

overvalued to the dollar, so converting their GDPs at current exchange rates gives an overestimate of the true size of their economies.

KEY TAKEAWAYS

- Using purchasing power parity (PPP) exchange rates to convert income data to a common currency is a better way to make international comparisons because it compensates for the differential costs of living.
- “International dollars” is the term used for the units for data converted to U.S. dollars using the PPP exchange rate.
- International rankings can vary significantly between data converted using actual versus PPP exchange rates.

EXERCISES

1. In February 2004, the Mexican peso–U.S. dollar exchange rate was 11 p/\$. The price of a hotel room in Mexico City was 1,000 pesos. The price of a hotel room in New York City was \$200.
 - a. Calculate the price of the Mexican hotel room in terms of U.S. dollars.
 - b. Calculate the price of the U.S. hotel room in terms of Mexican pesos.
 - c. Now suppose the exchange rate rises to 12 p/\$. What does the exchange rate change indicate has happened to the value of the U.S. dollar relative to the value of the Mexican peso?
 - d. Does the currency change benefit the U.S. tourist traveling to Mexico City or the Mexican tourist traveling to New York City? Explain why.

In 2008, Brazil’s per capita income in nominal terms was \$8,295 while its per capita income in purchasing power parity (PPP) terms was \$10,466. Based on this information, if you were an American traveling in Brazil, would Brazilian products seem expensive or inexpensive relative to U.S. products?

In 2008, Germany’s per capita income in nominal terms was \$44,729 while its per capita income in PPP terms was \$35,539. Based on this information, if you were a German traveling in the United States, would U.S. products seem expensive or inexpensive relative to German products?

Chapter 7: Interest Rate Determination

Money is a critical component of a modern economy because it facilitates voluntary exchanges. What exactly money is and how it fulfills this role is not widely understood. This chapter defines money and explains how a country's central bank determines the amount of money available in an economy. It also shows how changes in the amount of money in a country influence two very important macroeconomic variables: the interest rate and the inflation rate.

7.1 Overview of Interest Rate Determination

LEARNING OBJECTIVE

1. Learn how a money market model, combining money supply and demand, influences the equilibrium interest rate in an economy.

This chapter describes how the supply of money and the demand for money combine to affect the equilibrium interest rate in an economy. The model is called the money market model.

A country's money supply is mostly the amount of coin and currency in circulation and the total value of all checking accounts in banks. These two types of assets are the most liquid (i.e., most easily used to buy goods and services). The amount of money available to spend in an economy is mostly determined by the country's central bank. The bank can control the total amount of money in circulation by using several levers (or tools), the most important of which is the sale or purchase of U.S. government Treasury bonds. Central bank sales or purchases of Treasury bonds are called "open market operations."

Money demand refers to the demand by households, businesses, and the government, for highly liquid assets such as currency and checking account deposits. Money demand is affected by the desire to buy things soon, but it is also affected by the opportunity cost of holding money. The opportunity cost is the interest earnings one gives up on other assets to hold money.

If interest rates rise, households and businesses will likely allocate more of their asset holdings into interest-bearing accounts (these are usually not classified as money) and will hold less in the form of money. Since interest-bearing deposits are the primary source of funds used to lend in the financial sector, changes in total money demand affect the supply of loanable funds and in turn affect the interest rates on loans.

Money supply and money demand will equalize only at one average interest rate. Also, at this interest rate, the supply of loanable funds financial institutions wish to lend equalizes the amount that borrowers wish to borrow. Thus the equilibrium interest rate in the economy is the rate that equalizes money supply and money demand.

Using the money market model, several important relationships between key economic variables are shown:

- When the money supply rises (falls), the equilibrium interest rate falls (rises).
- When the price level increases (decreases), the equilibrium interest rate rises (falls).

- When real GDP rises (falls), the equilibrium interest rate rises (falls).

Connections

The money market model connects with the foreign exchange (Forex) market because the interest rate in the economy, which is determined in the money market, determines the rate of return on domestic assets. In the Forex market, interest rates are given exogenously, which means they are determined through some process not specified in the model. However, that process of interest rate determination *is* described in the money market. Economists will sometimes say that once the money market model and Forex model are combined, interest rates have been “endogenized.” In other words, interest rates are now conceived as being determined by more fundamental factors (gross domestic product [GDP] and money supply) that are not given as exogenous.

The money market model also connects with the goods market model in that GDP, which is determined in the goods market, influences money demand and hence the interest rate in the money market model.

KEY TAKEAWAY

- The key results from the money market model are the following:
 - When the money supply rises (falls), the equilibrium interest rate falls (rises).
 - When the price level increases (decreases), the equilibrium interest rate rises (falls).
 - When real gross domestic product (GDP) rises (falls), the equilibrium interest rate rises (falls).

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. The term describing what is mostly composed of coin and currency in circulation and checking account deposits in a country.
 - b. The term describing the amount of money that households, businesses, and government want to hold or have available.
 - c. Of *increase, decrease, or stay the same*, this happens to the interest rate when the money supply falls.

- d. Of *increase, decrease, or stay the same*, this happens to the interest rate when the domestic price level falls.
- e. Of *increase, decrease, or stay the same*, this happens to the interest rate when real GDP falls.



7.2 Some Preliminaries

LEARNING OBJECTIVES

1. Recognize how casual uses of the term *money* differ from the more formal definition used in the money market model.
2. Learn how to interpret *the* equilibrium interest rate in a world in which there are many different interest rates applied and different types of loans and deposits.

There are several sources of confusion that can affect complete understanding of this basic model.

The first source of confusion concerns the use of the term “money.” In casual conversation, money is sometimes used more narrowly and sometimes more broadly than the formal definition. For example, someone might say, “I want to be a doctor so I will make a lot of money.” In this case, the person is really referring to income, not money, per se. Since income is typically paid using money, the everyday substitution of the term *money* for income does make sense, but it can lead to confusion in interpreting the forthcoming model. In general, people use the term *money* whenever they want to refer to a country’s coin and currency and anything these items are used for in payment. However, our formal definition of *money* also includes items that are not coin and currency. Checking account deposits are an example of a type of money included in the formal definition but not more casually thought of as money. Thus pay attention to the definition and description below and be sure to recognize that one’s common conception of money may or may not overlap precisely with the formal definition.

A second source of confusion involves our usage of the term *interest rate*. The model that will be developed will derive an equilibrium interest rate for the economy. However, everyone knows that there are many interest rates in the economy, and each of these rates is different. There are different rates for your checking and savings account, different rates on a car loan and mortgage, different rates on credit cards and government bonds. Thus it is typical to wonder what interest rate we are talking about when we describe *the* equilibrium interest rate.

It is important to note that financial institutions make money (here I really should say “make a profit”) by lending to one group at a higher rate than it borrows. In other words, financial institutions accept deposits from one group of people (savers) and lend it to another group of people (borrowers.) If they charge a higher interest rate on their loans than they do on deposits, the bank will make a profit.

This implies that, in general, interest rates on deposits to financial institutions are lower than interest rates on their loans. When we talk about the equilibrium interest rate in the forthcoming model, it will mostly apply to the interest rates on deposits rather than loans. However, we also have a small problem in interpretation since different deposits have different interest rates. Thus which interest rate are we really talking about?

The best way to interpret the equilibrium interest rate in the model is as a kind of average interest rate on deposits. At the end of this chapter, we will discuss economic changes that lead to an increase or decrease in the equilibrium interest rate. We should take these changes to mean several things. First, that average interest rates on deposits will rise. Now, some of these rates may rise and a few may fall, but there will be pressure for the average to increase. Second, since banks may be expected to maintain their rate of profit (if possible) when average deposit interest rates do increase, average interest rates on loans will also increase. Again, some loan rates may rise and some fall, but the market pressure will tend to push them upward.

The implication is that when the equilibrium interest rate changes we should expect most interest rates to move in the same direction. Thus the equilibrium interest rate really is referring to an average interest rate across the entire economy, for deposits and for loans.

KEY TAKEAWAYS

- The term *money* is used causally in a different ways than we define it in the model: here *money* is defined as total value of coin and currency in circulation and checking account deposits at a point in time.
- The equilibrium interest rate in the money market model should be interpreted as an average interest rate across the entire economy, for deposits and for loans.

EXERCISES

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. Of *higher, lower, or the same*, this is how average interest rates on bank deposits compare with average interest rates on bank loans.
 - b. The term used to describe the amount of money a person earns as wages.

c. When a person is asked how much money he has, he typically doesn't think to include the current balance in this type of bank deposit.

Since there are many different interest rates on many types of loans and deposits, how do we interpret the equilibrium interest rate in the model?

7.3 What Is Money?

LEARNING OBJECTIVE

1. Learn why money exists and what purpose it serves.

The money supply in a country refers to a stock of assets that can be readily used to purchase goods and services. An asset is anything that has value. Anything that has value could potentially be used in exchange for other goods, services, or assets. However, some assets are more easily exchangeable than other assets.

Examples of assets include currency, checking account balances, stocks, bonds, whole life insurance policies, real estate, and automobiles. Currency—dollar bills in the United States, pounds sterling in Britain, and pesos in Mexico—is an asset that is readily exchangeable for goods and services within its respective countries. In contrast, real estate is an asset that is very difficult to use to buy goods. For example, no grocery store would accept ownership of a few square feet of your house in exchange for your weekly groceries. The idea of this transaction is unimaginable. Yet these two extreme cases can help us understand the distinction we make between assets classified as money and those not considered money. Most textbook definitions of *money* begin by defining several of money's key features.

Money as a Unit of Account

One of the most important features of money is its application as a unit of account. In other words, we choose to measure the value of goods, services, and assets in terms of currency or money. In ancient societies, shells, shovels, hoes, knives, cattle, and grain were used as money. In these cases, it would have been common to define the value of an item in terms of how many shells, or knives, or cows, and so on the item exchanges for. The standard unit of account in a country is its currency: dollars in the United States, yen in Japan, and euros in the European Union.

Money as a Medium of Exchange

The key distinguishing feature of money, as compared with other nonmoney assets, is its role as a medium of exchange. Coin, and later currency, came into existence primarily to serve as a vehicle for the exchange of goods and services. Rather than hauling around items that you might hope to barter exchange for other goods you need, it is easier and more efficient to carry coin and currency to purchase goods. However, in order for money to function in this role, it must have widespread acceptability. Anyone selling something

you want must be willing to accept the coin or currency you have. Their willingness to accept will in turn depend on the expectation that they'll be able to use that coin later to buy the goods they want.

Other types of assets are often not acceptable as a medium of exchange. For example, if I own a \$1,000 U.S. savings bond, I am unlikely to be able to use the bond to purchase items in a store. Bonds can be traded at a bank or a bond market, where exchanges of this sort are common, but not anywhere else. Thus bonds do not function as a medium of exchange.

Liquidity is a term used to describe the distinction made here between bonds and currency. An asset is said to be liquid if it is readily exchangeable for goods and services. An asset is illiquid if it is not easily exchangeable. Thus coin and currency are very liquid assets, while bonds are more illiquid. Real estate is an example of a very illiquid asset since it could take a considerable amount of time to convert the ownership share of a home into a spendable form.

Money as a Store of Value

Perhaps the least important characteristic of money is an ability to serve as a store of value. This is less important because it does not distinguish money from other assets. All assets serve as a store of value. As an example, if I want to save some income from each paycheck so that I can go on a vacation next year, I need to hold that income in a form that will maintain its purchasing power. One simple way to hold it is by cashing my paycheck and putting currency into an envelope. That money accumulating in the envelope will be easily used to purchase plane tickets and a hotel room when I take my vacation next year. In this way, holding currency will allow me to store value over time. On the other hand, I could cash each paycheck and deposit some of the money I want to save into my online stock trading account. With these funds I can purchase stocks, another form of asset. Next year, I can sell the stocks and use the money to take my vacation. Thus stocks represent a store of value as well.

KEY TAKEAWAY

- Money is any asset that serves as a unit of account and can be used as a medium of exchange for economic transactions. It is all assets that have a high degree of liquidity. Money also serves as a store of value, but it is not unique in this role.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. The three characteristics that are used to define money.
- b. This characteristic of money is shared by real estate assets.
- c. This characteristic of money allows us to compare the values of different products.
- d. Without this characteristic of money, individuals would be forced to trade by barter.



7.4 Money Supply Measures

LEARNING OBJECTIVE

1. Learn the various definitions of money supply and their approximate values in the U.S. economy.

In the United States, the Federal Reserve Bank (or “Federal Reserve,” and more informally, “the Fed”) reports several distinct measures of the aggregate money supply. The narrowest measure, M1, includes only the most liquid assets. Higher numbers following an “M” reflect broader measures of money that include less liquid assets. Below is a description of M1–M3. However, unless otherwise specified, all later references to the money supply will relate to the M1 definition.

Money Supply Measure “M1”

M1 consists of the most highly liquid assets. That is, M1 includes all forms of assets that are easily exchangeable as payment for goods and services. It consists of coin and currency in circulation, traveler’s checks, demand deposits, and other checkable deposits.

The first item in M1 is currency and coin in circulation. In the United States, “currency” refers to \$1, \$5, \$10, \$20, \$50, and \$100 bills. U.S. “coin,” meanwhile, refers to pennies, nickels, dimes, and quarters. “In circulation” means that it has to be outside of banks, in people’s wallets or purses and businesses’ cash registers. Once the currency or coin is deposited in a bank, it is no longer considered to be in circulation, thus it is no longer a part of the M1 money supply.

The second item of M1 is traveler’s checks. Traveler’s checks are like currency, except that they have a form of insurance tied to them. If a traveler’s check is lost or stolen, the issuer will reimburse you for the loss.

The third item in M1 is demand deposits or checking account balances in banks. These consist of money individuals and businesses have deposited into an account in which a check can be written to pay for goods and services. When a check is presented to the bank, it represents a demand for transfer of funds from the check writer to the agent receiving the check. Since the funds must be disbursed on demand, we also refer to these as demand deposits.

The final category in M1 is labeled “other checkable deposits.” This consists of two items; NOW accounts and ATS accounts. NOW stands for “negotiable orders of withdrawal.” A NOW account is exactly like a checking account except for one thing: it can earn interest. Thus checking accounts without interest are demand deposits and those with interest are NOW accounts. ATS stands for “automatic transfer service.”

