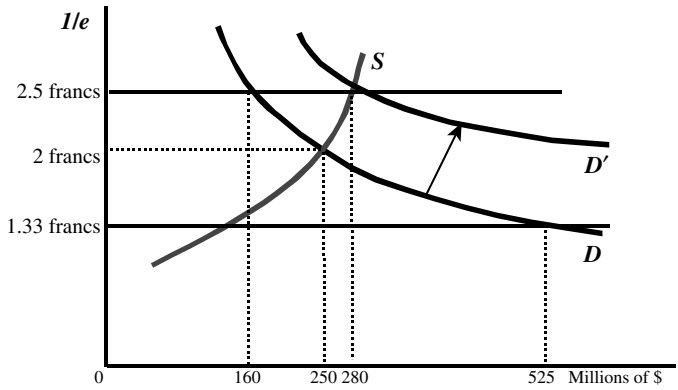

Figure 7.26 Foreign exchange market intervention from the Swiss perspective.

Intervention may not be as straightforward as the above example suggest, however. First of all, the required intervention may require the use of foreign exchange reserves rather than the creation of domestic currency. For example, if the target exchange rate in the example above is \$0.75 instead of \$0.40, the Swiss central bank would have to use reserves of dollars to buy francs. What if it runs out of dollars? The Swiss central bank cannot print dollars. In such a case, the Swiss central Bank would have to stop intervening and let the exchange rate deviate from the target-pegged rate.

The Swiss central bank does have another option for keeping the exchange rate from changing; however, it can tighten its monetary policy. A tighter monetary policy affects the spot exchange rate by raising Swiss interest rates and, possibly, lowering the rate of Swiss inflation. For example, by tightening the money supply and increasing interest rates, the Swiss central bank alters the ratio $(1 + r^*)/(1 + r)$ that links the spot exchange rate to expected future exchange rates. A higher r^* increases the ratio $[(1 + r^*)/(1 + r)]$ in the interest parity equation and thus, all other things equal, translates a given $E_t e_{t+n}$ into a higher spot rate e like \$0.75. Furthermore, the tighter monetary policy may convince people that there will be less inflation in Switzerland in the future and that they should therefore change their expectations about the future competitiveness of Swiss producers in

the world market and, hence, $E_t e_{t+n}$. Both the change in $[(1 + r^*)/(1 + r)]$ and $E_t e_{t+n}$ will tend offset people's decreased supply of dollars and demand for francs and may keep the exchange rate at \$0.75.

7.6.2 *The equivalence of monetary policy and exchange market intervention*

Actually, foreign exchange market intervention and monetary policy are fundamentally similar. Central banks normally manage the money supply by means of *open market operations*, which are purchases and sales of assets such as government bonds. In the example above, the Swiss central bank would reduce its money supply by selling bonds to the public, which are paid for by drawing down the purchasers' checking accounts and, therefore, reduces the amount of francs in circulation. There is nothing unique about government bonds when it comes to changing the amount of money in circulation, however. A central bank can decrease the amount of money in circulation by selling anything in its possession, not just bonds. The central bank could just as easily reduce the money supply by selling its headquarters building in Bern; the buyer would write a check on his or her account just as does the buyer of government bonds and thus trigger the same contraction in the amount of money in circulation. Or, the central bank could sell foreign exchange to the public!

Foreign exchange market intervention, therefore, *is* a form of monetary policy that alters the money supply. And, just like bond purchases under the typical open market operations, the central bank's selling of dollars to buy francs tends to raise the Swiss interest rates and reduces the expected inflation, thus helping to drive the franc price of dollars downs (or the dollar price of francs up).

The equivalence of exchange rate intervention and monetary policy makes it clear that a commitment to a pegged exchange rate can clash with a central bank's other goals, such as full employment, rapid economic growth, and price stability. The intervention required to maintain a fixed exchange rate may increase the inflation or raise the unemployment. This is not to say that there are no important advantages to keep the exchange rates *fixed*. The volatility and uncertainty

of *floating* exchange rates makes international trade and investment more risky and, therefore, less attractive. Also, changing exchange rates can have very large wealth effects when people own assets or owe debt denominated on currencies other than their own, and these wealth effects can have recessionary or inflationary macroeconomic effects. As will be discussed in the later chapters, efforts to keep the exchange rates from changing can cause financial crises and prolonged recessions that greatly diminish the human welfare. However, there is no avoiding the fact that the goal of keeping exchange rates fixed often results in specific monetary policies that clash with other macroeconomic goals. The analysis that follows further details how macroeconomic policies are restricted under a regime of fixed exchange rates maintained through foreign exchange market intervention.

7.6.3 *Monetary policy while pegging the exchange rates*

Figure 7.27 presents the case of expansionary monetary policy, say by means of open market operations in which it purchases Treasury bonds from the public, while exchange rates are fixed. The diagram shows both the case of immobile capital and mobile capital, as represented, respectively, by BOP_1 and BOP_2. In either case, when the

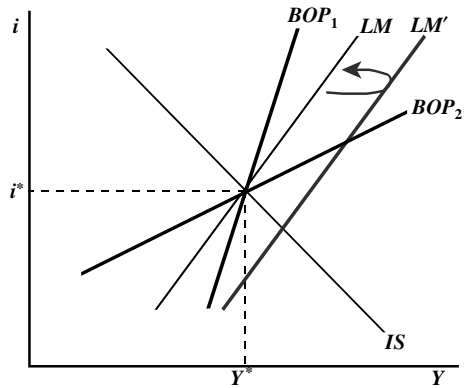

Figure 7.27 Monetary policy under a pegged exchange rate regime.

