CHAPTER 14 APPENDIX 14–1

Stability of the Foreign-Exchange Market

Chapter 14 analyzed the stability conditions of the commodity markets under the assumption of infinite supply elasticities. The first section developed the conditions under which depreciation of the home currency (the euro in our example) would improve (or appreciation would worsen) the current account; that is, move it in the desired direction. These elasticity conditions are directly related to the stability of the foreign-exchange market, and here we shall move from the “commodity space” to the “foreign-exchange space” to demonstrate the relationship.

The foreign-exchange market is said to be stable if changes in the exchange rate induce a movement in the balance of payments in the “right” or desired direction. Depreciation is expected to improve and appreciation to worsen the country’s external payments position. In other words, stability requires that depreciation of the currency increase the difference of inpayments minus outpayments, both expressed in terms of dollars. It was seen in Chapter 14 that, in terms of the foreign currency, outpayments necessarily decline while inpayments may move in either direction. But even when inpayments decline, stability is achieved if the decline is outpaced by a greater reduction in outpayments.

Figures 14-3 and 14-4, which demonstrated these relationships with respect to commodity trade, can be transformed into a chart that deals directly in foreign currency flows. Consider Figure A14-1.1: The horizontal axis measures the quantity of foreign exchange demanded (outpayments) or supplied (inpayments). It is equivalent to the area under the $S_{U.S.}$ or $D_{U.S.}$ curves (at the equilibrium points) in the upper panel of Figures 14-3 and 14-4, respectively—that is, the quantity of merchandise traded times its dollar price. Movements along the vertical axis (the exchange rate) are equivalent to shifts in, say, the supply curves in the commodity space as the exchange rate changes. The exchange rate is defined in such a way that depreciation is portrayed as moving upward along the vertical axis; that is, as a greater number of domestic currency units per dollar.

Since depreciation always reduces outpayments, the demand-for-dollars curve is negatively sloped. It is derived from Figure 14-3 by relating changes in the exchange rate to changes in the area under $S_{U.S.}$ at points of equilibrium (quantity times dollar price). The (colored) inpayments line is derived from the upper panel of Figure 14-4 by relating the areas under the equilibrium points on $D_{U.S.}$ to changes in the exchange rate, as reflected in shifts of $S_E$. The inpayments line can slope in either direction, depending on the elasticity of $D_{U.S.}$. In other words, this case shows the outpayments line negatively sloped and the inpayments line positively sloped, so that the slope (or elasticity) of inpayments exceeds that of outpayments.

In sum, Figure A14-1.1 shows the foreign exchange market when depreciation lowers outpayments and raises inpayments, and when appreciation does the reverse. On both counts depreciation improves—and appreciation worsens—the current account, and the foreign-exchange market is clearly stable. In Figure A14-1.1 the dollar is undervalued and the euro is overvalued at $1 = 0.8\€$, resulting in excess demand for dollars (a dollar shortage). A depreciation of the euro is indicated, which would push the exchange rate toward the equilibrium point of $1 = 1\€$. Conversely, at an exchange rate of $1 = 1.2\€$, the dollar is overvalued and the euro is undervalued, resulting in
an excess supply of dollars (a dollar surplus). An appreciation of the euro is indicated, which would push the exchange rate toward equilibrium. In both cases the movement is in the “right” direction, indicating a stable foreign-exchange market.

While the outpayments line must be negatively sloped, the inpayments line can slope either way, depending on the U.S. import-demand elasticity.

In Figure A14-1.2, the (colored) inpayment curve is negatively sloped, indicating relatively inelastic U.S. import demand, but it is steeper than the outpayment line (cuts it from above). Although both slopes are negative, the slope of the inpayment line is greater than that of the outpayment line. This is still a stable situation, for it represents the case where the adjustment in outpayments exceeds that in inpayments. As before, at $1 = 0.8\;€ (1\;€ = 1.25) the dollar is undervalued and the euro overvalued, creating excess demand (shortage) for dollars. Depreciation of the euro reduces inpayments, but it lowers outpayments by a greater amount—so that the quantity of inpayments minus outpayments increases, and the market moves toward equilibrium. Conversely, at $1 = 1.2\;€, the dollar is overvalued (and the euro is undervalued), creating excess supply of dollars. Appreciation of the euro pushes the market toward the equilibrium exchange rate of 1\;€ = 1.
Finally, consider the case in which both lines are negatively sloped, but the outpayments line is steeper than the (colored) inpayments line (Figure A14-1.3). In other words, the slope of the inpayments line is less (has a higher negative number) than that of the outpayments line. Depreciation reduces both inpayments and outpayments, but the decline in inpayments is greater for any given depreciation, so that the difference inpayments minus outpayments declines rather than rises. This is the foreign-exchange equivalent of the case in which the sum of the demand elasticities is below one (in absolute value), with supply elasticities being infinite. In this case, when $1 = 0.8\text{€}$, there is excess supply (surplus) of dollars and appreciation is indicated, while at $1 = 1.2\text{€}$ there is excess demand for dollars (a dollar shortage), which calls for depreciation of the euro. In both cases the indicated action drives the market away from, rather than toward, equilibrium. This is an unstable foreign-exchange market, and it occurs when the inpayment line has a lower slope than the outpayment line.