ATS accounts are savings accounts (also called time deposits) with one special feature. They can be drawn automatically to cover overdrafts from one’s checking account. Thus if an individual has a checking account with “overdraft protection” tied to their savings account, then the savings account is an ATS account.

Table 7.1 "Components of U.S. M1 Money Supply, November 2009" shows the M1 money supply for the U.S. economy as of November 2009. Notice that the largest component of M1, just over half, is the coin and currency in circulation. Traveler’s checks are an insignificant share at \$7.5 billion. Demand deposits and other checkable deposits almost equally split the remaining shares of M1 at close to 25 percent each. The total value of the M1 money supply is \$1,688 billion, which is over 10 percent of annual U.S. GDP.

Table 7.1 Components of U.S. M1 Money Supply, November 2009

	Billions (\$)	Total M1 (%)
Currency in Circulation	859.1	51
Traveler’s Checks	5.1	< 1
Demand Deposits	439.0	26
Other Checkable Deposits	385.4	23
Total M1 Money Supply	1,688.7	100

Source: Federal Reserve Statistical Release, Money Stock Measures, January 14, 2010. <http://www.federalreserve.gov/releases/h6/Current>.

Money Supply Measure “M2”

M2 is a broader measure of money than M1. It includes all of M1, the most liquid assets, and a collection of additional assets that are slightly less liquid. These additional assets include savings accounts, money market deposit accounts, small time deposits (less than \$100,000) and retail money market mutual funds. Excluded are IRA and Keogh deposits in money market accounts. (These are excluded since they are retirement funds and hence are unlikely to be used as payment for goods and services anytime soon.)

Money Supply Measure “M3”

M3 is an even broader definition of the money supply, including M2 and other assets even less liquid than M2. As the number gets larger (i.e., “1, 2, 3...”), the assets included become less and less liquid. The



additional assets include large-denomination time deposits (amounts greater than \$100,000), balances in institutional money funds (these include pension funds deposits), responsible party (RP) liabilities issued by depository institutions (refers to repurchase agreements), and eurodollars held by U.S. residents at foreign branches of U.S. banks worldwide and all banking offices in Canada and the United Kingdom (eurodollars are any U.S. dollar deposits made in a depository institution outside the United States). M3 excludes assets held by depository institutions, the U.S. government, money funds, and foreign banks and official institutions.

The United States values of all three major money supply definitions are given in [Table 7.2 "U.S. Money Supply Measures \(in Billions of Dollars\), November 2009"](#). Note that the M1 definition of money is just under one-tenth of the value of the annual GDP in the United States. The M2 money supply is almost six times larger, indicating substantial deposits in savings and time deposits and money market funds. M3 was last reported by the U.S. Fed in February 2006. But at that time, it was almost 90 percent of the U.S. annual GDP.

Table 7.2 U.S. Money Supply Measures (in Billions of Dollars), November 2009

M1	1,688.7
M2	8,391.9
M3 (February 2006)	10,298.7

Source: Federal Reserve Statistical Release, Money Stock Measures, January 14, 2010. For the most recent figures, go to <http://www.federalreserve.gov/releases/h6/Current>. (M3 was last reported for February 2006.)

KEY TAKEAWAYS

- M1 consists of the most highly liquid assets, including coin and currency in circulation, traveler's checks, demand deposits, and other checkable deposits.
- M2 is a broader measure of money than M1. It includes all of M1, plus savings accounts, money market deposit accounts, small-time deposits, and retail money market mutual funds.
- M3 is an even broader definition of the money supply that includes M2 plus large-denomination time deposits, balances in institutional money funds, repurchase liabilities, and eurodollars held by U.S. residents at foreign branches of U.S. banks.

- In 2009, the U.S. M1 was at just over \$1.6 trillion, around 10 percent of the U.S. gross domestic product (GDP).

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. Of *M1*, *M2*, or *M3*, this measure of money is the most liquid.
 - b. Of *M1*, *M2*, and/or *M3*, this measure(s) of money includes checking account deposits.
 - c. Of *M1*, *M2*, and/or *M3*, this measure(s) of money includes savings account deposits.
 - d. Of *M1*, *M2*, and/or *M3*, this measure(s) of money includes coin and currency in circulation.
 - e. Of *M1*, *M2*, and/or *M3*, this measure(s) of money includes eurodollars held by U.S. residents at foreign branches of U.S. banks.

7.5 Controlling the Money Supply

LEARNING OBJECTIVE

1. Learn the mechanisms (or tools) the U.S. Federal Reserve Bank can use to control the U.S. money supply.

The size of the money stock in a country is primarily controlled by its central bank. In the United States, the central bank is the Federal Reserve Bank while the main group affecting the money supply is the Federal Open Market Committee (FOMC). This committee meets approximately every six weeks and is the body that determines monetary policy. There are twelve voting members, including the seven members of the Fed Board of Governors and five presidents drawn from the twelve Federal Reserve banks on a rotating basis. The current Chairman of the Board of Governors is **Ben Bernanke** (as of January 2010). Because Bernanke heads the group that controls the money supply of the largest economy in the world, and because the FOMC's actions can have immediate and dramatic effects on interest rates and hence the overall United States and international economic condition, he is perhaps the most economically influential person in the world today. As you'll read later, because of his importance, anything he says in public can have tremendous repercussions throughout the international marketplace. The Fed has three main levers that can be applied to affect the money supply within the economy: (1) open market operations, (2) reserve requirement changes, and (3) changes in the discount rate.

The Fed's First Lever: Open Market Operations

The most common lever used by the Fed is open market operations. This refers to Fed purchases or sales of U.S. government Treasury bonds or bills. The "open market" refers to the secondary market for these types of bonds. (The market is called secondary because the government originally issued the bonds at some time in the past.)

When the Fed purchases bonds on the open market it will result in an increase in the money supply. If it sells bonds on the open market, it will result in a decrease in the money supply.

Here's why. A purchase of bonds means the Fed buys a U.S. government Treasury bond from one of its primary dealers. This includes one of twenty-three financial institutions authorized to conduct trades with the Fed. These dealers regularly trade government bonds on the secondary market and treat the Fed as one of their regular customers. It is worth highlighting that bonds sold on the secondary open market are bonds issued by the government months or years before and will not mature for several months or years

in the future. Thus when the Fed purchases a bond from a primary dealer in the future, when that bond matures, the government would have to pay back the Fed, which is the new owner of that bond.

When the open market operation (OMO) purchase is made, the Fed will credit that dealer's reserve deposits with the sale price of the bond (e.g., \$1 million). The Fed will receive the IOU, or "I owe you" (i.e., bond certificate), in exchange. The money used by the Fed to purchase this bond does not need to come from somewhere. The Fed doesn't need gold, other deposits, or anything else to cover this payment.

Instead, the payment is created out of thin air. An accounting notation is made to indicate that the bank selling the bond now has an extra \$1 million in its reserve account.

At this point, there is still no change in the money supply. However, because of the increase in its reserves, the dealer now has additional money to lend out somewhere else, perhaps to earn a greater rate of return. When the dealer does lend it, it will create a demand deposit account for the borrower and since a demand deposit is a part of the M1 money supply, money has now been created.

As shown in all introductory macroeconomics textbooks, the initial loan, once spent by the borrower, is ultimately deposited in checking accounts in other banks. These increases in deposits can in turn lead to further loans, subject to maintenance of the bank's deposit reserve requirements. Each new loan made creates additional demand deposits and hence leads to further increases in the M1 money supply. This is called the money multiplier process. Through this process, each \$1 million bond purchase by the Fed can lead to an increase in the overall money supply many times that level.

The opposite effect will occur if the Fed sells a bond in an OMO. In this case, the Fed receives payment from a dealer (as in our previous example) in exchange for a previously issued government bond. (It is important to remember that the Fed does not issue government bonds; government bonds are issued by the U.S. Treasury department. If the Fed were holding a mature government bond, the Treasury would be obligated to pay off the face value to the Fed, just as if it were a private business or bank.) The payment made by the dealer comes from its reserve assets. These reserves support the dealer's abilities to make loans and in turn to stimulate the money creation process. Now that its reserves are reduced, the dealer's ability to create demand deposits via loans is reduced and hence the money supply is also reduced accordingly.

A more detailed description of open market operations can be found at New York Federal Reserve Bank's Web site at <http://www.ny.frb.org/aboutthefed/fedpoint/fed32.html>.

The Fed's Second Lever: Reserve Requirement Changes

When the Fed lowers the reserve requirement on deposits, the money supply increases. When the Fed raises the reserve requirement on deposits, the money supply decreases.

The reserve requirement is a rule set by the Fed that must be satisfied by all depository institutions, including commercial banks, savings banks, thrift institutions, and credit unions. The rule requires that a fraction of the bank's total transactions deposits (e.g., this would include checking accounts but not certificates of deposit) be held as a reserve either in the form of coin and currency in its vault or as a deposit (reserve) held at the Fed. The current reserve requirement in the United States (as of December 2009) is 10 percent for deposits over \$55.2 million. (For smaller banks—that is, those with lower total deposits—the reserve requirement is lower.)

As discussed above, the reserve requirement affects the ability of the banking system to create additional demand deposits through the money creation process. For example, with a reserve requirement of 10 percent, Bank A, which receives a deposit of \$100, will be allowed to lend out \$90 of that deposit, holding back \$10 as a reserve. The \$90 loan will result in the creation of a \$90 demand deposit in the name of the borrower, and since this is a part of the money supply M1, it rises accordingly. When the borrower spends the \$90, a check will be drawn on Bank A's deposits and this \$90 will be transferred to another checking account, say, in Bank B. Since Bank B's deposits have now risen by \$90, it will be allowed to lend out \$81 tomorrow, holding back \$9 (10 percent) as a reserve. This \$81 will make its way to another bank, leading to another increase in deposits, allowing another increase in loans, and so on. The total amount of demand deposits (*DD*) created through this process is given by the formula

$$DD = \$100 + (.9)\$100 + (.9)(.9)\$100 + (.9)(.9)(.9)\$100 + \dots$$

This simplifies to

$$DD = \$100/(1 - 0.9) = \$1,000$$

or

$$DD = \$100/RR,$$

where *RR* refers to the reserve requirement.

This example shows that if the reserve requirement is 10 percent, the Fed could increase the money supply by \$1,000 by purchasing a \$100 Treasury bill (T-bill) in the open market. However, if the reserve requirement were 5 percent, a \$100 T-bill purchase would lead to a \$2,000 increase in the money supply. However, the reserve requirement not only affects the Fed's ability to create new money but also allows the banking system to create more demand deposits (hence more money) out of the total deposits it now has. Thus if the Fed were to lower the reserve requirement to 5 percent, the banking system would be able to increase the volume of its loans considerably and it would lead to a substantial increase in the money supply.

Because small changes in the reserve requirement can have substantial effects on the money supply, the Fed does not use reserve requirement changes as a primary lever to adjust the money supply.

A more detailed description of open market operations can be found at New York Federal Reserve Bank Web site at <http://www.ny.frb.org/aboutthefed/fedpoint/fed45.html>.

The Fed's Third Lever: Discount Rate/Federal Funds Rate Changes

When the Fed lowers its target federal funds rate and discount rate, it signals an expanded money supply and lower overall interest rates.

When the Fed raises its target federal funds rate and discount rate, it signals a reduced money supply and higher overall interest rates.

In news stories immediately after the FOMC meets, one is likely to read that the Fed raised (or lowered) interest rates yesterday. For many who read this, it sounds as if the Fed "sets" the interest rates charged by banks. In actuality, the Fed only sets one interest rate, and that is the discount rate. The rate that is announced every month is not the discount rate, but the federal funds rate. The federal funds rate is the interest rate banks charge each other for short-term (usually overnight) loans. The Fed does not actually set the federal funds rate, but it does employ open market operations to target this rate at a desired level. Thus what is announced at the end of each FOMC meeting is the target federal funds rate.

The main reason banks make overnight loans to each other each day is to maintain their reserve requirements. Each day some banks may end up with excess reserves. Other banks may find themselves short of reserves. Those banks with excess reserves would prefer to loan out as much as possible at some rate of interest rather than earning nothing. Those banks short of reserves are required by law to raise up their reserves to the required level. Thus banks lend money to each other each night.

If there is excess demand for money overnight relative to supply, the Fed keeps the discount window open. The discount window refers to a policy by the Fed to lend money on a short-term basis (usually overnight) to financial institutions. The interest rate charged on these loans is called the discount rate. Before 2003, banks needed to demonstrate that they had exhausted all other options before coming to the discount window. After 2003, the Fed revised its policies and set a primary credit discount rate and a secondary credit discount rate. Primary credit rates are set 100 basis points (1 percent) above the federal funds rate and are available only to very sound, financially strong banks. Secondary credit rates are set 150 basis points above the federal funds target rate and are available to banks not eligible for primary credit. Although these loans are typically made overnight, they can be extended for longer periods and can be used for any purpose.

Before the changes in discount window policy in 2003, very few banks sought loans through the discount window. Hence, it was not a very effective lever in monetary policy.

However, the announcement of the federal funds target rate after each FOMC meeting does remain an important signal about the future course of Fed monetary policy. If the FOMC announces a lower target federal funds rate, one should expect expanded money supply, perhaps achieved through open market operations. If the FOMC announces a higher target rate, one should prepare for a more contractionary monetary policy to follow.

A more detailed description of the discount window can be found on the New York Federal Reserve Bank Web site at <http://www.ny.frb.org/aboutthefed/fedpoint/fed18.html>. For more information about federal funds, go to <http://www.ny.frb.org/aboutthefed/fedpoint/fed15.html>.

KEY TAKEAWAYS

- When the Federal Reserve Bank (a.k.a. “Federal Reserve,” or more informally, “the Fed”) purchases bonds on the open market it will result in an increase in the U.S. money supply. If it sells bonds in the open market, it will result in a decrease in the money supply.
- When the Fed lowers the reserve requirement on deposits, the U.S. money supply increases. When the Fed raises the reserve requirement on deposits, the money supply decreases.
- When the Fed lowers its target federal funds rate and discount rate, it signals an expanded U.S. money supply and lower overall interest rates.