central bank carries out open market operations and increases the real money supply, the *LM* curve shifts to the right. Such a shift lowers the interest rate and raises the output to a combination below and to the right of the *BOP* curve. This causes the supply of the national currency to exceed its demand, and the exchange rate will depreciate. With instructions to prevent the exchange rate from changing, the central bank then has to intervene in the foreign exchange market by using foreign reserves to buy its national currency. This reduces the amount of currency in the hands of the public and shifts the *LM* curve back to the left. Intervention stops only when the *LM* curve is back where it started, exactly offsetting the monetary expansion. Specifically, the same amount of dollars that the central bank put into circulation when it purchased Treasury bonds are withdrawn from circulation when it sells foreign exchange to buy dollars in the foreign exchange market. The only difference is that now the central bank has more Treasury bonds and fewer foreign exchange reserves. Notice also that these results do not depend at all on whether the *BOP* curve is steep or flat.

Therefore, in both the mobile capital and immobile capital cases, if the central bank is instructed to keep the exchange rates fixed, it no longer has the freedom to carry out monetary policy to stimulate or contract output or to address other domestic policy objectives. The commitment to fix exchange rates takes away the central bank's freedom to carry out the monetary policy to address other policy goals such as full employment, low inflation, or output stability.

7.6.4 *Fiscal policy with pegged exchange rates*

Expansionary fiscal policy, say an increase in government expenditures, shifts the *IS* curve to the right. Like the shift in the *LM* curve under monetary policy, a fiscal policy shift moves the economy away from balance in its foreign payments, and the exchange rate will change. If the central bank is committed to keeping the exchange rate fixed, it will have to intervene in the foreign exchange market to compensate for the induced disequilibrium in foreign payments. Such intervention causes a de facto change in the money supply and, hence,

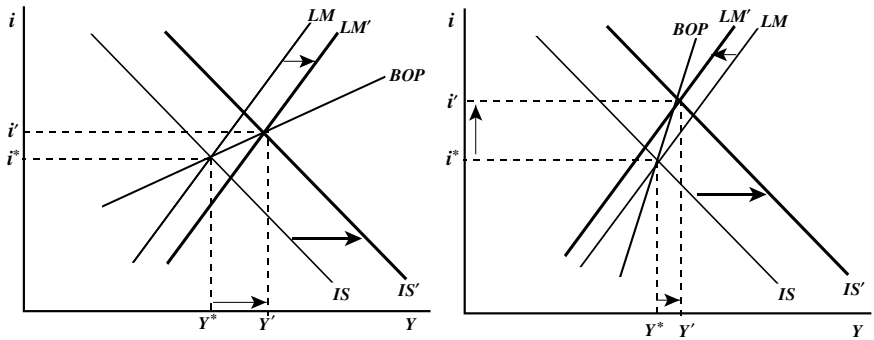

Figure 7.28 Fiscal policy under fixed exchange rates, comparing mobile and immobile capital.

a shift in the *LM* curve. In this case, the direction of the shift in the *LM* curve depends on how mobile capital is, how steep the *BOP* curve is relative to the *LM* curve.

As illustrated in the left-hand diagram in Fig. 7.28, if capital is mobile and the *BOP* curve is relatively flat, an initial shift to the right of the *IS* curve pushes the economy's interest rate/output combination above the *BOP* curve and the exchange rate begins to appreciate. To prevent the appreciation, the central bank begins buying foreign exchange and thus selling its currency on the foreign exchange market, and this increases the amount of dollars in circulation and, therefore, shifts the *LM* curve to the right. The amount of intervention required consists of selling enough currency to maintain equilibrium in the balance of payments and keep the economy on the *BOP*, which remains unchanged when the exchange rate is not allowed to change. Thus, the economy returns to equilibrium in all three markets shown in the diagram (and thus the fourth too), and the *BOP*, *LM′*, and *IS′* curves again intersect at one common point. The interest rate ends up having increased, and output also rises.

Compared to the case of mobile capital above, fiscal policy has a somewhat different effect on output and the interest rate when capital is immobile. The right-hand side of Fig. 7.28 shows that when the *BOP* curve is steeper than the *LM* curve, expansionary fiscal policy

moves the economy to a combination of output and interest rate to the right of the *BOP* curve, where the supply of the domestic currency exceeds the demand in the foreign exchange market and the currency begins to depreciate. Thus, to keep the exchange rate constant, the central bank must buy its currency in the foreign exchange market, which reduces the money supply and shifts the *LM* curve to the left. Because expansionary fiscal policy forces the central bank to contract the money supply when capital is immobile, output rises less and interest rates rise more than in the case of mobile capital.

In sum, in an international monetary system of fixed exchange rates, fiscal policy shifts affect the output less when capital is immobile than when capital is mobile, but, not surprisingly, interest rates are more volatile in the case of immobile capital. The analysis also shows clearly that in an open economy, fiscal policy has different effects than in a closed economy.

7.6.5 *Monetary policy with floating exchange rates*

When exchange rates are allowed to float freely and the central bank does not have to intervene in the foreign exchange market to keep the exchange rate fixed, the central bank can focus its monetary policy on other goals, such as full employment, price stability, and economic growth. Suppose that the central bank judges the level of unemployment to be too high and it undertakes open market purchases of government bonds to expand the money supply in the expectation that this will cause total aggregate demand, and hence output, to expand. Such an expansionary monetary policy causes a rightward shift of the *LM* curve, and as both diagrams in Fig. 7.29 show, the economy moves toward a new domestic equilibrium below and to the right of the initial *BOP* curve.