Cases of multiple equilibria are also possible; for example, one unstable equilibrium and two stable equilibria on either side of it.
PART II  INTERNATIONAL FINANCIAL RELATIONS

Assume that euro is a freely fluctuating currency, and that the exchange rate is defined as the number of euros per one dollar. An upward move along the vertical axis means euro depreciation and a downward movement—appreciation. A real depreciation of the euro can be caused either by a nominal depreciation (holding prices constant), by a fall in the European price level, or by a rise in the foreign price level. If all domestic prices are fixed, it can be caused only by nominal depreciation.

In Figure A14-2.1 the exchange rate is displayed on the vertical axis and short-run output on the horizontal axis. Exchange depreciation (appreciation) increases (decreases) \((X - M)\) and therefore aggregate demand and output. From that relation we obtain the (shaded) DD schedule that shows all combinations of output and the exchange rate under which the output market is in short-run equilibrium. Representing points of equilibrium in the commodity markets, it is positively sloped. Any rise (decline) in aggregate

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**FIGURE A14-1.3**

**UNSTABLE FRANKFURT FOREIGN-EXCHANGE MARKET**

When both supply and demand for dollars are negatively sloped but demand is steeper, the foreign exchange market is unstable.

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**CHAPTER 14 APPENDIX 14–2**

**Equilibrium Exchange Rate and Output**

Assume that euro is a freely fluctuating currency, and that the exchange rate is defined as the number of euros per one dollar. An upward move along the vertical axis means euro depreciation and a downward movement—appreciation. A real depreciation of the euro can be caused either by a nominal depreciation (holding prices constant), by a fall in the European price level, or by a rise in the foreign price level. If all domestic prices are fixed, it can be caused only by nominal depreciation.
demand would shift the entire $DD$ schedule to the right (left). In particular:

1. A rise in investment, government expenditures, or in the entire consumption function would increase aggregate demand and raise output at each exchange rate. The $DD$ curve would rise (shift rightward) to (the colored) $D'D'$. A fall in the above types of expenditures would shift the $DD$ curve to the left.

2. A rise (fall) in taxes would lower (raise) aggregate demand and shift the $DD$ curve to the left (right).

3. A rise (fall) in the domestic price level would make domestic output less (more) competitive, reduce (raise) net exports, and shift the $DD$ curve to the left (right).

4. A change in foreign prices would have the opposite effect to those mentioned under 3.

5. A shift in global taste toward (away from) European products would raise (lower) net exports and shift the $DD$ curve to the right (left).

Next, the $EE$ schedule shows the combinations of exchange rates and output levels consistent with equilibrium in the foreign exchange market. A rise in output increases domestic money demand and hence boosts interest rates. The currency appreciates. Thus, to maintain asset-market equilibrium a rise (fall) in domestic output must be associated with appreciation (depreciation) of the currency rate. The $EE$ curve is negatively sloped as portrayed in Figure A14–2.2. Shifts in the entire $EE$ function can be caused by the following factors:

1. A rise in the money supply causes depreciation of the currency at each level of output. The $EE$ function shifts upward to (the colored) $E'E'$. A fall in money supply would move it downward.

2. A rise in foreign interest rates depreciates the currency at each level of output and
shifts the $EE$ curve upward to $E'E'$. A fall in foreign interest rates shifts it downward.

3. Changes in domestic interest rates have the opposite effects to those under item 2.

Intersection of the $DD$ and $EE$ curves yields equilibrium output and exchange rate, as shown in Figure A14-2.3. The observant reader might note that the slopes of the $DD$ and $EE$ curves are precisely the reverse of the slopes of the $IS$ and $LM$ curve in the familiar $IS-LM$ model. That is because the vertical axis here measures the exchange rate rather than the interest rate, and the two are inversely related.