- When the Fed raises its target federal funds rate and discount rate, it signals a reduced U.S. money supply and higher overall interest rates.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. Of *increase, decrease, or no change*, the effect on the money supply if the central bank sells government bonds.
- b. Of *increase, decrease, or no change*, the effect on the money supply if the central bank lowers the reserve requirement.
- c. Of *increase, decrease, or no change*, the effect on the money supply if the central bank lowers the discount rate.
- d. The name given to the interest rate charged by the Federal Reserve Bank on loans it provides to commercial banks
- e. The name given to the interest rate charged by commercial banks on overnight loans made to other banks.

7.6 Money Demand

LEARNING OBJECTIVE

1. Learn the determinants of money demand in an economy.

The demand for money represents the desire of households and businesses to hold assets in a form that can be easily exchanged for goods and services. Spendability (or liquidity) is the key aspect of money that distinguishes it from other types of assets. For this reason, the demand for money is sometimes called the demand for liquidity.

The demand for money is often broken into two distinct categories: the transactions demand and the speculative demand.

Transactions Demand for Money

The primary reason people hold money is because they expect to use it to buy something sometime soon. In other words, people expect to make transactions for goods or services. How much money a person holds onto should probably depend on the value of the transactions that are anticipated. Thus a person on vacation might demand more money than on a typical day. Wealthier people might also demand more money because their average daily expenditures are higher than the average person's.

However, in this section we are interested not so much in an individual's demand for money but rather in what determines the aggregate, economy-wide demand for money. Extrapolating from the individual to the group, we could conclude that the total value of all transactions in the economy during a period would influence the aggregate transactions demand for money. Gross domestic product (GDP), the value of all goods and services produced during the year, will influence the aggregate value of all transactions since all GDP produced will be purchased by someone during the year. GDP may underestimate the demand for money, though, since people will also need money to buy used goods, intermediate goods, and assets. Nonetheless, changes in GDP are very likely to affect transactions demand.

Anytime GDP rises, there will be a demand for more money to make the transactions necessary to buy the extra GDP. If GDP falls, then people demand less money for transactions.

The GDP that matters here is nominal GDP, meaning GDP measured in terms of the prices that currently prevail (GDP at current prices). Economists often break up GDP into a nominal component and a real component, where real GDP corresponds to a quantity of goods and services produced after eliminating

any price level changes that have occurred since the price level base year. To convert nominal to real GDP, simply divide nominal GDP by the current U.S. price level (P_s); thus

$$\text{real } GDP = \text{nominal } GDP / P_s.$$

If we use the variable Y_s to represent real U.S. *GDP* and rearrange the equation, we can get

$$\text{nominal } GDP = P_s Y_s.$$

By rewriting in this way we can now indicate that since the transactions demand for money rises with an increase in nominal GDP, it will also rise with either an increase in the general price level or an increase in real GDP.

Thus if the amount of goods and services produced in the economy rises while the prices of all products remain the same, then total GDP will rise and people will demand more money to make the additional transactions. On the other hand, if the average prices of goods and services produced in the economy rise, then even if the economy produces no additional products, people will still demand more money to purchase the higher valued GDP, hence the demand for money to make transactions will rise.

Speculative Demand for Money

The second type of money demand arises by considering the opportunity cost of holding money. Recall that holding money is just one of many ways to hold value or wealth. Alternative opportunities include holding wealth in the form of savings deposits, certificate of deposits, mutual funds, stock, or even real estate. For many of these alternative assets interest payments, or at least a positive rate of return, may be obtained. Most assets considered money, such as coin and currency and most checking account deposits, do not pay any interest. If one does hold money in the form of a negotiable order of withdrawal (NOW) account, a checking account with interest, the interest earned on that deposit will almost surely be less than on a savings deposit at the same institution.

Thus to hold money implies giving up the opportunity of holding other assets that pay interest. The interest one gives up is the opportunity cost of holding money.

Since holding money is costly—that is, there is an opportunity cost—people's demand for money should be affected by changes in its cost. Since the interest rate on each person's next best opportunity may differ across money holders, we can use the average interest rate (i_s) in the economy as a proxy for the

opportunity cost. It is likely that as average interest rates rise, the opportunity cost of holding money for all money holders will also rise, and vice versa. And as the cost of holding money rises, people should demand less money.

The intuition is straightforward, especially if we exaggerate the story. Suppose interest rates on time deposits suddenly increased to 50 percent per year (from a very low base). Such a high interest rate would undoubtedly lead individuals and businesses to reduce the amount of cash they hold, preferring instead to shift it into the high-interest-yielding time deposits. The same relationship is quite likely to hold even for much smaller changes in interest rates. This implies that as interest rates rise (fall), the demand for money will fall (rise). The speculative demand for money, then, simply relates to component of the money demand related to interest rate effects.

KEY TAKEAWAYS

- Anytime the gross domestic product (GDP) rises, there will be a demand for more money to make the transactions necessary to buy the extra GDP. If GDP falls, then people demand less money for transactions.
- The interest one gives up is the opportunity cost of holding money.
- As interest rates rise (fall), the demand for money will fall (rise).

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. Of *increase, decrease, or no change*, the effect on the transactions demand for money when interest rates fall.
 - b. Of *increase, decrease, or no change*, the effect on the transactions demand for money when GDP falls.
 - c. Of *increase, decrease, or no change*, the effect on the speculative demand for money when GDP falls.
 - d. Of *increase, decrease, or no change*, the effect on the speculative demand for money when interest rates fall.

7.7 Money Functions and Equilibrium

LEARNING OBJECTIVE

1. Define real money demand and supply functions, graph them relative to the interest rate, and use them to define the equilibrium interest rate in an economy.

Demand

A money demand function displays the influence that some aggregate economic variables will have on the aggregate demand for money. The above discussion indicates that money demand will depend positively on the level of real gross domestic product (GDP) and the price level due to the demand for transactions. Money demand will depend negatively on average interest rates due to speculative concerns. We can depict these relationships by simply using the following functional representation:

$$M^D = P_s^+ L(Y_s^+, i_s^-).$$

Here MD is the aggregate, economy-wide money demand, P_s is the current U.S. price level, Y_s is the United States' real GDP, and i_s is the average U.S. interest rate. The f stands for “function.” The f is not a variable or parameter value; it simply means that some function exists that would map values for the right-side variables, contained within the brackets, into the left-side variable. The “+” symbol above the price level and GDP levels means that there is a positive relationship between changes in that variable and changes in money demand. For example, an increase (decrease) in P_s would cause an increase (decrease) in MD . A “-” symbol above the interest rate indicates that changes in i_s in one direction will cause money demand to change in the opposite direction.

For historical reasons, the money demand function is often transformed into a real money demand function as follows. First, rewrite the function on the right side to get

$$M^D = P_s^+ L(Y_s^+, i_s^-).$$

In this version, the price level (P_s) is brought outside the function $f()$ and multiplied to a new function labeled $L()$, called the “liquidity function.” Note that $L()$ is different from $f()$ since it contains only Y_s and i_s as variables. Since P_s is multiplied to $L()$ it will maintain the positive relationship to MD and thus is perfectly consistent with the previous specification. Finally, by moving the price level variable to the left side, we can write out the general form of the real money demand function as

$$\frac{M^D}{P_s} = L(Y_s, i_s).$$

This states that real money demand (M^D/P_s) is positively related to changes in real GDP (Y_s) and the average interest rate (i_s) according to the liquidity function. We can also say that the liquidity function represents the real demand for money in the economy—that is, the liquidity function is equivalent to real money demand.

Finally, simply for intuition's sake, any real variable represents the purchasing power of the variable in terms of prices that prevailed in the base year of the price index. Thus real money demand can be thought of as the purchasing power of money demanded in terms of base year prices.

Supply

Money supply is much easier to describe because we imagine that the level of money balances available in an economy is simply set by the actions of the central bank. For this reason, it will not depend on other aggregate variables such as the interest rate, and thus we need no function to describe it.

We will use the parameter M_s^S to represent the nominal U.S. money supply and assume that the Federal Reserve Bank (or simply "the Fed"), using its three levers, can set this variable wherever it chooses. To represent real money supply, however, we will need to convert by dividing by the price level. Hence let

$\frac{M_s^S}{P_s}$ represent the real money supply in terms of prices that prevailed in the base year.

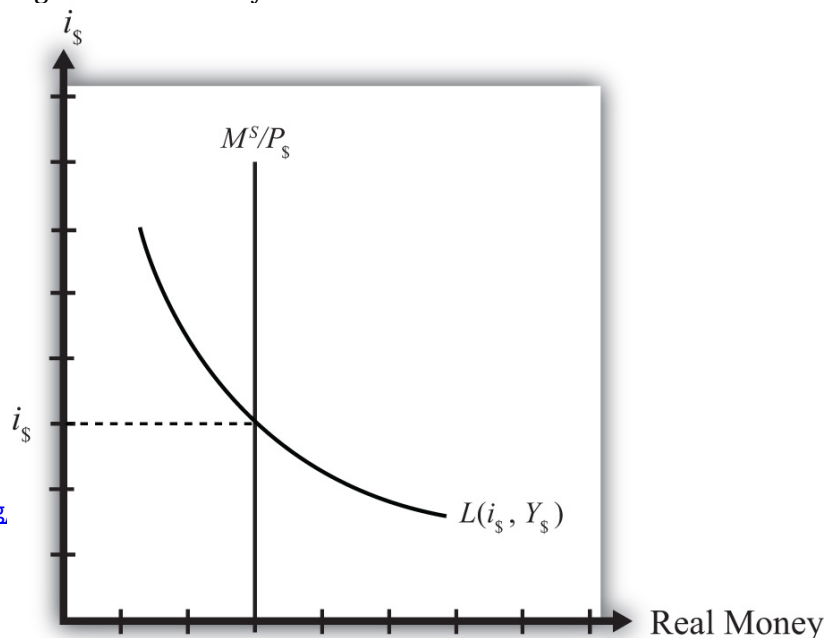
Equilibrium

The equilibrium interest rate is determined at the level that will equalize real money supply with real money demand. We can

depict the equilibrium by graphing the money supply and demand functions on the following diagram.

The functions are drawn in Figure 7.1 "The Money Market" with real money, both supply and demand,

Figure 7.1 The Money Market



plotted along the horizontal axis and the interest rate plotted along the vertical axis.

Real money supply, $\frac{M_s^s}{P_s}$, is drawn as a vertical line at the level of money balances, measured best by M1.

It is vertical because changes in the interest rate will not affect the money supply in the economy.

Real money demand—that is, the liquidity function $L(i_s, Y_s)$ —is a downward sloping line in i_s reflecting the speculative demand for money. In other words, there is a negative relationship presumed to prevail between the interest rate and real money demand.

Where the two lines cross determines the equilibrium interest rate in the economy (i_s) since this is the only interest rate that will equalize real money supply with real money demand.

KEY TAKEAWAYS

- Real money demand is positively related to changes in real gross domestic product (GDP) and the average interest rate.
- Real money supply is independent of the average interest rate and is assumed to be determined by the central bank.
- The intersection of the real money supply function and the real money demand function determines the equilibrium interest rate in the economy.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. Of *positive, negative, or no effect*, this is the relationship between the interest rate and real money demand.
 - b. Of *positive, negative, or no effect*, this is the relationship between real GDP and real money demand.
 - c. Of *positive, negative, or no effect*, this is the relationship between the price level and nominal money demand.
 - d. Of *positive, negative, or no effect*, this is the relationship between the interest rate and real money supply.

- e. Of *positive, negative, or no effect*, this is the relationship between real GDP and real money supply.
- f. Of *positive, negative, or no effect*, this is the relationship between the price level and real money supply.
- g. The endogenous variable (in the money market model) whose value is determined at the intersection of the real money supply curve and the real money demand curve.

7.8 Money Market Equilibrium Stories

LEARNING OBJECTIVE

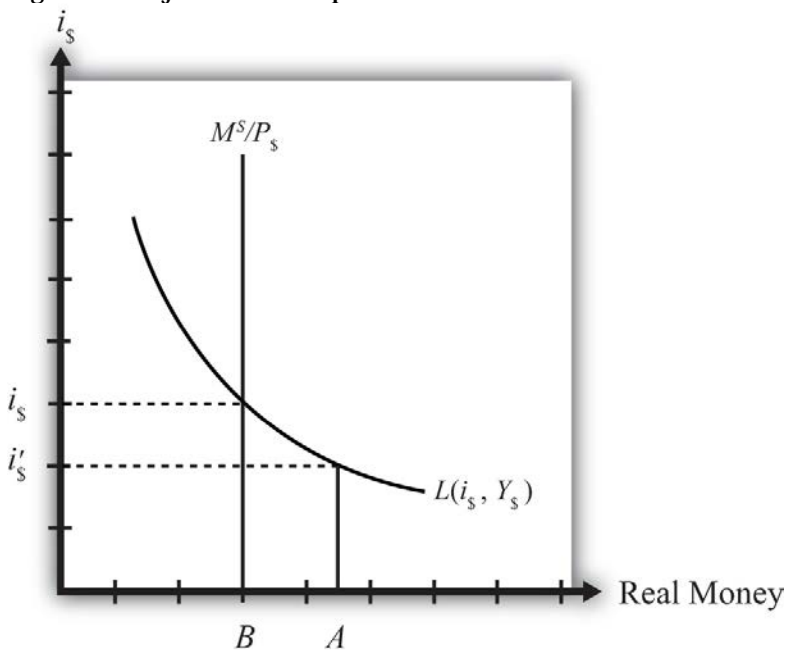
1. Learn the equilibrium stories in the money market that describe how the interest rate adjusts when it is not at its equilibrium value.

Any equilibrium in economics has an associated behavioral story to explain the forces that will move the endogenous variable to the equilibrium value. In the money market model, the endogenous variable is the interest rate. This is the variable that will change to achieve the equilibrium. Variables that do not change in the adjustment to the equilibrium are the exogenous variables. In this model, the exogenous variables are P_s , Y_s , and M_s/S . Changes in the exogenous variables are necessary to cause an adjustment to a new equilibrium. However, in telling an equilibrium story, it is typical to simply assume that the endogenous variable is not at the equilibrium (for some unstated reason) and then to explain how and why the variable will adjust to the equilibrium value.