With the decision to let the exchange rates float freely, the central bank does not have to react to the depreciation of the national currency; it simply lets the currency depreciate. The case of expansionary monetary policy under floating exchange rates and mobile capital is presented in the left-hand diagram of Fig. 7.29. The rightward shift of the *LM* curve pushes the economy away from the *BOP* curve, and because the depreciation of the currency increases net exports, *NX*, in

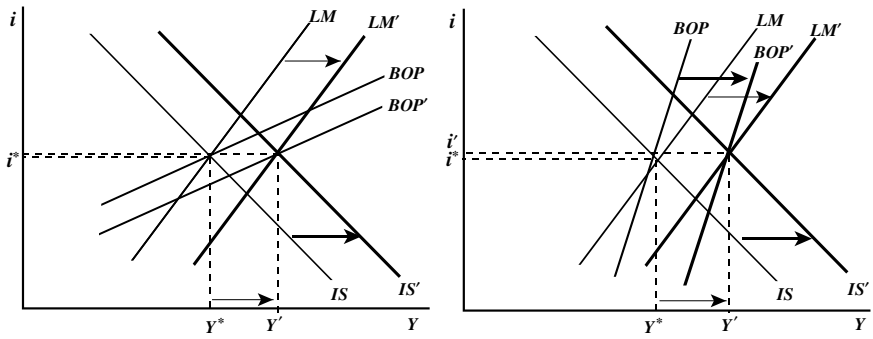

Figure 7.29 Monetary policy under floating exchange rates and immobile capital.

aggregate demand, the *IS* curve shifts to the right. The depreciation's effect on *NX* also shifts the *BOP* curve to the right. The relative shifts in the *IS* and *BOP* curves may depend on whether the monetary expansion is seen as permanent, so that the exchange rate is likely to remain depreciated for a long time, or temporary. If permanent, the *BOP* curve is likely to shift relatively less than the *IS* curve because the expected future depreciations will discourage capital inflows and at least partially offset the improvement in the trade balance. Since the *IS* curve is affected only by the growth in net exports, it will shift further than the *BOP* curve. Note from the left-hand diagram in Fig. 7.29 that if the *IS* curve shifts more than the *BOP* curve, expansionary monetary policy increase the equilibrium level of Y more.

The case of immobile capital illustrated in the right-hand diagram of Fig. 7.29 is similar to the mobile capital case. The monetary expansion shifts the *LM* curve from *LM* to *LM′*, which induces a currency depreciation that, in turn, causes net exports to increase and both the *IS* and *BOP* curves to shift to the right. The issue of whether the *IS* curve shifts more than the *BOP* curve is less important in the case of immobile capital, because the immobility implies that expectations about the permanence of expansionary monetary policy are likely to have little effect on capital movements. In any case, the new equilibrium where all three curves again intersect will involve an increase in Y. Note that the interest rate may increase or decrease.

The specific examples in Fig. 7.29 show the interest rate remaining about the same. Actually, depending on the strength of the shifts in the *BOP* and *IS* curves, the interest rate could increase or decrease modestly. However, output clearly expands in both cases. Also, compared to the case of fixed exchange rates, monetary policy is clearly more potent in raising output in the case of floating exchange rates because the expansionary monetary policy tends to keep the interest rates from rising when output increases.

7.6.6 *Fiscal policy with floating exchange rates*

To complete our analysis of macroeconomic policy in an open economy, we analyze fiscal policy in a regime of floating exchange rates. The left-hand and right-hand sides of Fig. 7.30 describe the cases when capital is mobile and immobile, respectively. Note that fiscal policy does not affect the *LM* curve because the central bank does not have to intervene in the foreign exchange market. Since we seek to isolate the effect of a shift in fiscal policy, we assume central bank monetary policy remains unchanged when fiscal policy changes.

In the case of mobile capital, illustrated in the left-hand diagram of Fig. 7.30, an expansionary fiscal policy that shifts the *IS* curve to *IS′* pushes the economy's equilibrium above and to the left of the relatively flat *BOP* curve. Therefore, the exchange rate appreciates and

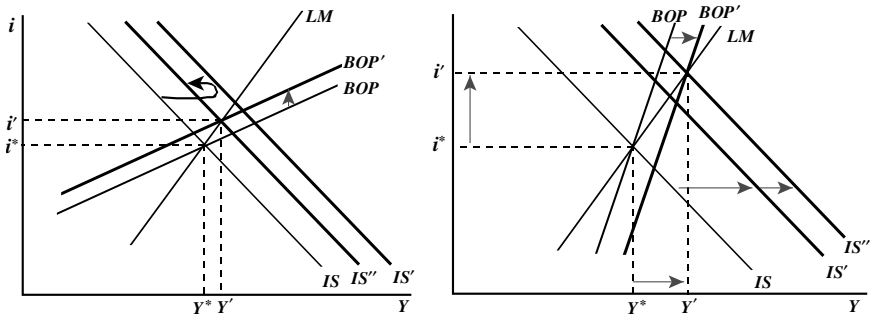

Figure 7.30 Fiscal policy under floating exchange rates, mobile and immobile capital.

the trade balance *NX* declines, which partially offsets the initial policy-mandated shift in the *IS* curve. The *IS* curve therefore only shifts to, say, *IS″*. Also, the *BOP* curve shifts upward when the currency appreciates. The economy establishes a new equilibrium at a point like Y' and i' in the left-hand side diagram. Output and employment are higher.