This model can be used to analyze the effects of various policies. An increase in money supply shifts $EE$ upward without affecting $DD$; the currency depreciates and output rises. In particular the rise in money supply lowers interest rates and causes depreciation of the currency, which in turn makes home products cheaper and raises output. Fiscal expansion shifts $DD$ to the right without affecting $EE$. The currency appreciates and output rises. In particular, the rise in output increases money demand and raises interest rates. That causes the currency to appreciate. To sum up, monetary expansion raises output and depreciates the currency, thereby improving the current account. Fiscal expansion raises output and appreciates the currency, thereby worsening the current account.
Two convenient diagrams are often used to demonstrate the policy options open to a country attempting to attain internal and external balance. These are described next.

Expenditures-Changing and Expenditures-Switching Policies

In the first case, assume that international capital movements do not exist. External balance then implies balance on the goods and services account. With respect to domestic conditions, assume that unemployment or inflation are caused only by deficient or excessive demand, respectively. In such a case recession and inflation cannot coexist.

Figure A14-3.1 shows real expenditures on the horizontal axis and a ratio of international to domestic prices (or costs) on the vertical axis. Because the vertical axis is in a form of a ratio of foreign over domestic prices, an increase in foreign prices (domestic prices remaining unchanged) implies moving upward along the axis, while an increase in domestic prices (foreign prices remaining unchanged) implies moving downward along the axis. Thus the vertical axis can be viewed as an index of the country’s competitive position. An upward movement along it means increased competitiveness leading to higher exports and lower imports. Conversely, a downward movement means lower exports and greater imports.

The internal balance or full-employment line is the locus of all combinations of real expenditures and cost ratios that yield full
employment without inflation. The higher the domestic prices relative to foreign prices (limiting exports and encouraging imports), the higher real domestic expenditures must be to maintain full employment. Hence, the internal balance curve slopes downward from left to right. Above the line (and to its right) are combinations of real expenditures and cost ratios that yield inflation, while below it and to the left are combinations that yield unemployment.

In contrast, the external balance line slopes upward and to the right. It represents combinations of real expenditures and cost ratios that yield equality between exports and imports of goods and services. In this case the higher the domestic expenditures, the more competitive (that is, a higher foreign-to-domestic price ratio) the country must be to maintain external balance. Below the line (and to its right) are expenditures—price ratio combinations yielding
deficits in the balance on goods and services, while above it (and to the left) are combinations yielding surpluses.

The two lines divide the space into the following four regions:

<table>
<thead>
<tr>
<th>Region</th>
<th>Domestic Condition</th>
<th>External Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Inflation</td>
<td>Surplus</td>
</tr>
<tr>
<td>II</td>
<td>Inflation</td>
<td>Deficit</td>
</tr>
<tr>
<td>III</td>
<td>Unemployment</td>
<td>Deficit</td>
</tr>
<tr>
<td>IV</td>
<td>Unemployment</td>
<td>Surplus</td>
</tr>
</tbody>
</table>

Regions II and IV represent consistent situations calling, respectively, for fiscal and monetary policies that contract or expand real domestic expenditures. These are known as expenditures-changing policies. The effect of such measures is shown by straight horizontal lines, such as the lines starting at points C (contractionary domestic policies) and E (expansionary domestic policies). Regions I and III represent inconsistent situations calling for policies that would change relative prices and induce people to switch expenditures between foreign and domestic goods; these are expenditures-switching policies. In region I the main therapy is appreciation, which makes the country less competitive and also combats the inflation. Conversely, in region III the main action called for is currency devaluation or depreciation, which improves the country's competitive position and expands income. The impact of these two policy measures is shown by straight vertical lines, such as those starting, respectively, from points R and D.

The objective of economic policy is to attain a combination of internal and external balance. Such a situation is obtained only at point b, the intersection of the two balance curves. Point b cannot be reached by employing only one policy measure, except in the rare cases where the straight policy lines happen to pass through it (that is, the dashed lines). All other cases call for a combination of expenditures-changing and expenditures-switching policies.