Interest Rate Too Low

Suppose that for some reason the actual interest rate, i'_s lies below the equilibrium interest rate (i_s) as shown in Figure 7.2 "Adjustment to Equilibrium: Interest Rate Too Low". At i'_s , real money demand is given by the value A along the horizontal axis, while real money supply is given by the value B . Since A is

Figure 7.2 Adjustment to Equilibrium: Interest Rate Too Low



to the right of B , real demand for money exceeds the real money supply. This means that people and businesses wish to hold more assets in a liquid, spendable form rather than holding assets in a less liquid form, such as in a savings account. This excess demand for money will cause households and businesses to convert assets from less liquid accounts into checking accounts or cash in their pockets. A typical transaction would

involve a person who withdraws money from a savings account to hold cash in his wallet.

The savings account balance is not considered a part of the M1 money supply; however, the currency the person puts into his wallet is a part of the money supply. Millions of conversions such as this will be the behavioral response to an interest rate that is below equilibrium. As a result, the financial sector will experience a decrease in time deposit balances, which in turn will reduce their capacity to make loans. In other words, withdrawals from savings and other type of nonmoney accounts will reduce the total pool of funds available to be loaned by the financial sector. With fewer funds to lend and the same demand for loans, banks will respond by raising interest rates. Higher interest rates will reduce the demand for loans helping to equalize supply and demand for loans. Finally, as interest rates rise, money demand falls until it equalizes with the actual money supply. Through this mechanism average interest rates will rise, whenever money demand exceeds money supply.

Interest Rate Too High

If the actual interest rate is higher than the equilibrium rate, for some unspecified reason, then the opposite adjustment will occur. In this case, real money supply will exceed real money demand, meaning that the amount of assets or wealth people and businesses are holding in a liquid, spendable form is greater than the amount they would like to hold. The behavioral response would be to convert assets from money into interest-bearing nonmoney deposits. A typical transaction would be if a person deposits some of the cash in his wallet into his savings account. This transaction would reduce money holdings since currency in circulation is reduced, but will increase the amount of funds available to loan out by the banks. The increase in loanable funds, in the face of constant demand for loans, will inspire banks to lower interest rates to stimulate the demand for loans. However, as interest rates fall, the demand for money will rise until it equalizes again with money supply. Through this mechanism average interest rates will fall whenever money supply exceeds money demand.

KEY TAKEAWAYS

- If the actual interest rate is lower than the equilibrium rate, the amount of assets people are holding in a liquid form is less than the amount they would like to hold. They respond by converting assets from interest-bearing nonmoney deposits into money. The decrease in loanable funds will cause banks to raise interest rates. Interest rates rise until money supply equals money demand.

- If the actual interest rate is higher than the equilibrium rate, the amount of assets people are holding in a liquid form is greater than the amount they would like to be holding. They respond by converting assets from money into interest-bearing nonmoney deposits. The increase in loanable funds will cause banks to lower interest rates. Interest rates fall until money supply equals money demand.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. Of *increase, decrease, or stay the same*, the effect on the average interest rate when real money supply exceeds real money demand.
 - b. Of *increase, decrease, or stay the same*, the effect on the average interest rate when real money demand is less than real money supply.
 - c. Of *increase, decrease, or stay the same*, the effect on the average interest rate when real money demand exceeds real money supply.
 - d. Of *increase, decrease, or stay the same*, the effect on the average interest rate when households and businesses wish to convert assets from interest-bearing nonmoney deposits into money.
 - e. Of *increase, decrease, or stay the same*, the effect on the average interest rate when households and businesses wish to convert assets from money into interest-bearing nonmoney deposits.

7.9 Effects of a Money Supply Increase

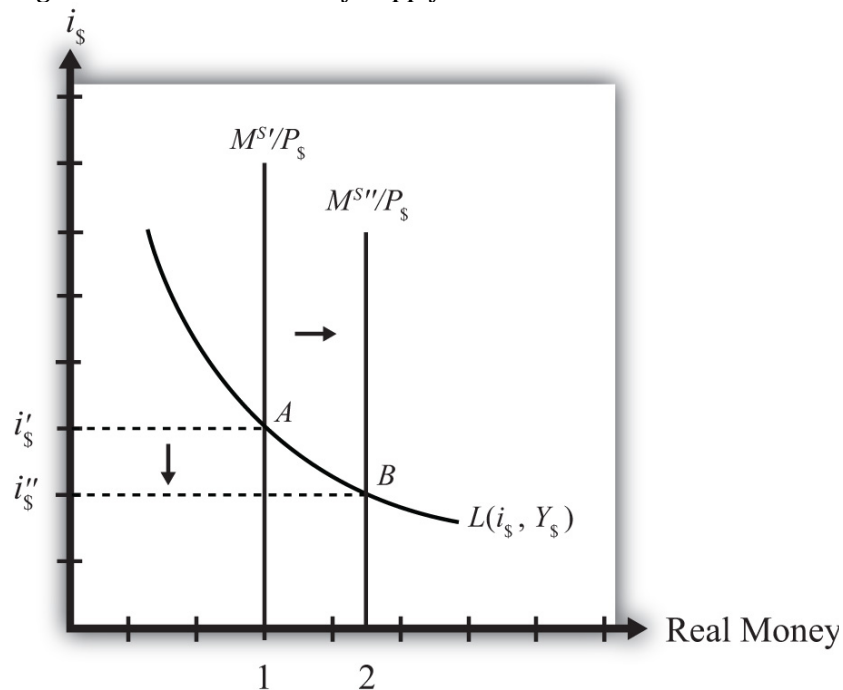
LEARNING OBJECTIVE

1. Learn how a change in the money supply affects the equilibrium interest rate.

Expansionary monetary policy refers to any policy initiative by a country's central bank to raise (or expand) its money supply. This can be accomplished with open market purchases of government bonds, with a decrease in the reserve requirement, or with an announced decrease in the discount rate. In most growing economies the money supply is expanded regularly to keep up with the expansion of gross domestic product (GDP). In this dynamic context, expansionary monetary policy can mean an increase in the *rate of growth* of the money supply, rather than a mere increase in money. However, the money market model is a nondynamic (or static) model, so we cannot easily incorporate money supply growth rates. Nonetheless, we can project the results from this static model to the dynamic world without much loss of relevance. (In contrast, any decrease in the money supply or decrease in the growth rate of the money supply is referred to as *contractionary monetary policy*.)

Suppose the money market is originally in equilibrium in [Figure 7.3 "Effects of a Money Supply Increase"](#) at point *A* with real money supply MS/P_s and interest rate i_s' when the money supply increases, *ceteris paribus*. The *ceteris paribus* assumption means we assume that all other exogenous variables in the model remain fixed at their original levels. In this exercise, it means that real GDP (Y_s) and the price level (P_s) remain fixed. An increase in the money supply (MS) causes an increase in the real money supply (MS/P_s) since P_s remains constant. In the diagram, this is shown as a rightward shift

Figure 7.3 Effects of a Money Supply Increase



from MS/P_s to MS''/P_s . At the original interest rate, real money supply has risen to level 2 along the horizontal axis while real money demand remains at level 1. This means that money supply exceeds money demand, and the actual interest rate is higher than the equilibrium rate. Adjustment to the lower interest rate will follow the “interest rate too high” equilibrium story.

The final equilibrium will occur at point B on the diagram. The real money supply will have risen from level 1 to 2 while the equilibrium interest rate has fallen from i_s' to i_s'' . Thus expansionary monetary policy (i.e., an increase in the money supply) will cause a decrease in average interest rates in an economy. In contrast, contractionary monetary policy (a decrease in the money supply) will cause an increase in average interest rates in an economy.

Note this result represents the short-run effect of a money supply increase. The short run is the time before the money supply can affect the price level in the economy. In [Chapter 7 "Interest Rate Determination"](#), [Section 7.14 "Money Supply and Long-Run Prices"](#), we consider the long-run effects of a money supply increase. In the long run, money supply changes can affect the price level in the economy. In the previous exercise, since the price level remained fixed (i.e., subject to the ceteris paribus assumption) when the money supply was increased, this exercise provides the short-run result.

KEY TAKEAWAY

- An increase (decrease) in the money supply, ceteris paribus, will cause a decrease (increase) in average interest rates in an economy.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. Term often used to describe the type of monetary policy that results in a reduction of the money supply.
 - b. Term often used to describe the type of monetary policy that results in an increase in the money supply.
 - c. Of *increase, decrease, or stay the same*, the effect on the equilibrium interest rate when the nominal money supply increases, ceteris paribus.

- d. Of *increase, decrease, or stay the same*, the effect on the equilibrium interest rate when the nominal money supply decreases, *ceteris paribus*.
- e. Term for the time period before price level changes occur in the money market model.



7.10 Effect of a Price Level Increase (Inflation) on Interest Rates

LEARNING OBJECTIVE

1. Learn how a change in the price level affects the equilibrium interest rate.

Now let's consider the effects of a price level increase in the money market. When the price level rises in an economy, the average price of all goods and services sold is increasing. Inflation is calculated as the percentage increase in a country's price level over some period, usually a year. This means that in the period during which the price level increases, inflation is occurring. Thus studying the effects of a price level increase is the same as studying the effects of inflation.

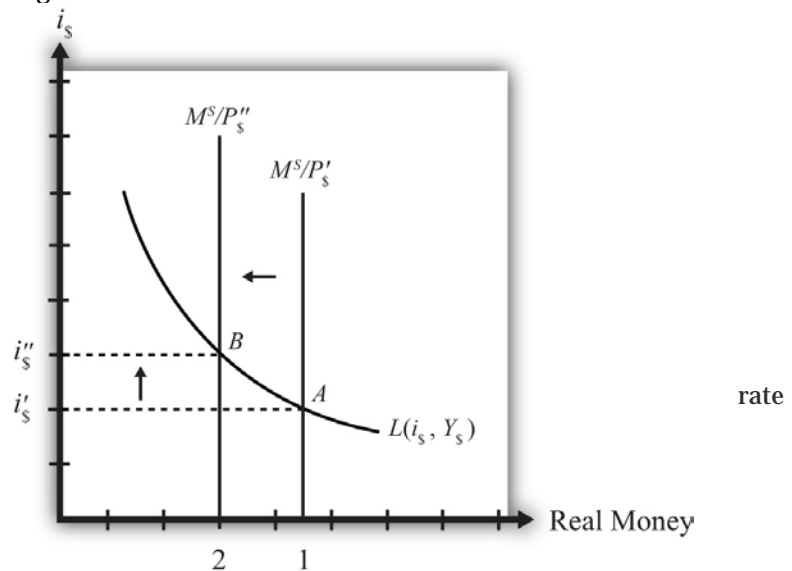
Inflation can arise for several reasons that will be discussed later in this chapter. For now, we will imagine that the price level increases for some unspecified reason and consider the consequences.

Suppose the money market is originally in equilibrium at point *A* in Figure 7.4 "Effects of a Price Level Increase" with real money supply MS/P_s' and interest rate i_s' . Suppose the price level increases, ceteris paribus. Again, the ceteris paribus assumption means that we assume all other exogenous variables in the model remain fixed at their original levels. In this exercise, it means that the money supply (MS) and real GDP (Y_s) remain fixed. An increase in the price level (P_s) causes a decrease in the real money supply (MS/P_s) since MS remains constant. In the adjoining diagram, this is shown as a shift from MS/P_s' to MS/P_s'' . At the original interest

rate, i_s' , the real money supply has fallen to level 2 along the horizontal axis, while real money demand remains at level 1. This means that money demand exceeds money supply and the actual interest rate is lower than the new equilibrium rate. Adjustment to the higher interest will follow the "interest rate too low" equilibrium story.

More intuition concerning these effects arises if one recalls that price

Figure 7.4 Effects of a Price Level Increase



level increases will increase the transactions demand for money. In this version, nominal money demand will exceed nominal money supply and set off the same adjustment process described in the previous paragraph.

The final equilibrium will occur at point *B* on the diagram. The real money supply will have fallen from level 1 to level 2 while the equilibrium interest rate has risen from i_s' to i_s'' . Thus an increase in the price level (i.e., inflation) will cause an increase in average interest rates in an economy. In contrast, a decrease in the price level (deflation) will cause a decrease in average interest rates in an economy.

KEY TAKEAWAY

- An increase in the price level (i.e., inflation), ceteris paribus, will cause an increase in average interest rates in an economy. In contrast, a decrease in the price level (deflation), ceteris paribus, will cause a decrease in average interest rates in an economy.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. The term used to describe a percentage increase in a country’s price level over a period of time.
 - b. Of *increase, decrease, or stay the same*, the effect on the equilibrium interest rate when the domestic price level decreases, ceteris paribus.
 - c. Of *increase, decrease, or stay the same*, the effect on the equilibrium interest rate when the domestic price level increases, ceteris paribus.

7.11 Effect of a Real GDP Increase (Economic Growth) on Interest Rates

LEARNING OBJECTIVE

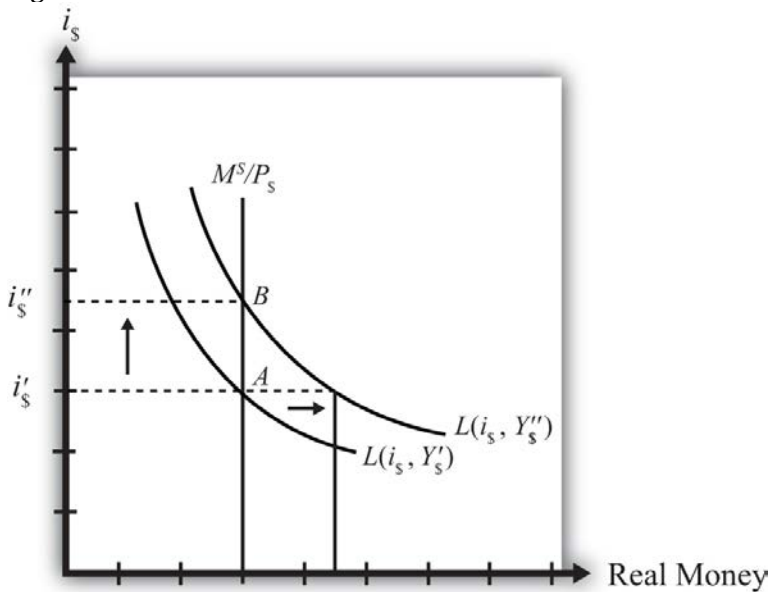
1. Learn how a change in real GDP affects the equilibrium interest rate.