The case of immobile capital is illustrated in the right-hand side of Fig. 7.30. When expansionary fiscal policy shifts the *IS* curve to the right, the balance of payments goes into deficit and the currency depreciates. As a result, net exports increase and the *IS* shifts further to the right to *IS″*. The depreciation also causes the *BOP* curve to shift down and to the right. The new equilibrium is at Y' and i' in the right-hand side diagram.

A comparison of the two cases in Fig. 7.30 shows that fiscal policy is relatively more powerful in increasing output and employment when capital is immobile. In the case of mobile capital, expansionary fiscal policy causes the currency to appreciate, reducing the trade balance and, thus, aggregate demand, which offsets the initial fiscal expansion. In the case of immobile capital, expansionary fiscal policy causes a currency depreciation that further stimulates aggregate demand by improving the trade balance.

7.6.7 *Comparing macroeconomic policy in closed and open economies*

It is interesting to compare monetary and fiscal policy in open and closed economies to see whether globalization reduces or increases the strength of policymakers' traditional macroeconomic tools. Policymakers often deflect criticism of their management of their economies by claiming that the globalization has reduced their ability to influence the output and employment.

Table 7.1 compares the effect on equilibrium output of expansionary fiscal and monetary policies in closed and open economies under the eight cases discussed above. For each case, the comparable closed economy effect is the simple shift to the new intersection of the *IS* and *LM* curves, ignoring the follow-on effects of the shift in the

Table 7.1 Comparing the Fiscal and Monetary Policy in Closed and Open Economies.

	Fixed Exchange Rates		Floating Exchange Rates	
	Immobile capital	Mobile capital	Immobile capital	Mobile capital
Fiscal policy	Less effective	More effective	More effective	Less effective
Monetary policy	Completely ineffective	Completely ineffective	More effective	More effective

BOP curve or the mandated foreign exchange market intervention to avoid the *BOP* shift.

Table 7.1 shows that Mundell and Fleming's addition of the trade balance and financial account to the basic Keynesian model, in the form of the *BOP* curve and the augmented *IS* relationship, changes the potency of fiscal and monetary policy to pursue the policy goals such as increasing the economy's output and reducing the unemployment. But the differences vary across the policies and circumstances. Several results of the analysis stand out. First, in the case of fixed exchange rates, fiscal policy is more effective in changing the output than monetary policy. In fact, monetary policy is completely ineffective in changing either output or interest rates when the central bank is obligated to peg the exchange rate by intervening in the foreign exchange market. This result helps to explain the complaints from many central bankers in the 1960s, when the Bretton Woods system of pegged exchange rates was in effect, that they were powerless to respond to unemployment and inflation. Second, fiscal policy is more effective in managing the economy's level of output when the *BOP* curve is flat, that is, when capital is mobile and international trade is large relative to the individual economy. This helps to explain why fiscal policy is today seen as the main tool for managing the individual economies within the European Union, where the introduction of a single currency managed by a regional central bank has effectively eliminated monetary policy as a national policy option. Third, in the case of floating exchange rates and mobile capital, the case most

relevant for most policymakers operating in today's global economy, monetary policy is the more potent policy tool for maintaining full employment and price stability.

7.7 Does a Depreciation Improve the Trade Balance?

The Mundell–Fleming model assumes that the depreciation of a country's currency increases net exports and an appreciation decreases net exports. This assumption is what justifies shifting the *IS* and *BOP* curves to the right in the case of a depreciation, for example. This assumption seems reasonable to most people, but is it accurate? The legitimacy of this assumption depends critically on the elasticities of the import and export supply and demand curves.

For example, if foreign demand for a country's exports is very price inelastic, a depreciation of the country's currency will actually result in lower earnings of foreign exchange from exports. Then, if the domestic demand for imports is also very inelastic, so that the foreign currency cost of imports remains nearly unchanged after the depreciation, the balance of payments actually declines (the *BOP* curve may shift to the left) with a depreciation!

7.7.1 *The Marshall–Lerner condition*

If we also suppose that the foreign exchange value of exports is about equal to the foreign exchange value of imports, so that $X^* = IM^*$, then the following relationship must hold for a depreciation to increase a country's net exports:

$$(h_x + h_{im} - 1) > 0 \tag{7.6}$$

Equation (7.6) defines what is known as the *Marshall–Lerner condition*, which states that the sum of the elasticities of demand for exports, h_x, and imports, h_{im}, must be greater than one. This relationship is named for two prominent early 20th century economists, Alfred Marshall and Abba P. Lerner, who contributed to its derivation. When the Marshall–Lerner condition is satisfied, depreciation of its currency improves a country's balance of trade.

In the open-economy macroeconomics literature, economists often precede analysis that uses the Mundell–Fleming model by stating explicitly that "the Marshall–Lerner condition is assumed to be satisfied". They are effectively assuming that a currency depreciation increases net exports, or more specifically, that a depreciation shifts the *BOP* curve to the right and an appreciation shifts the *BOP* curve to the left. We implicitly made that assumption throughout this chapter. Were we justified in making that assumption?

7.7.2 *Evidence on the Marshall–Lerner condition*

In the 1950s, when international investment was very small and the balance of payments consisted mostly of international trade flows, some economists argued that low demand elasticities made the exchange rate a useless tool for correcting balance of payments deficits and surpluses. These economists were referred to as "elasticity pessimists" because they argued that elasticities of demand for exports and imports were very low. They argued against floating exchange rates, insisting that balance of payments problems required macroeconomic policies that changed aggregate demand. Other economists, known as "elasticity optimists", countered with estimates of demand elasticities that suggested a depreciation would indeed correct the trade deficits, and, therefore, floating exchange rates would be a stabilizing force in the world economy.