Consider the consistent region IV, which calls for expansionary domestic policies to combat the external surplus as well as the domestic unemployment. Only if the initial situation happens to be positioned exactly to the left of b will expansionary policies land the economy right on target. Starting from point E, for example, expansion up to the internal balance line would still leave the country with an external surplus. Getting to point b requires expansion beyond the internal balance line, accompanied by currency appreciation. Likewise, point C requires contractionary domestic policies accompanied by depreciation; point D calls for depreciation plus domestic expansion; and point R calls for appreciation and domestic contraction.

Indeed, it is possible to divide the space into four policy zones circumscribed by the straight-dashed lines and the internal and external balance lines as follows:

<table>
<thead>
<tr>
<th>Desired Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone</td>
</tr>
<tr>
<td>Iα and IIβ</td>
</tr>
<tr>
<td>IIα and IIIβ</td>
</tr>
<tr>
<td>IIIα and IVβ</td>
</tr>
<tr>
<td>IVα and Iβ</td>
</tr>
</tbody>
</table>

In no zone is one policy measure sufficient to attain both external and internal balance, except for situations on the dashed lines.
CHAPTER 14 APPENDIX 14–4

On the Relative Effectiveness (for Domestic Purposes) of Fiscal and Monetary Policy under Alternative Exchange-Rate Regimes

Consider a small country, with liquid capital highly mobile internationally, so that interest rates cannot diverge from world interest rates (in terms of Appendix 14–3 this means a flat EE curve):

(1) With a fixed exchange rate, fiscal policy is fully effective in changing income. The accompanying diagrams show the Hicksian IS and LM curves on the income-interest rate space. The initial equilibrium is at point \( a \), yielding \( Y_1 \) and \( i_1 \), with \( i_1 \) equal to the world interest rate. Suppose the government expands fiscally, borrowing the needed funds on the money market, without any new money being created. In Figure A14–4.1, the IS curve shifts to (the colored) IS\(_2\) and the equilibrium to point \( b \). But the rise in interest rates attracts foreign capital, raising the domestic money supply, with the inflow lasting until the interest rate is back to its original level, \( i_1 \), equal to the world rate. In terms of the diagram, LM shifts to (the colored) LM\(_2\), and the final equilibrium is at point \( c \), yielding income \( Y_2 \). The rise in income is not hampered by an increase in the domestic interest rate.

By contrast, monetary policy is ineffective in changing income. Starting from equilibrium point \( a \) in Figure A14–4.2, an increase in money supply shifts the LM curve to (the colored) LM\(_2\). But equilibrium point \( b \) involves an interest rate below the world’s level (\( i_1 \)). Capital flows out, reducing the domestic money supply, until the original interest level is restored, with the LM curve reverting back to LM\(_1\). Income remains at \( Y_1 \).

(2) With a freely floating exchange rate, fiscal policy is ineffective. Starting from equilibrium point \( a \) in Figure A14–4.3 fiscal expansion shifts the IS curve to (the colored) IS\(_2\) and the equilibrium point to \( b \). The rise in the interest rate above world levels would attract foreign capital. But in this case, it leads to appreciation of the currency. This lowers \((X - M)\), leading to a multiple reduction in income. IS reverts to

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\text{FIGURE A14-4.1}
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FISCAL POLICY UNDER A FIXED EXCHANGE RATE

Fiscal expansion moves IS to IS\(_2\) and equilibrium from \( a \) to \( b \). The rise in interest rate attracts foreign funds, which under a fixed exchange rate are absorbed by the central bank. The attendant rise in money supply shifts LM to LM\(_2\), and output expands further from \( b \) to \( c \).
its original position \( (IS_1) \), leaving income unchanged.

By contrast, monetary policy is fully effective. Starting from equilibrium point \( a \) in Figure A14-4.4, the rise in money supply shifts \( LM_1 \) to (the colored) \( LM_2 \) and the equilibrium point moves to \( b \). The decline in the interest rate below world levels would generate an outflow of capital. But in this case, the exchange rate depreciates. The resulting rise in \( (X - M) \) leads to a multiple increase in income. The \( IS \) curve shifts to (the colored) \( IS_2 \) until world interest rate is reached at equilibrium point \( c \). Income rises from \( Y_1 \) to \( Y_2 \).
FIGURE A14-4.4
MONETARY POLICY UNDER A FREELY FLOATING EXCHANGE RATE

Monetary expansion shifts $LM$ to $LM_2$ and equilibrium from $a$ to $b$. The decline in interest rate causes an outflow of funds and depreciation. In turn that raises $X - M$ and shifts $IS$ to $IS_2$. Output expands further to point $c$. 