Finally, let's consider the effects of an increase in real gross domestic product (GDP). Such an increase represents economic growth. Thus the study of the effects of a real GDP increase is the same as asking how economic growth will affect interest rates.

GDP may increase for a variety of reasons, which are discussed in subsequent chapters. For now, we will imagine that GDP increases for some unspecified reason and consider the consequences of such a change in the money market.

Suppose the money market is originally in equilibrium at point *A* in Figure 7.5 "Effects of an Increase in Real GDP" with real money supply MS/P_s and interest rate i_s' . Suppose real GDP (Y_s) increases, ceteris paribus. Again, the ceteris paribus assumption means that we assume all other exogenous variables in the model remain fixed at their original levels. In this exercise, it means that the money supply (MS) and the price level (P_s) remain fixed. An increase in GDP will raise the demand for money because people will need more money to make the transactions necessary to purchase the new GDP. In other words, real money demand rises due to the transactions demand effect. This increase is reflected in the rightward

Figure 7.5 Effects of an Increase in Real GDP



shift of the real money demand function from $L(i_s, Y_s')$ to $L(i_s, Y_s'')$.

At the original interest rate, i_s , real money demand has increased to level 2 along the horizontal axis while real money supply remains at level 1. This means that real money demand exceeds real money supply and the current interest rate is lower than the equilibrium rate.

Adjustment to the higher interest rate will follow the “interest rate too low” equilibrium story.

The final equilibrium will occur at point *B* on the diagram. As the interest rate rises from i_s' to i_s'' , real money demand will have fallen from level 2 to level 1. Thus an increase in real GDP (i.e., economic growth) will cause an increase in average interest rates in an economy. In contrast, a decrease in real GDP (a recession) will cause a decrease in average interest rates in an economy.

KEY TAKEAWAY

- An increase in real gross domestic product (i.e., economic growth), *ceteris paribus*, will cause an increase in average interest rates in an economy. In contrast, a decrease in real GDP (a recession), *ceteris paribus*, will cause a decrease in average interest rates in an economy.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. The term used to describe a percentage increase in real GDP over a period of time.
 - b. Of *increase, decrease, or stay the same*, the effect on the equilibrium interest rate when real GDP decreases, *ceteris paribus*.
 - c. Of *increase, decrease, or stay the same*, the effect on the equilibrium interest rate when real GDP increases, *ceteris paribus*.

7.12 Integrating the Money Market and the Foreign Exchange Markets

LEARNING OBJECTIVE

1. Integrate the money market with the foreign exchange market and highlight the interactions that exist between the two.

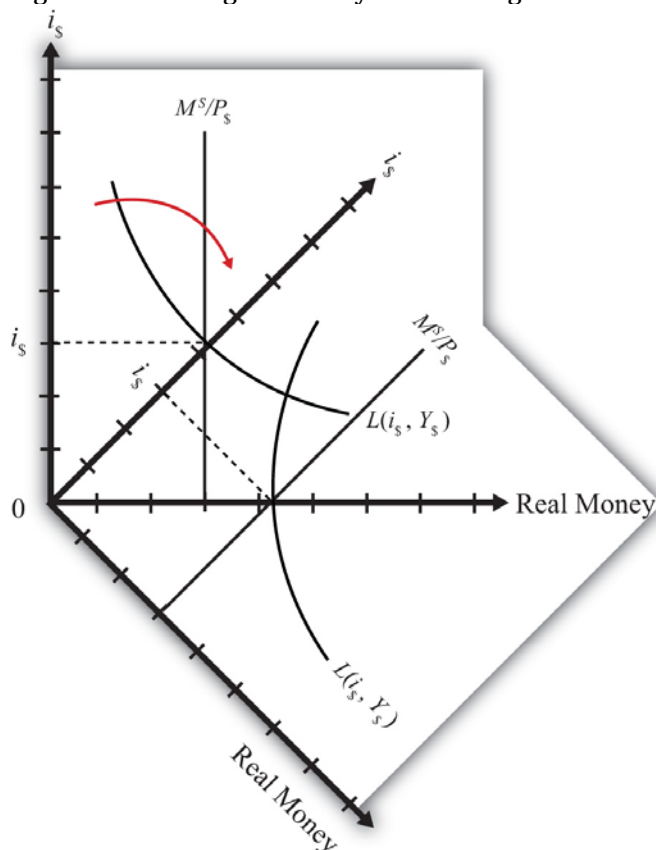
In this section, we will integrate the money market with the foreign exchange market to demonstrate the interactions that exist between the two. First, let's review.

In the money market, the endogenous variable is the interest rate (i_s). This is the variable that is determined in equilibrium in the model. The exogenous variables are the money supply (MS), the price level (P_s), and the level of real gross domestic product (GDP) (Y). These variables are determined outside the money market and treated as known values. Their values determine the supply and demand for money and affect the equilibrium value of the interest rate.

In the foreign exchange (Forex) market, the endogenous variable is the exchange rate, $E_{\$/\text{€}}$. The exogenous variables are the domestic interest rate (i_s), the foreign interest rate ($i_{\text{€}}$), and the expected exchange rate ($E_{\$/\text{€}}^e$). Their values determine the domestic and foreign rates of return and affect the equilibrium value of the exchange rate.

The linkage between the two markets arises because the domestic interest rate is the endogenous variable in the money market and an exogenous variable in the Forex market. Thus when considering the Forex, when we say the interest rate is determined

Figure 7.6 Rotating the Money Market Diagram



outside of the Forex market, we know where it is determined: it is determined in the U.S. money market as the interest rate that satisfies real supply and demand for money.

Linking the Diagrams

We can keep track of the interactions between these two markets using a simple graphical technique. We begin with the money market diagram as developed

Figure 7.7 Ninety-Degree Rotation of the Money Market Diagram

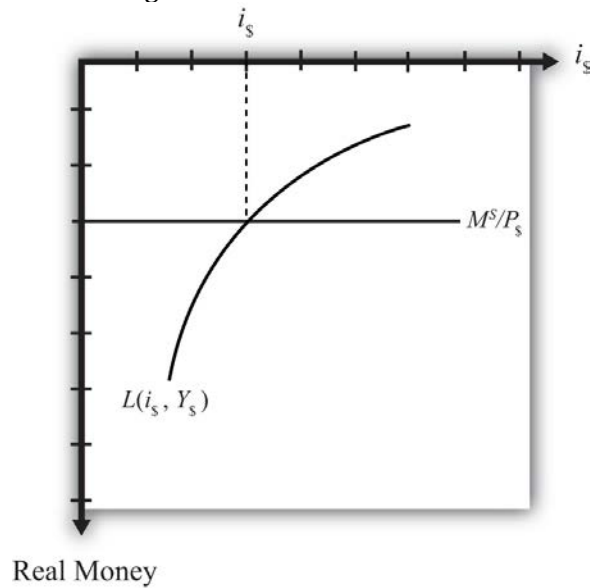
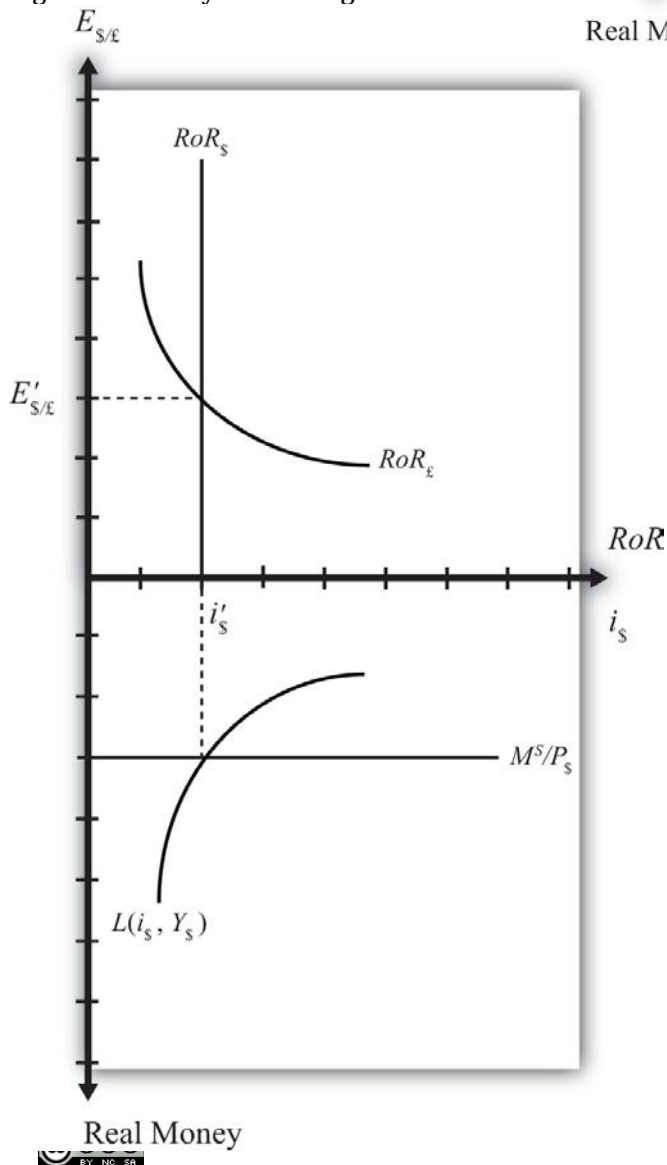


Figure 7.8 Money-Forex Diagram



in Chapter 7 "Interest Rate

Determination", Section 7.7 "Money Functions and Equilibrium".

The trick is to rotate the diagram ninety degrees in a clockwise direction. Figure 7.6 "Rotating the Money Market Diagram" shows the beginning of the rotation pivoted around the origin at zero.

When rotated the full ninety degrees, it will be positioned as shown in Figure 7.7 "Ninety-Degree Rotation of the Money Market Diagram".

The most important thing to remember about this new diagram is that the value of real money supply and demand increases downward away from the origin at zero along the vertical axis. Thus when the money supply "increases," this will be

represented in the diagram as a “downward” shift in the real money supply line. The interest rate, in contrast, increases away from the origin to the right along the horizontal axis when rotated in this position.

Since the interest rate is identical to the rate of return on dollar assets from a U.S. dollar holder’s perspective (i.e., $RoR_s = i_s$), we can now place the RoR diagram directly on top of the rotated money market diagram as shown in [Figure 7.8 "Money-Forex Diagram"](#). The equilibrium interest rate (i_s), shown along the horizontal axis above the rotated money market diagram, determines the position of the RoR_s line in the Forex market above. This combined with the RoR_e curve determines the equilibrium exchange rate, $E_{\$/\text{€}}$, in the Forex market. We will call this diagram the “money-Forex diagram” and the combined model the “money-Forex model.”

KEY TAKEAWAY

- Using a two-quadrant diagram with appropriate adjustments, we can represent the equilibrium in the money market and the foreign exchange market simultaneously.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. The value of this endogenous variable is used to determine the position of the U.S. rate of return line.
 - b. In the money-Forex diagram, these are the two endogenous variables.
 - c. In the money-Forex diagram, these are the five exogenous variables.

7.13 Comparative Statics in the Combined Money-Forex Model

LEARNING OBJECTIVE

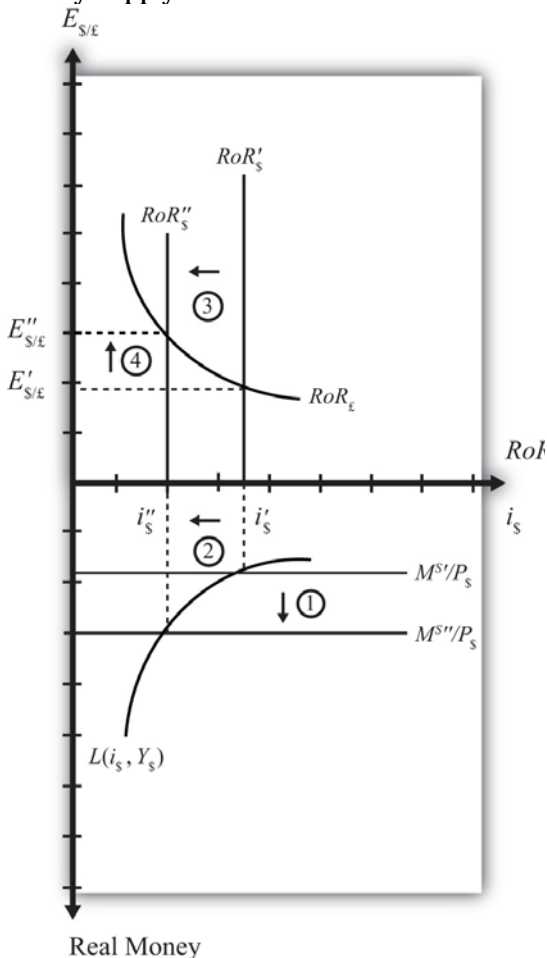
1. Show the effects of an increase in the money supply and an increase in GDP on the interest rate and exchange rate using the two-quadrant money-Forex market diagram.

Comparative statics is any exercise examining how the endogenous variables will be affected when one of the exogenous variables is presumed to change, while holding all other exogenous variables constant.

Holding other variables constant at their original values is the “ceteris paribus” assumption. We will do several such exercises here using the combined money-Forex market diagram.