A popular study by Houthakker and Magee (1969) used data for the years 1951 through 1966 to estimate the export and import demand elasticities. They estimated that $h_x = 1.51$ and $h_{im} = 1.03$, which implied that the Marshall–Lerner condition was satisfied:

$$(h_x + h_{im} - 1) = (1.51 + 1.03 - 1) = 1.54 > 0 \qquad (7.7)$$

Equation (7.7) has been used to estimate how much the trade balance changes with a depreciation. For example, given that US exports were equal to about \$59.7 billion in 1971, the year when the US dollar was devalued by an 8.57 percent against other world currencies, equation (7.7) and the estimate of the Marshall–Lerner condition from

Table 7.2 The US Trade Balance ($ Billions): 1971–1975.

	1971	1972	1973	1974	1975
Exports	59.7	67.2	91.2	120.9	132.6
Imports	–61.0	–72.7	–89.3	–125.2	–120.2
Balance (*NX*)	–1.3	–5.4	1.9	–4.3	12.4

Houthakker and Magee suggests that the trade balance should have improved by

$$\begin{aligned} NX^{*} &= X^{*}(h_x + h_{im} - 1)\Delta e/e \\ &= \$59.7(1.54)\ .0857 = \$7.9 \text{ billion} \end{aligned} \tag{7.8}$$

Did this happen?

Table 7.2 shows the actual changes in the balance of trade from 1971 through 1975. The 1972 trade balance did not improve by $8 billion compared to 1971. Interestingly, it did improve by nearly that amount from 1972 to 1973. Then, when the US dollar depreciated further in 1973, the trade balance declined by over $6 billion in 1974, only to improve again by over $16 billion from 1974 to 1975.

7.7.3 *Why the Marshall-Lerner condition is inaccurate*

The analysis using the Mundell–Fleming model suggests why it is not really correct to use the Marshall–Lerner condition to predict the change in the trade balance following a currency depreciation or appreciation. In general, other things seldom remain the same. The elasticities approach to the balance of payments unrealistically assumes that all other things remain equal when the exchange rate changes. For one thing, the Mundell–Fleming model shows that a change in the exchange rate may shift other curves. The actual change in the balance of trade depends on how all the other shifts and adjustments described in the Mundell–Fleming model work themselves out.

Another weakness of the *elasticities approach* to the balance of payments is that demand and supply elasticities are not constants.

Elasticities are generally much smaller in the short run than they are in the long run. In the short run, it is difficult for importers and exporters to change their behavior, but in the long run, price changes tend to change the behavior quite substantially. Exports require marketing activities, and these take time to put into effect. It takes time to establish the distribution channels, to develop an advertising campaign, to establish a reputation, and to develop customer loyalty. Much international trade is conducted under long-term contracts and agreements. On the supply side, it takes time to increase output when the exchange rate improves international competitiveness. Increased exports may require new factories and changes in product characteristics.

There is evidence suggesting that the Marshall–Lerner condition changes gradually following a sharp change in the exchange rate. For example, the US dollar depreciated sharply in the first half of 1985, but the US trade deficit continued to grow throughout 1985 and 1986. Only in1987 did the US trade deficit begin to shrink. Similar delayed effects of devaluations and depreciation had been observed in the 1970s following the oil price increases, with trade deficits initially increasing before beginning to shrink some two years later. This phenomenon was termed the *J*-Curve effect, for reasons that should be obvious from Fig. 7.31.

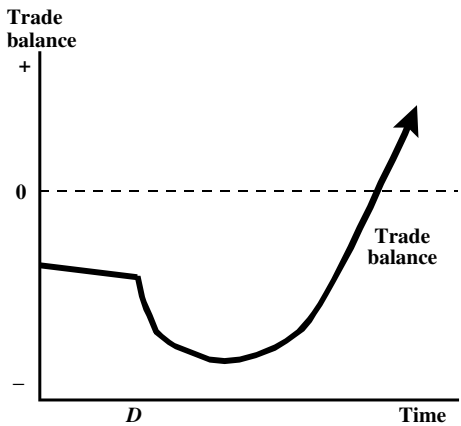

Figure 7.31 The *J*-curve.

Figure 7.31 graphs a trade balance that is negative and becoming more negative. Suppose that at the point in time denoted by the letter *D*, the government devalues the currency by changing its intervention in the foreign exchange market or it triggers a depreciation by suddenly altering its monetary and fiscal policies. If the Marshall–Lerner condition is not satisfied in the short run because short-run elasticities are small, the trade balance will actually grow larger after the depreciation. As time passes, however, importers and exporters at home and abroad begin to adjust to the new currency values. Demand and supply become more elastic as time passes, and the Marshall–Lerner condition is eventually satisfied, at which point the trade deficit begins to shrink. The deficit may even turn into a surplus in the long run if elasticities change enough.

7.8 Summary and Conclusions

This chapter detailed the popular Mundell–Fleming open-economy macroeconomic model. The Mundell–Fleming model is the open-economy version of the textbook Keynesian macroeconomic model, often called the *IS-LM* model. Among the important points to remember are

1. Keynes developed the first modern macroeconomic model during the Great Depression.
2. His model describes how the main sectors of the model interact within the overall economic system to determine the total output and the level of employment.
3. Mundell and Fleming added international trade and international investment to the Keynesian model.
4. The graphic Mundell–Fleming model shows how the exchange rate interacts with the other variables in the Keynesian model, such as income, the interest rate, the money supply, investment, consumption, and government fiscal policy to determine the economic equilibrium.
5. Like the Keynesian model, the Mundell–Fleming model shows that the economy's equilibrium is not always at or even near its full employment level.