An Increase in the U.S. Money Supply

Figure 7.9 Effects of an Increase in the Money Supply



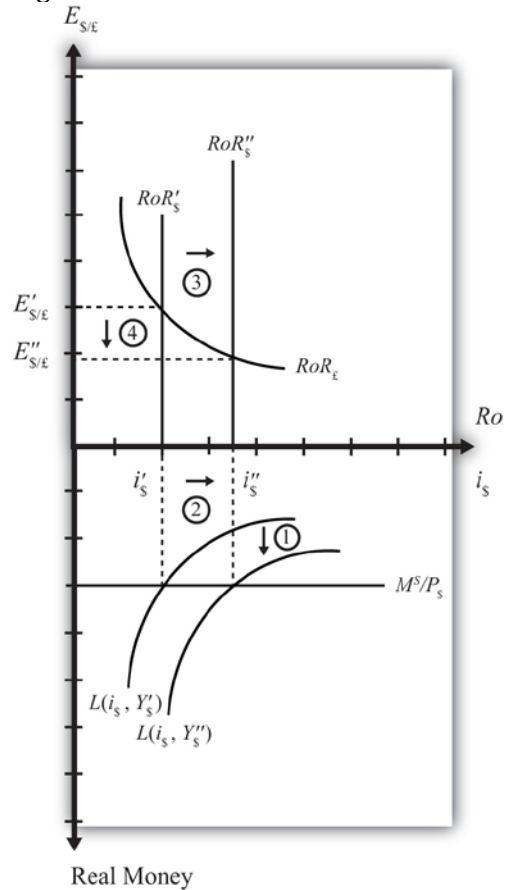
Suppose the U.S. money supply increases, ceteris paribus. The increase in MS causes an increase in the real money supply (MS/P_s), which causes the real money supply line to shift “down” from MS'/P_s to MS''/P_s (step 1) in the adjacent Money-Forex diagram, Figure 7.9 "Effects of an Increase in the Money Supply". (Be careful here: down in the diagram means an increase in the real money supply.) This causes a decrease in the equilibrium interest rate from i'_s to i''_s (step 2). The decrease in the U.S. interest rate causes a decrease in the rate of return on dollar assets: RoR_s shifts from RoR'_s to RoR''_s (step 3). Finally, the reduction in the dollar rate of return causes an increase in the exchange rate from $E_{S/E}$ to $E''_{S/E}$ (step 4). This exchange rate change corresponds to an appreciation of the British pound and a depreciation of the U.S. dollar. In summary, an increase in the U.S. money supply, ceteris paribus, causes a decrease in U.S. interest rates and a

depreciation of the dollar.

An Increase in U.S. GDP

Suppose there is an increase in U.S. GDP, *ceteris paribus*. This will increase real money demand, causing a “downward” shift in the real money demand curve from $L(i_s, Y_s')$ to $L(i_s, Y_s'')$ (step 1) in Money-Forex diagram, Figure 7.10 "Effects of an Increase in GDP". (Remember, real money increases as you move down on the rotated money diagram.) This causes an increase in the U.S. interest rate from i_s' to i_s'' (step 2). The increase in interest means that the rate of return on dollar increases from RoR_s' to RoR_s'' (step 3). Finally, the increase in the U.S. RoR causes a decrease in the exchange rate from $E'_{\$/\pounds}$ to $E''_{\$/\pounds}$ (step 4). The exchange rate change corresponds to an appreciation of the U.S. dollar and a depreciation of the British pound. In summary, an increase in real GDP, *ceteris paribus*, causes an increase in U.S.

Figure 7.10 Effects of an Increase in GDP



the
the
assets
of the
U.S.

interest rates and appreciation (depreciation) of the U.S. dollar (British pound).

KEY TAKEAWAYS

- In the money-Forex model, an increase in the U.S. money supply, *ceteris paribus*, causes a decrease in U.S. interest rates and a depreciation of the dollar.
- In the money-Forex model, an increase in real U.S. gross domestic product (GDP), *ceteris paribus*, causes an increase in U.S. interest rates and appreciation (depreciation) of the U.S. dollar (British pound).

EXERCISE

1. Using the Forex market and money market models, indicate the effect of each change listed in the first row of the table, sequentially, on the variables listed in the first column. For example, “Expansionary U.S. Monetary Policy” will first cause an increase in the “Real

U.S. Money Supply.” Therefore, a “+” is placed in the first box of the table. In the next row, answer how “U.S. Interest Rates” will be affected. You do not need to show your work. Note $E_{\$/\text{€}}$ represents the dollar/foreign exchange rate. Use the following notation:

+ the variable increases

- the variable decreases

0 the variable does not change

A the variable change is ambiguous (i.e., it may rise, it may fall)

	Expansionary U.S. Monetary Policy	An Increase in U.S. Price Level	An Increase in U.S. Real GDP
Real U.S. Money Supply	+		
U.S. Interest Rates			
RoR on U.S. Assets			
Foreign Interest Rates			
RoR on Foreign Assets			
U.S. Dollar Value			
$E_{\$/\text{€}}$			

7.14 Money Supply and Long-Run Prices

LEARNING OBJECTIVE

1. Understand the conditions under which changes in the money supply will have a long-run impact on the price level and hence the inflation rate in a country.

In previous sections we assumed that price levels were given exogenously and were unaffected by changes in other variables. In this section, we will argue that money supply increases tend to have a positive effect on the price level and thus the rate of inflation in an economy. This effect is unlikely to occur quickly, instead arising over several months or years. For this reason, we will say the effect occurs in the *long run*. The magnitude of the price level effect is also greatly influenced by the level of unemployment in the economy. Unemployment affects the degree to which the money increase affects prices and the degree to which it affects output.

The easiest way to see the linkage between money supply and prices is to simplify the story by assuming output cannot change. We tell that in story 1. This assumption allows us to isolate the impact of money on prices alone. In the subsequent adjustment stories, we'll relax the fixed output assumption to show how money increases can also affect the level of output in an economy.

Story 1: Money Supply Increase with Extreme Full Employment

Here we'll consider the effects of a money supply increase assuming what I'll call "extreme full employment." Extreme full employment means that every person who wishes to work within the economy is employed. In addition, each working person is working the maximum number of hours that he or she is willing to work. In terms of capital usage, this too is assumed to be maximally employed. All machinery, equipment, office space, land, and so on that can be employed in production is currently being used. Extreme full employment describes a situation where it is physically impossible to produce any more output with the resources currently available.

Next, let's imagine the central bank increases the money supply by purchasing U.S. government Treasury bills (T-bills) in the open market. Suppose the transaction is made with a commercial bank that decides to sell some of its portfolio of Treasury bills to free reserves to make loans to businesses. The transaction transfers the T-bill certificate to the central bank in exchange for an accounting notation the central bank makes in the bank's reserve account. Since the transaction increases bank reserves without affecting bank

deposits, the bank will now exceed its reserve requirement. Thus these new reserves are available for the bank to lend out.

Let's suppose the value of the T-bills transacted is \$10 million. Suppose the bank decides to lend the \$10 million to Ford Motor Corporation, which is planning to build a new corporate office building. When the loan is made, the bank will create a demand deposit account in Ford's name, which the company can use to pay its building expenses. Only after the creation of the \$10 million demand deposit account is there an actual increase in the money supply.

With money in the bank, Ford will now begin the process of spending to construct the office building. This will involve hiring a construction company. However, Ford will now run into a problem given our assumption of extreme full employment. There are no construction companies available to begin construction on their building. All the construction workers and the construction equipment are already being used at their maximum capacity. There is no leeway.

Nonetheless, Ford has \$10 million sitting in the bank ready to be spent and it wants its building started. So what can it do?

In this situation, the demand for construction services in the economy exceeds the supply. Profit-seeking construction companies that learn that Ford is seeking to begin building as soon as possible, can offer the following deal: "Pay us more than we are earning on our other construction projects and we'll stop working there and come over to build your building." Other construction companies may offer a similar deal. Once the companies, whose construction projects have already started, learn that their construction companies are considering abandoning them for a better offer from Ford, they will likely respond by increasing their payments to their construction crews to prevent them from fleeing to Ford. Companies that cannot afford to raise their payments will be the ones that must cease their construction, and their construction company will flee to Ford. Note that another assumption we must make for this story to work is that there are no enforceable contracts between the construction company and its client. If there were, a company that flees to Ford will find itself being sued for breach of contract. Indeed, this is one of the reasons why contracts are necessary. If all works out perfectly, the least productive construction projects will cease operations since these companies are the ones that are unwilling to raise their wages to keep the construction firm from fleeing.

Once Ford begins construction with its newly hired construction company, several effects are noteworthy. First, Ford's construction company will be working the same amount of time and producing the same amount of output, though for a different client. However, Ford's payments to the construction company are higher now. This means some workers or owners in the construction company are going home with a fatter paycheck. Other construction companies are also receiving higher payments so wages and rents will likely be higher for them as well.

Other companies that have hired the construction firms now face a dilemma, however. Higher payments have to come from somewhere. These firms may respond by increasing the prices of their products for their customers. For example, if this other firm is Coca-Cola, which must now pay higher prices to complete its construction project, it most probably will raise the price of Coke to pay for its higher overall production costs. Hence increases in wages and rents to construction companies will begin to cause increases in market prices of other products, such as Coke, televisions, computers, and so on.

At the same time, workers and owners of the construction companies with higher wages will undoubtedly spend more. Thus they will go out and demand more restaurant meals, cameras, and dance lessons and a whole host of other products. The restaurants, camera makers, and dance companies will experience a slight increase in demand for their products. However, due to the assumption of extreme full employment, they have no ability to increase their supply in response to the increase in demand. Thus these companies will do what the profit-seeking construction companies did before...they will raise their prices.

Thus price increases will begin to ripple through the economy as the extra money enters the circular flow, resulting in demand increases. As prices for final products begin to rise, workers may begin to demand higher wages to keep up with the rising cost of living. These wage increases will in turn lead firms to raise the prices of their outputs, leading to another round of increases in wages and prices. This process is known as the wage-price spiral.

Nowhere in this process can there ever be more production or output. That's because of our assumption of extreme full employment. We have assumed it is physically impossible to produce any more. For this reason, the only way for the market to reach a new equilibrium with aggregate supply equal to aggregate demand is for prices for most inputs and outputs to rise. In other words, the money supply

increase *must* result in an increase in average prices (i.e., the price level) in the economy. Another way of saying this is that money supply increases are inflationary.

The increase in prices will not occur immediately. It will take time for the construction companies to work out their new payment scheme. It will take more time for them to receive their extra wages and rents and begin spending them. It will take more time, still, for the restaurants and camera makers and others to respond to higher demands. And it will take even more time for workers to respond to the increases in prices and to demand higher wages. The total time may be several years before an economy can get back to equilibrium. For this reason, we think about this money supply effect on the price level as a long-run effect. In other words, we say an increase in the money supply will lead to an increase in the price level in the long run.

Inflation arises whenever there is too much money chasing too few goods. This effect is easy to recognize in this example since output does not change when the money supply increases. So, in this example, there is more money chasing the same quantity of output. Inflation can also arise if there is less output given a fixed amount of money. This is an effect seen in the transition economies of the former Soviet Union.

After the breakdown of the political system in the early 1990s, output dropped precipitously, while money in circulation remained much the same. The outcome was a very rapid inflation. In these cases, it was the same amount of money chasing fewer goods.

Story 2: Money Supply Increase with High Unemployment

In this story, we relax the assumption of extreme full employment and assume instead that there is a very high rate of unemployment in the economy. This example will show how money supply increases can affect national output as well as prices.

Suppose there is a money supply increase as in the previous story. When Ford Motor Company goes out looking for a construction company to hire, there is now an important new possibility. Since unemployment is very high, it is likely that most construction companies are not operating at their full capacity. Some companies may have laid off workers in the recent past due to a lack of demand. The construction company that wins the Ford contract will not have to give up other construction projects. Instead, it can simply expand output by hiring unemployed workers and capital. Because there is a ready and waiting source of inputs, even at the original wage and rental rates, there is no need for the

construction company to charge Ford more than current prices for its services. Thus there is no pressure to increase wages or the prices of construction services.

It is true, there is more money being paid out in wages by this company, and the new workers will go out and spend that money, leading to an increase in demand for restaurant services, cameras, dance lessons, and other products. These companies are also likely to respond by hiring more workers and idle equipment to provide more restaurant meals, cameras, and dance lessons. Here too, with a ready and willing source of new inputs from the ranks of the unemployed, these companies will not have an incentive to raise wages, rents, or prices. Instead, they will provide more output of goods and services. Thus as the increase in money ripples through the economy, it will stimulate demand for a wide variety of products. However, because of high unemployment, the money supply increase need not result in higher prices. Instead, national output increases and the unemployment rate falls.

A comparison of stories 1 and 2 highlights the importance of the unemployment rate in determining the extent to which a money supply increase will be inflationary. In general, we can conclude that an increase in the money supply will raise the domestic price level to a larger degree in the long run, thus lowering the unemployment rate of labor and capital.

Natural Rate of Unemployment

Economists typically say that an economy is at full employment output when the unemployment rate is at the natural rate. The natural rate is defined as the rate that does not cause inflationary pressures in the economy. It is a rate that allows for common transitions that characterize labor markets. For example, some people are currently unemployed because they have recently finished school and are looking for their first job. Some are unemployed because they have quit one job and are in search of another. Some people have decided to move to another city, and are unemployed during the transition. Finally, some people may have lost a job in a company that has closed or downsized and may spend a few weeks or months in search of their next job.

These types of transitions are always occurring in the labor market and are known as *frictional* (or *transitional*) *unemployment*. When employment surveys are conducted each month, they will always identify a group of people unemployed for these reasons. They count as unemployed, since they are all actively seeking work. However, they all will need some time to find a job. As one group of unemployed

workers find employment, others will enter the unemployment ranks. Thus there is a constant turnover of people in this group and thus a *natural unemployment rate*.^[1]

There is no simple way to measure the natural rate of unemployment. It will likely vary with economic conditions and the fluidity of the labor market. Nonetheless, economists estimate the natural rate of unemployment to be around 5 percent in the United States today.

When economists talk about the inflationary effect of money supply increases, they typically refer to the natural rate of unemployment. A money supply increase will likely be inflationary when the unemployment rate is below the natural rate. In contrast, inflationary effects of money supply increases are reduced if the economy has unemployment above the natural rate. Here's how the story would work.

Story 3: Money Supply Increase above and below the Natural Unemployment Rate

Suppose there is a money supply increase as in the previous story, but now let's assume the economy is operating above full employment, meaning that unemployment is below its natural rate.

As the money supply increase ripples through the economy causing excess demand, as described above, businesses have some leeway to expand output. Since unemployment is not zero, they can look to hire unemployed workers and expand output. However, as frictional unemployment decreases, the labor market will pick up speed. Graduating students looking for their first job will find one quickly. Workers moving to another job will also find one quickly. In an effort to get the best workers, firms may begin to raise their wage offers. Workers in transition may quickly find themselves entertaining several job offers, rather than just one. These workers will begin to demand higher wages. Ultimately, higher wages and rents will result in higher output prices, which in turn will inspire demands for higher wages. Thus despite the existence of some unemployment, the money supply increase may increase output slightly but it is also likely to be inflationary.

In contrast, suppose the economy were operating with unemployment above the natural rate. In this case, the increase in demand caused by a money supply increase is likely to have a more significant effect upon output. As firms try to expand output, they will face a much larger pool of potential employees.

Competition by several workers for one new job will put power back in the hands of the company, allowing it to hire the best quality worker without having to raise its wage offer to do so. Thus, in general, output will increase more and prices will increase less, if at all. Thus the money supply increase is less

likely to be inflationary in the long run when the economy is operating above the natural rate of unemployment.

KEY TAKEAWAYS

- Inflation arises whenever there is too much money chasing too few goods.
- A money supply increase will lead to increases in aggregate demand for goods and services.
- A money supply increase will tend to raise the price level in the long run.
- A money supply increase may also increase national output.
- A money supply increase will raise the price level more and national output less the lower the unemployment rate of labor and capital is.
- A money supply increase will raise national output more and the price level less the higher the unemployment rate of labor and capital is.
- The natural rate of unemployment is the rate that accounts for frictional unemployment. It is also defined as the rate at which there are no aggregate inflationary pressures.
- If a money supply increase drives an economy below the natural rate of unemployment, price level increases will tend to be large while output increases will tend to be small.
- If a money supply increase occurs while an economy is above the natural rate of unemployment, price level increases will tend to be small while output increases will tend to be large.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. The term coined in this text for the situation when everybody who wishes to work is employed.
 - b. The term used to describe how increases in output prices lead to increases in wages, which further cause output prices to rise ad infinitum.
 - c. The term for the unemployment rate at which there is no inflationary or deflationary pressure on average prices.
 - d. The term for the level of GDP in an economy when the unemployment rate is at its natural level.

- e. The term used to describe the type of unemployment that arises because of the typical adjustments of workers into, out of, and between jobs in an economy.
- f. The likely larger long-run effect of a money supply increase when an economy has unemployment below the natural rate.
- g. The likely larger long-run effect of a money supply increase when an economy has unemployment above the natural rate.

[1] This type of unemployment is also called frictional, or transitional, unemployment. It is distinguished from a second type called structural unemployment. Structural unemployment occurs when there is a change in the structure of production in an economy. For example, if the textile and apparel industry closes down and moves abroad, the workers with skills specific to the industry and the capital equipment designed for use in the industry will not be employable in other sectors. These workers and capital may remain unemployed for a longer period of time, or may never find alternative employment.

Chapter 8: National Output Determination

In most introductory macroeconomics courses, the basic Keynesian model is presented as a way of showing how government spending and taxation policies can influence the size of a country's growth national product (GNP). This chapter revisits the basic Keynesian model but adds an international angle by including impacts on domestic demand for goods and services caused by changes in the exchange rate. With this relationship in place, the chapter concludes with several comparative statics exercises showing how changes in key variables may influence the level of GNP.



8.1 Overview of National Output Determination

LEARNING OBJECTIVE

1. Understand the structure and results of the basic Keynesian model of national output determination.

This chapter describes how the supply and demand for the national output of goods and services combine to determine the equilibrium level of national output for an economy. The model is called the goods and services market model, or just the G&S market model.

In this model, we use gross national product (GNP) as the measure of national output rather than gross domestic product (GDP). This adjustment is made because we wish to define the trade balance ($EX - IM$) as the current account (defined as the difference between exports and imports of goods, services incomes payments/receipts, and unilateral transfers). This adjustment is discussed in more detail in [Section 8.6 "Export and Import Demand"](#).

The diagram used to display this model is commonly known as the Keynesian cross. The model assumes, for simplicity, that the amount of national output produced by an economy is determined by the total amount demanded. Thus if, for some reason, the demand for GNP were to rise, then the amount of GNP supplied would rise up to satisfy it. If demand for the GNP falls—for whatever reason—then supply of GNP would also fall. Consequently, it is useful to think of this model as “demand driven.”

The model is developed by identifying the key determinants of GNP demand. The starting point is the national income identity, which states that

$$GNP = C + I + G + EX - IM,$$

that is, the gross national product is the sum of consumption expenditures (C), investment expenditures (I), government spending (G), and exports (EX) minus imports (IM).

Note that the identity uses GNP rather than GDP if we define EX and IM to include income payments, income receipts, and unilateral transfers as well as goods and services trade.

We rewrite this relationship as

$$AD = CD + ID + GD + EXD - IMD,$$

where AD refers to aggregate demand for the GNP and the right-side variables are now read as consumption demand, investment demand, and so on. The model further assumes that consumption demand is positively related to changes in disposable income (Yd). Furthermore, since disposable income

is in turn negatively related to taxes and positively related to transfer payments, these additional variables can also affect aggregate demand.

The model also assumes that demand on the current account ($CAD = EXD - IMD$) is negatively related to changes in the domestic real currency value (i.e., the real exchange rate) and changes in disposable income. Furthermore, since the domestic real currency value is negatively related to the domestic price level (inflation) and positively related to the foreign price level, these variables will also affect current account demand.

Using the G&S market model, several important relationships between key economic variables are shown:

- When government demand (G) or investment demand (I) for G&S rises (falls), equilibrium GNP rises (falls).
- When disposable income rises (falls) due to a decrease (increase) in taxes or an increase (decrease) in transfer payments, equilibrium GNP increases (decreases).
- When the real exchange rate depreciates (appreciates), either due to a depreciation of the nominal exchange rate, an increase in the domestic price level, or a decrease in the foreign price level, equilibrium GNP rises (falls).

Connections

The G&S market model connects with the money market because the value of GNP determined in the G&S model affects money demand. If equilibrium GNP rises in the G&S model, then money demand will rise, causing an increase in the interest rate.

The G&S model also connects with the foreign exchange (Forex) market. The equilibrium exchange rate determined in the Forex affects the real exchange rate that in turn influences demand on the current account.

A thorough discussion of these interrelationships is given in [Chapter 9 "The AA-DD Model"](#).

Omissions

There is one important relationship omitted in this version of the G&S model, and that is the relationship between interest rates and investment. In most standard depictions of the Keynesian G&S model, it is assumed that increases (decreases) in interest rates will reduce (increase) demand for investment. In this version of the model, to keep things simple, investment is assumed to be exogenous (determined in an external process) and unrelated to the level of interest rates.

Some approaches further posit that interest rates affect consumption demand as well. This occurs because household borrowing, to buy new cars or other consumer items, will tend to rise as interest rates fall.

However, this relationship is also *not* included in this model.

KEY TAKEAWAYS

- The Keynesian, or G&S, model of output determination is a demand-driven model in that the amount of national output produced by an economy is determined by the total amount demanded.
- One important relationship omitted in this version of the G&S model is the lack of a relationship between interest rates and investment.

- The main results from the G&S model are the following:
 - When government demand (G) or investment demand (I) for G&S rises (falls), equilibrium GNP rises (falls).
 - When disposable income rises (falls) due to a decrease (increase) in taxes or an increase (decrease) in transfer payments, equilibrium GNP increases (decreases).
 - When the real exchange rate depreciates (appreciates), either due to a depreciation of the nominal exchange rate, an increase in the domestic price level, or a decrease in the foreign price level, equilibrium GNP rises (falls).

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. In the Keynesian, or G&S, model, this is the primary determinant of aggregate supply.
 - b. Of *increase, decrease, or stay the same*, this is the effect on equilibrium GNP if government spending decreases in the G&S model.
 - c. Of *increase, decrease, or stay the same*, this is the effect on equilibrium GNP if investment spending increases in the G&S model.
 - d. Of *increase, decrease, or stay the same*, this is the effect on equilibrium GNP if tax revenue decreases in the G&S model.

- e. Of *increase, decrease, or stay the same*, this is the effect on equilibrium GNP if transfer payments increase in the G&S model.
- f. Of *increase, decrease, or stay the same*, this is the effect on equilibrium GNP if the domestic currency depreciates in the G&S model.
- g. Of *increase, decrease, or stay the same*, this is the effect on equilibrium GNP if the domestic price level decreases in the G&S model.
- h. Of *increase, decrease, or stay the same*, this is the effect on equilibrium GNP if the foreign price level decreases in the G&S model.

8.2 Aggregate Demand for Goods and Services

LEARNING OBJECTIVE

1. Learn that aggregate demand is the summation of the separate demands for each variable in the national income identity.

The Keynesian model of aggregate demand for goods and services is developed by identifying key determinants of demand for the national output. When we talk about *aggregate* demand (AD), it means demand by households, businesses, and the government for anything and everything produced within the economy. The starting point is the national income identity, which states that

$$GNP = C + I + G + EX - IM,$$

that is, the gross national product is the sum of consumption expenditures, investment expenditures, government spending, and exports minus imports of goods and services.

We rewrite this relationship as

$$AD = CD + ID + GD + EXD - IMD,$$

where the left side, *AD*, refers to aggregate demand for the GNP and the right-side variables are read as consumption demand, investment demand, and so on. Determinants of the right-side variables will be considered in turn.

It is important to remember that demand is merely what households, businesses, and the government “would like” to purchase given the conditions that exist in the economy. Sometimes demand will be realized, as when the economy is in equilibrium, but sometimes demand will not be satisfied. On the other hand, the variable *Y*, for real GNP, represents the aggregate supply of G&S. This will correspond to the actual GNP whether in equilibrium or not.

Next, we'll present the determinants of each demand term: consumption, investment, government, and export and import demand.

KEY TAKEAWAY

- In the G&S model, aggregate demand for the GNP is the sum of consumption demand, investment demand, government demand, and current account demand.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. In the G&S model, the variable Y stands for this.
- b. In the G&S model, the variable AD stands for this.
- c. In the G&S model, the variable ID stands for this.
- d. In the G&S model, the variable EXD stands for this.
- e. In the G&S model, the variable CAD stands for this.

8.3 Consumption Demand

LEARNING OBJECTIVE

1. Learn the determinants of consumption demand and the effects of changes in these variables.

Consumption demand represents the demand for goods and services by individuals and households in the economy. This is the major category in the national income accounts for most countries, typically comprising from 50 percent to 70 percent of the gross national product (GNP) for most countries.

In this model, the main determinant of consumption demand is disposable income. Disposable income is all the income households have at their disposal to spend. It is defined as national income (GNP) minus taxes taken away by the government, plus transfer payments that the government pays out to people.

More formally, this is written as

$$Y_d = Y - T + TR,$$

where Y_d refers to disposable income, Y is real GNP, T is taxes, and TR represents transfer payments.

In this relationship, disposable income is defined in the same way as in the circular flow diagram presented in [Chapter 2 "National Income and the Balance of Payments Accounts"](#), [Section 2.7 "The Twin-Deficit Identity"](#). Recall that taxes withdrawn from GNP are assumed to be all taxes collected by the government from all sources. Thus income taxes, social insurance taxes, profit taxes, sales taxes, and property taxes are all assumed to be included in taxes (T). Also, transfer payments refer to all payments made by the government that do not result in the provision of a good or service. All social insurance payments, welfare payments, and unemployment compensation, among other things, are included in transfers (TR).

In the G&S model, demand for consumption G&S is assumed to be positively related to disposable income. This means that when disposable income rises, demand for consumption G&S will also rise, and vice versa. This makes sense since households who have more money to spend will quite likely wish to buy more G&S.

We can write consumption demand in a functional form as follows:

$$C^D(Y_d^+) = C^D(Y - T + TR).$$

This expression says that consumption demand is a function CD that depends positively (+) on disposable income (Y_d). The second term simply substitutes the variables that define disposable income in place

of Y_d . It is a more complete way of writing the function. Note well that CD here denotes a function, not a variable. The expression is the same as if we had written $f(x)$, but instead we substitute a CD for the f and Y_d for the x .

It is always important to keep track of which variables are exogenous and which are endogenous. In this model, real GNP (Y) is the key endogenous variable since it will be determined in the equilibrium. Taxes (T) and transfer payments (TR) are exogenous variables, determined outside the model. Since consumption demand CD is dependent on the value of Y , which is endogenous, CD is also endogenous. By the same logic, Y_d is endogenous as well.

Linear Consumption Function

It is common in most introductory textbooks to present the consumption function in linear form. For our purposes here, this is not absolutely necessary, but doing so will allow us to present a few important points.

In linear form, the consumption function is written as

$$C^D = C_0 + mpcY_d = C_0 + mpc(Y - T + TR).$$

Here C_0 represents autonomous consumption and mpc refers to the *marginal propensity to consume*. Autonomous consumption (C_0) is the amount of consumption that would be demanded even if income were zero. (Autonomous simply means “independent” of income.) Graphically, it corresponds to the y -intercept of the linear function. Autonomous consumption will be positive since households will spend some money (drawing on savings if necessary) to purchase consumption goods (like food) even if income were zero.

The marginal propensity to consume (mpc) represents the additional (or marginal) demand for G&S given an additional dollar of disposable income. Graphically, it corresponds to the slope of the consumption function. This variable must be in the range of zero to one and is most likely to be between 0.5 and 0.8 for most economies. If mpc were equal to one, then households would spend every additional dollar of income. However, because most households put some of their income into savings (i.e., into the bank, or pensions), not every extra dollar of income will lead to a dollar increase in consumption demand. That fraction of the dollar not used for consumption but put into savings is called the marginal propensity to save (mps). Since each additional dollar must be spent or saved, the following relationship must hold:

$$mpc + mps = 1,$$

that is, the sum of the marginal propensity to consume and the marginal propensity to save must equal 1.