6. Comparing the closed-economy and open-economy versions of the Keynesian model shows that globalization changes the effects of monetary and fiscal policies; Table 7.1 details the changes.
7. Overall, the Mundell–Fleming model reinforces the conclusions of Keynesian macroeconomic analysis, namely that the government has a role in keeping the economy operating near the full employment.
8. Like all models, the Mundell–Fleming model makes certain assumptions, among which is the satisfaction of the Marshall–Lerner condition.

Extending the *IS-LM* model to include international trade and investment certainly makes the model more relevant for analyzing today's global economy. However, the Mundell–Fleming model suffers from the several weaknesses that also plague the popular *IS-LM* model. First of all, the Keynesian model focuses on the demand side of the economy. It lacks a formal supply side, which is why the model was not very helpful for explaining the oil supply shock of the 1970s and the inflationary episodes that followed.

A second shortcoming of the graphic Keynesian and Mundell–Fleming models is that investment is specified to be a stable function of the interest rate. Keynes never assumed that the investment was driven by such a simple, or simplistic, function, however. He certainly never intended such a simplistic relationship to occupy the center of his model. In his 1936 *General Theory of Employment, Interest, and Money*, Keynes offered a very insightful and sophisticated discussion of investment, not at all like the investment function presented in the graphic model of this chapter.

We have to remember that the graphic model presented in this chapter is due not to Keynes, but to other economists who sought a simple graphic way to teach Keynes' most important ideas from his *General Theory*. The graphic model in this chapter clearly brings out the roles of monetary and fiscal policies in stabilizing the economy, as Keynes intended. Unfortunately, the simplified model loses Keynes' explanation of why economies are volatile and require continual stabilization policies in the first place. In short, the textbook version of the Keynesian model explains why an economy can settle into a high

unemployment equilibrium. But it cannot explain the other concern of economists during the Great Depression, which was to figure out the cause of the large decline in aggregate demand that pushed the economy to its depression equilibrium. Fortunately, Keynes provides a very lucid and insightful explanation of the causes of the collapse in lending and investment in the 1930s but those insights were not included in the graphic model by those Keynesians who designed it. Chapter 18 returns to Keynes' (1936) insight in order to explain the 2008 global economic recession.

The next chapter moves beyond the Mundell–Fleming model to introduce the supply side of the economy. Then, in Chapter 9, the demand side from this chapter and the supply side from the next chapter will be combined to provide a richer macroeconomic model, in which, by the way, it is possible to more accurately bring out Keynes' investment model and his dynamic analysis that reveals the sources of instability in a modern economic system.

Key Terms and Concepts

Aggregate demand
Asset market
Consumption function
Crowding out effect
Export demand elasticity
Fiscal policy
Holism
Immobile capital
Elasticity
IS-LM model
J-curve
Keynesian cross
Marginal propensity
Marshall–Lerner condition
Mobile capital
Monetary policy
Money market
Mundell–Fleming model
Product market
Scientific reductionism
Store-of-wealth motive
Transactions demand
Walras' law
Walrasian model

Chapter Questions and Problems

1. Explain under which conditions the following statement is true: "The central bank can control either the exchange rate or the money supply, but not both".
2. Explain precisely how the exchange rate affects the curves in the graphic Mundell–Fleming model. As an illustration, explain how an appreciation of the currency affects the economy's equilibrium level of GDP.

3. In the early 1980s, US macroeconomic policy combined a tight monetary policy to combat high inflation and very expansionary fiscal policy resulting from a reduction in taxes and an expansion of military expenditures. Use the Mundell–Fleming model to illustrate the effects of this combination of policies on the exchange rate. Specifically, set up the model by stating your exact assumptions about the shapes of the curves and why those assumptions are appropriate for 1980, and then show how the curves shift as a direct result of the macroeconomic shifts. Finally, describe exactly how the shifts in the curves move the economy to a new macroeconomic equilibrium.
4. In the 1960s, US macroeconomic policy combined a monetary policy that tried to keep the interest rate constant while the Lyndon Johnson administration and Congress allocated increasing amounts of money toward the Vietnam War and the social programs of the "Great Society", all without increasing taxes. Use the Mundell–Fleming model to illustrate the effects of this combination of policies on the exchange rate. Specifically, set up the model by stating your exact assumptions about the shapes of the curves and why those assumptions are appropriate for 1965, and then show how the curves shift as a direct result of the macroeconomic policy shifts. Finally, describe exactly how the shifts in the curves move the economy to a new macroeconomic equilibrium.
5. Use the Mundell–Fleming model to analyze how the deep economic recession in the major economies in 2009 would affect the economy of China, a major exporter of goods and capital to the major economies of North America and Europe. Discuss how international trade and international investment flows affect China. Does what you know about macroeconomic performance in China in 2010 match what the model suggests? Discuss.
6. Use the Mundell–Fleming model to explain precisely why in an open economy, the share of trade in the economy and the mobility of international capital are important for determining the overall effects of fiscal policies (Hint: review the explanation for the steepness of the *BOP* curve).
7. Explain how the Mundell–Fleming model depends on the Marshall–Lerner condition. Specifically, explain why the elasticities of import and export demand matter for the adjustment of the model to a stable equilibrium.

8. Read the following short mystery story entitled "The Fatal Equilibrium" below and use the Mundell–Fleming model to explain precisely how the inspector figured out who the murderer was. In your answer, you should draw an appropriate model that reflects the economic conditions in Europe in 1963, especially with regard to the exchange rate regime (Bretton Woods is still in effect) and the degree of capital mobility in Europe the early 1960s.

The Fatal Equilibrium

It was a cold Tuesday morning in January of 1963, the Minister of Economic Affairs, Dr. Henri Boulanger, was found dead on the floor of the study of his country mansion in a small village in the outskirts of the capital city. The minister was apparently killed by a single shot from a small hand weapon, and judging by the burn in his clothes near the wound, the shot had been at very close range. The newspaper delivery man, known to the whole village only as Marcel, said he had found the body at about 8:20 a.m. Marcel had called the police from the Minister's telephone in the study.

Because the murder involved a government Minister, the local police immediately called in the National Police. The National Police brought in their top investigators, who began scouring the house for clues. By mid-morning, there were about two dozen vehicles parked outside the Boulanger mansion. The local police had been relegated to directing the traffic and keeping the reporters away from the house.

This was the biggest murder case in years. Boulanger was a very popular public official, perhaps the most popular official in the country given that most people seemed to have little regard for the politicians who occupied the positions of President, Prime Minister, and Speaker of the Assembly. Boulanger was a competent economist and had been a popular professor at School of Economics at the National University. He had the ability to actually make economics understandable to the average person on the street. The country's position in the new European Common Market, the limits of monetary policy under the rules of the Bretton Woods system, the maintenance of tight controls on capital movements into and out of the country despite the commitment to liberalize the trade, the increased expenditures on education to improve the employment and productivity, and many other policy issues the

Minister had explained in entertaining radio talks listened to by surprisingly large numbers of people. The trust Boulanger inspired helped to elevate him to a prominent position in what was otherwise a very weak and undistinguished government. He had come to assume a key role in the government's attempt to introduce new economic measures to restore the economic growth and price stability after several years of political confusion and policy reversals.

Marcel was questioned by a team of investigators. He nervously explained that, over the past 30 years, he had been accustomed to entering the front door and bringing the copies of the capital's three major newspapers into Boulanger's study.

"Dr. Boulanger always left the front door unlocked for me. He couldn't wait to get his newspapers", Marcel explained. "No matter how early I came, he'd look at me as if to say: "Why are you so late? But he was a nice man", continued Marcel. "I made him the first stop on my route".

"Did anything in the house look different this morning?" asked Hercule Cognac, the renowned detective of the National Police who had been called on to head the investigation of this very sensitive case.

"It was very cold in the house; the fire had gone out in the fireplace. I knew something was wrong", continued Marcel. "I was disappointed because I had been looking forward to the little glass of brandy that the Minister usually offered me on a cold morning like this. This is terrible!" exclaimed Marcel.

"Thank you very much", said Cognac in a business-like manner. Please let us know if you think of anything else that seemed different this morning", continued Cognac, pointing Marcel toward one of the other inspectors from the National Police.

One of the investigators soon found a small handgun on a bookshelf near the front door, carelessly squeezed between Adam Smith's *Wealth of Nations* and Keynes' *General Theory*. The gun had been fired once.

"Ah, a careless amateur!" exclaimed Hercule Cognac as he eyed every detail at the crime scene.

"But not entirely stupid", replied Wilson, Cognac's long-time assistant who had accompanied him to the mansion that morning. "The fingerprints were thoroughly cleaned off".

Cognac's thoughts were already elsewhere. "You have, of course, contacted the neighbors?"

"Yes, but we learned nothing. No one heard a shot or any other suspicious activity", replied Wilson.

The minister lived alone in the large mansion that had belonged to his family for generations. The grounds were extensive, and the mansion sat far from the road and even farther from the neighbors' homes. The cold weather meant that the mansion's windows and curtains had all been tightly closed. Cognac was not surprised that the shot had not reached the ears of the distant neighbors, who were similarly enclosed in their warm homes.

The phone rang, and Wilson answered. He looked toward Cognac and said: "The preliminary autopsy suggests that the murder took place between 21:00 and 23:00".

"Ah, that gives us three suspects", replied Cognac, looking at the minister's agenda on the massive oak desk in the corner of the study. "He was expecting visits from the Central Bank Director, Louis Fabricant d'Argent, Jan Van Noord, the Minister of Economic Affairs from our neighbor Belgium, and Jean Domage, the President of the National Real Estate Association".

"In that order?" asked Wilson.

"There are no times written in the agenda, just that they were going to visit last night", replied Cognac.

"Fabricant d'Argent is the one who went through the long confirmation hearings in the Assembly, isn't he?" asked Wilson.

"Yes, of course", replied Cognac. "He's the former financial columnist from that second-rate newspaper that the Prime Minister insisted on putting in charge of the Central Bank. Rumor has it that he got the job because he was the Prime Minister's nephew. Silly sentiments always get people in trouble! I stopped reading his financial column a long time ago", Cognac went on. "For years he has been advocating rapid money creation as the solution to all economic problems. That's what his political party always pushes for".

"But then during his confirmation hearing, he swore that he would be a conservative Central Bank Director, entirely dedicated to preventing inflation", chipped in Wilson. "Few people believe him to this day. Do you suppose he had some sort of argument with the Minister of Economic Affairs?"

"It's possible", replied Cognac. "Of course, under the Bretton Woods arrangement, the Central Bank has few choices about monetary policy".

"What do you mean?" asked Wilson.

Cognac did not feel the urge to explain the international finance to Wilson, so he simply continued looking around the room. "Don't forget Jean Domage and the Belgian". Cognac said, changing the subject. "The Belgian Minister of Economic Affairs has often been criticized for his handling of economic policy. Their economy is not doing well, and unemployment is nearly 12 percent! Rumors have it that Van Noord is not a very good economist. I did read, though, that his new economic plan was praised by several leading Belgian economists."

"But, why would the economic situation in Belgium lead him to shoot our Minister of Economic Affairs?" asked Wilson.

"Borders mean little today, Wilson. We are living in an increasingly global economy!" exclaimed Cognac. "What we do in this country matters a lot to whether his new economic plan works in Belgium. Of course, our own economy has been a little lifeless lately too", continued Cognac. "What is our unemployment rate now?"

"It is a bit higher than normal, the newspaper said yesterday, the fifth straight month of above average unemployment", replied Wilson.

"But it is not very high compared to Belgium", replied Cognac, now digging through the drawers of the Minister's desk.

"I don't trust that real estate guy", said Wilson, anxious to switch the subject away from economics.

"That goes without saying", replied Cognac without looking up. "I'd rather buy a used car than a house!"

Wilson smiled at Cognac and then continued looking around the room while they talked. "Domage has been making speeches calling on the government to lower interest rates so that housing loans would be more affordable. He openly criticized the Minister of Economic Affairs. I saw the remarks in the paper just the other day".

"Yes, I read that too", replied Cognac. "But this is a case of murder, not a policy argument. We need more information. A murder requires a strong motive. We need to use our brains, Wilson. We must not jump to unsubstantiated conclusions!"

Wilson had heard these little lectures many times. He could see that Cognac was getting excited about the new case, and he just looked down while leafing through a pile of papers on the minister's desk.

The following day, the three suspects were discretely brought to police headquarters for questioning. Protests from the Belgian Embassy required the personal attention of the Foreign Minister, but the Belgian Economics Minister finally agreed to waive his diplomatic status and answer questions. Each suspect claimed to have visited the murdered minister around 21:00 and to have parted on the friendliest terms with the minister very much alive.

"Of course", said Hercule Cognac. "What else would they say? These political characters will not confess easily. We need to look for motives!"

Cognac's questioning of the Minister of Economic Affairs' secretary the previous afternoon had given him very useful information. The Minister of Economic Affairs had been given the authority by the Prime Minister to draw up the new government budget. It was entirely up to Minister Boulanger to decide the final numbers for all of the government's taxes and expenditures. The large majority that the Prime Minister controlled in the Assembly meant that the budget would probably pass without difficulty when it came up for a vote. However, getting a budget ready for the vote had proven especially difficult. Endless bickering within the party ranks had prevented the committee in charge from completing the budget. According to the secretary, "The Prime Minister was so frustrated that he decided to just let an objective financial expert like the Minister of Economic Affairs make the decisions". Cognac learned that the Prime Minister had earlier that week confirmed to several important political allies that the Minister of Economic Affairs' budget decisions would be final. Equally frustrated leaders of the party's many factions had guaranteed full support for the budget in the National Assembly, whatever the budget was to be. The agreement signaled the high regard that the Minister of Economic Affairs enjoyed throughout the party and the Assembly. It also was a recognition of a political reality: the public was losing confidence in the politicians that led the political coalition in control of the Assembly and wanted action.

The Minister of Economic Affairs was to have presented his budget decisions in a speech to the Assembly at 10:00 that cold morning of his murder. No one at the Ministry or the Assembly had any idea about what the Minister was going to say. The Minister had met with many people, but, according to those involved, he had asked all the questions and said nothing himself.

According to Boulanger's secretary, Boulanger had become annoyed at the lack of economic understanding among government leaders. "He tended more and more to make his own decisions", the secretary had told Cognac. "He often said how he missed discussing economics with his students at the University", she had added.

"We need to find his speech. That speech can tell us who the murderer is", exclaimed Cognac. "Wilson, do you remember seeing a copy of a speech anywhere in the Minister's mansion?"

"No, but I wasn't looking for a speech to solve a murder", Wilson replied.

Cognac had Wilson drive him back to the Minister's mansion. When they finally arrived at the mansion, the door was tightly locked. The investigators had apparently finished their work and left. Cognac had brought one of the keys his office had made for those on the case. He unlocked the door, and he and Wilson began searching the house.

Cognac and Wilson looked through the many file cabinets, drawers, and closets, but the speech and budget proposals were nowhere be found. The longer he searched, the more Hercule Cognac became convinced that the speech held the key to the mystery.

"If only we knew whether the budget was to have been expansionary or contractionary", thought Cognac, "That would neatly eliminate one or two of the suspects".

"Contractionary or expansionary?" exclaimed Wilson. "What on earth do you mean by that?"

Few people knew that the renowned detective and national hero Cognac had a Ph.D. in economics. He never mentioned it to anyone, perhaps for fear of undermining his social reputation. Cognac had become known as something of a bonvivant, which often served to open doors among the rich and famous of the capital city. Few people would trust him as readily if they knew he was an economist.

After looking in, under, and behind everything in the mansion, Cognac was ready to quit and go to dinner at one of his favorite restaurants in the capital. On his way out, he noticed an envelope with some scribbling sticking out from under the blotter on the Minister's large mahogany desk. He grabbed the envelope and as he began to read the scribbled words as he exclaimed: "Just like an economist, he never wasted anything".

Cognac continued to read the scribbled words on the envelope. Then he looked at Wilson and exclaimed: "Case Solved!"

"Oh, just like that?" replied Wilson skeptically.

"Listen to this, Wilson! This explains everything", continued Cognac, as he read from the envelope. "...and therefore I have become convinced that the country must have a budget that raises expenditures but does not increase taxes".

"How in the world does that statement tell you who murdered the minister?", asked Wilson, clearly puzzled by Cognac's confidence.

"Some friends of mine at the IMF, Mundell and Fleming, they gave me an interesting model some time ago. It is most helpful".

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