KEY TAKEAWAYS

- In the G&S model, consumption demand is determined by disposable income.
- A linear consumption function includes the marginal propensity to consume and an autonomous consumption component, besides disposable income.
- Disposable income is defined as national income (GNP) minus taxes plus transfer payments.
- An increase (decrease) in disposable income will cause an increase (decrease) in consumption demand.
- An increase (decrease) in the marginal propensity to consume will cause an increase (decrease) in consumption demand.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. The term that represents the additional amount of consumption demand caused by an additional dollar of disposable income.
 - b. The term that represents the additional amount of saving caused by an additional dollar of disposable income.
 - c. The term for the amount of consumption demand that would arise even if disposable income were zero.
 - d. Of *positive* or *negative*, the relationship between changes in disposable income and changes in consumption demand.
 - e. Of *positive* or *negative*, the relationship between changes in tax revenues and changes in consumption demand.
 - f. Of *positive* or *negative*, the relationship between changes in real GNP and changes in consumption demand.
 - g. A household purchase of a refrigerator would represent demand recorded in this component of aggregate demand in the G&S model.



8.4 Investment Demand

LEARNING OBJECTIVE

1. Learn the determinants of investment demand and the effects of changes in these variables.

Investment demand refers to the demand by businesses for physical capital goods and services used to maintain or expand its operations. Think of it as the office and factory space, machinery, computers, desks, and so on that are used to operate a business. It is important to remember that investment demand here does not refer to financial investment. Financial investment is a form of saving, typically by households that wish to maintain or increase their wealth by deferring consumption till a later time. In this model, investment demand will be assumed to be exogenous. This means that its value is determined outside of the model and is not dependent on any variable within the model. This assumption is made primarily to simplify the analysis and to allow the focus to be on exchange rate changes later. The simple equation for investment demand can be written as

$$ID = I_0,$$

where the “0,” or naught, subscript on the right side indicates that the variable is exogenous or autonomous. In words, the equation says that investment demand is given exogenously as I_0 .

Admittedly, this is not a realistic assumption. In many other macro models, investment demand is assumed to depend on two other aggregate variables: GNP and interest rates. GNP may affect investment demand since the total demand for business expansion is more likely the higher the total size of the economy. The growth rate of GNP may also be an associated determinant since the faster GNP is growing, the more likely companies will predict better business in the future, inspiring more investment.

Interest rates can affect investment demand because many businesses must borrow money to finance expansions. The interest rate is the cost of borrowing money; thus, the higher the interest rates are, the lower the investment demand should be, and vice versa.

If we included the GNP and interest rate effects into the model, the solution to the extended model later would prove to be much more difficult. Thus we simplify things by assuming that investment is exogenous. Since many students have learned about the GNP and interest rate effect in previous courses, you need to remember that these effects are *not* a part of this model.

KEY TAKEAWAYS

- In the G&S model, investment demand is assumed to be exogenous, meaning not dependent on any other variable within the model such as GNP or interest rates.
- The omission of an effect by GNP and interest rates on investment demand is made to simplify the model.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. Term for a type of investment by households that wish to maintain or increase their wealth by deferring consumption till a later time.
 - b. Investment demand refers to this type of goods and services.
 - c. Of *exogenous* or *endogenous*, this describes investment demand in the G&S model in the text.
 - d. The name of two variables that are likely to influence investment demand in reality but are excluded from the G&S model as a simplification.
 - e. A business purchase of a company delivery van would represent demand recorded in this component of aggregate demand in the G&S model.

8.5 Government Demand

LEARNING OBJECTIVE

1. Learn the determinants of government demand and the effects of changes in these variables.

Government demand refers to the government's demand for goods and services produced in the economy. In some cases this demand is for G&S produced by private businesses, as when the government purchases a naval aircraft. Other government demand is actually produced by the government itself, as what occurs with teachers providing educational services in the public schools. All levels of government demand—federal, state, and local—are included in this demand term. Excluded are transfer payments such as social insurance, welfare assistance, and unemployment compensation.

In this model, government demand is treated the same way as investment demand: it is assumed to be exogenous. This means that its value is determined outside of the model and is not dependent on any variable within the model. A simple equation for government demand can be written as

$$GD = G_0,$$

where the “0,” or naught, subscript on the right side indicates that the variable is exogenous or autonomous. In words, the equation says that government demand is given exogenously as G_0 . This is a more common assumption in many other macro models, even though one could argue dependencies of government demand on GNP and interest rates. However, these linkages are not likely to be as strong as with investment, thus assuming exogeneity here is a more realistic assumption than with investment.

KEY TAKEAWAY

- In the G&S model, government demand is assumed to be exogenous, meaning not dependent on any other variable within the model such as GNP or interest rates.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. These three levels of government demand are included in GD in the G&S model.
 - b. This type of government expenditure is not included in GD in the G&S model.

- c. Of *exogenous* or *endogenous*, this describes government demand in the G&S model in the text.
- d. An expenditure by a state school system on teachers' salaries would represent demand recorded in this component of aggregate demand in the G&S model.

8.6 Export and Import Demand

LEARNING OBJECTIVE

1. Learn the determinants of export and import demand and the effects of changes in these variables.

Export demand refers to the demand by foreign countries for G&S produced domestically. Ultimately, these goods are exported to foreign residents. Import demand refers to demand by domestic residents for foreign-produced G&S. Imported G&S are not a part of domestic GNP. Recall from [Chapter 2 "National Income and the Balance of Payments Accounts"](#), [Section 2.3 "U.S. National Income Statistics \(2007–2008\)"](#) that imports are subtracted from the national income identity because they are included as a part of consumption, investment, and government expenditures as well as in exports. Likewise in this model, consumption, investment, government, and export demand are assumed to include demand for imported goods. Thus imports must be subtracted to assure that only domestically produced G&S are included.

We will define current account demand as $CAD = EXD - IMD$. The key determinants of current account demand in this model are assumed to be the domestic real currency value and disposable income.

First, let's define the real currency value, then show how it relates to the demand for exports and imports. The real British pound value in terms of U.S. dollars (also called the real exchange rate between dollars and pounds), $RE_{\$/\pounds}$, is a measure of the cost of a market basket of goods abroad relative to the cost of a similar basket domestically. It captures differences in prices, converted at the spot exchange rate, between the domestic country and the rest of the world. It is defined as

$$RE_{\$/\pounds} = \frac{E_{\$/\pounds} CB_{\pounds}}{CB_{\$}}$$

where $E_{\$/\pounds}$ is the spot exchange rate, CB_{\pounds} is the cost of a market basket of goods in Britain, and $CB_{\$}$ is the cost of a comparable basket of goods in the United States. The top expression, $E_{\$/\pounds} CB_{\pounds}$, represents the cost of a British market basket of goods converted to U.S. dollars. Thus if $RE_{\$/\pounds} > 1$, then a British basket of goods costs more than a comparable U.S. basket of goods. If $RE_{\$/\pounds} < 1$, then a U.S. basket of goods costs more than a British basket. Also note that $RE_{\$/\pounds}$ is a unit less number. If $RE_{\$/\pounds} = 2$, for example, it means that British goods cost twice as much as U.S. goods, on average, at the current spot exchange rate.

Note that we could also have defined the reciprocal real exchange rate, $RE_{\pounds/\$}$. This real exchange rate is the real value of the pound in terms of U.S. dollars. Since the real exchange rate can be defined in two

separate ways between any two currencies, it can be confusing to say things like “the real exchange rate rises” since the listener may not know which real exchange rate the speaker has in mind. Thus it is always preferable to say the real dollar value rises, or the real pound value falls, since this eliminates any potential confusion. In this text, I will always adhere to the convention of writing the spot exchange rate and the real exchange rate with the U.S. dollar in the numerator. Thus references to the real exchange rate in this text will always refer to that form.

Since the cost of a market basket of goods is used to create a country’s price index, changes in CB will move together with changes in the country’s price level P . For this reason, it is common to rewrite the real exchange rate using price levels rather than costs of market baskets and to continue to interpret the expression in the same way. For more information related to this, see [Chapter 6 "Purchasing Power Parity"](#), [Section 6.2 "The Consumer Price Index \(CPI\) and PPP"](#). We will follow that convention here and rewrite $RE_{\$/\pounds}$ as

$$RE_{\$/\pounds} = \frac{E_{\$/\pounds} P_{\pounds}}{P_{\$}}$$

where P_{\pounds} is the British price index and $P_{\$}$ is the U.S. price index. From this point forward, we’ll mean this expression whenever we discuss the real exchange rate.

Next, we’ll discuss the connection to current account demand. To understand the relationship it is best to consider a change in the real exchange rate. Suppose $RE_{\$/\pounds}$ rises. This means that the real value of the pound rises and, simultaneously, the real U.S. dollar value falls. This also means that goods and services are becoming relatively more expensive, on average, in Britain compared to the United States.

Relatively cheaper G&S in the United States will tend to encourage U.S. exports since the British would prefer to buy some cheaper products in the United States. Similarly, relatively more expensive British G&S will tend to discourage U.S. imports from Britain. Since U.S. exports will rise and imports will fall with an increase in the real U.S. dollar value, current account demand, $CAD = EXD - IMD$, will rise.

Similarly, if the real U.S. dollar value falls, U.S. exports will fall and imports rise, causing a decrease in CAD . Hence, there is a positive relationship between this real exchange rate (i.e., the real value of the pound) and U.S. current account demand.

Disposable income can also affect the current account demand. In this case, the effect is through imports. An increase in disposable income means that households have more money to spend. Some fraction of

this will be consumed, the marginal propensity to consume, and some fraction of that consumption will be for imported goods. Thus an increase in disposable income should result in an increase in imports and a subsequent reduction in current account demand. Thus changes in disposable income are negatively related to current account demand.

We can write current account demand in functional form as follows:

$$CA^D(RE_{\$/\text{€}}^+, \bar{Y}_d).$$

The expression indicates that current account demand is a function of $RE_{\$/\text{€}}$ and Y_d . The “+” sign above $RE_{\$/\text{€}}$ indicates the positive relationship between the real exchange rate (as defined) and current account demand. The “-” sign above the disposable income term indicates a negative relationship with current account demand.

KEY TAKEAWAYS

- The key determinants of current account demand in the G&S model are assumed to be the domestic real currency value and disposable income.
- The real exchange rate captures differences in prices, converted at the spot exchange rate, between the domestic country and the rest of the world.
- In the G&S model, there is a positive relationship between the real exchange rate (as defined) and current account demand and a negative relationship between disposable income and current account demand.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. Of *positive* or *negative*, the relationship between changes in the domestic price level and the real value of the domestic currency.
 - b. Of *positive* or *negative*, the relationship between changes in the foreign price level and the real value of the domestic currency.
 - c. Of *positive* or *negative*, the relationship between changes in the nominal value of the domestic currency and the real value of the domestic currency.

- d. Of *increase, decrease, or stay the same*, the effect of a real appreciation of the domestic currency on current account demand in the G&S model.
- e. Of *increase, decrease, or stay the same*, the effect of a depreciation of the domestic currency on current account demand in the G&S model.
- f. Of *increase, decrease, or stay the same*, the effect of an increase in the domestic price level on current account demand in the G&S model.
- g. Of *increase, decrease, or stay the same*, the effect of an increase in the foreign price level on current account demand in the G&S model.
- h. Of *increase, decrease, or stay the same*, the effect of a decrease in real GNP on current account demand in the G&S model.
- i. An expenditure by a domestic business for a microscope sold by a Swiss firm would represent demand recorded in this component of aggregate demand in the G&S model.
- j. An expenditure by a foreign business for a microscope sold by a U.S. firm would represent demand recorded in this component of aggregate demand in the G&S model.

8.7 The Aggregate Demand Function

LEARNING OBJECTIVE

1. Combine the individual demand functions into an aggregate demand (AD) function.

Notice that the right side indicates that if disposable income were to rise, consumption demand would rise but current account demand, which is negatively related to disposable income, would fall. This would seem to make ambiguous the effect of a disposable income change on aggregate demand. However, by thinking carefully about the circular flow definitions, we can recall that consumption expenditures consist of the sum of expenditures on domestically produced goods and imported goods. This was the reason imports are subtracted away in the national income identity. This also means that the marginal propensity to spend on imported goods must be lower than the total marginal propensity to consume, again since imports are a fraction of total consumption spending. This implies that the negative effect on imports from a \$1 increase in disposable income must be less than the positive impact on consumption demand. We indicate the net positive effect on aggregate demand of changes in disposable income with the “+” sign above Yd on the left-hand side. The positive impact of changes in the real exchange rate, investment demand, and government demand is obvious and is also shown.

We can write the aggregate demand function in several different ways. To be more explicit, we can include all the fundamental variables affecting aggregate demand by writing out the disposable income and real exchange rate terms as follows:

$$AD(Y - \overset{+}{T} + TR, \frac{\overset{+}{E_{S/\$}} P_{\$}}{P_S}, \overset{+}{I}_0, \overset{+}{G}_0) = C^D(Y - \overset{+}{T} + TR) + I_0 + G_0 + CA^D(\frac{\overset{+}{E_{S/\$}} P_{\$}}{P_S}, Y - \overset{-}{T} + TR).$$

Writing the expression in this way allows us to indicate that the spot exchange rate, the price levels domestically and abroad, and domestic taxes and transfer payments also affect aggregate demand. For example, increases in autonomous transfer payments will raise aggregate demand since it raises disposable income, which in turn raises demand. Increases in taxes, however, will lower disposable income, which in turn will lower aggregate demand. Similarly, an increase in the spot exchange rate (as defined) or the foreign price level will raise aggregate demand, since both changes will increase the real exchange rate. However, an increase in the domestic price level will reduce the real exchange rate (because it is in the denominator) and thus reduce aggregate demand.

KEY TAKEAWAY

- Aggregate demand is positively related to changes in disposable income, the real exchange rate (as defined), and investment and government demands.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. Of *increase, decrease, or stay the same*, the effect of a real appreciation of the domestic currency on aggregate demand in the G&S model.
- b. Of *increase, decrease, or stay the same*, the effect of an increase in investment demand on aggregate demand in the G&S model.
- c. Of *increase, decrease, or stay the same*, the effect of an increase in disposable income on aggregate demand in the G&S model.
- d. Of *increase, decrease, or stay the same*, the effect of an increase in income taxes on aggregate demand in the G&S model.
- e. Of *increase, decrease, or stay the same*, the effect of an increase in government demand on aggregate demand in the G&S model.
- f. Of *increase, decrease, or stay the same*, the effect of an increase in the real currency value on aggregate demand in the G&S model.
- g. Of *increase, decrease, or stay the same*, the effect of an increase in the domestic price level on aggregate demand in the G&S model.

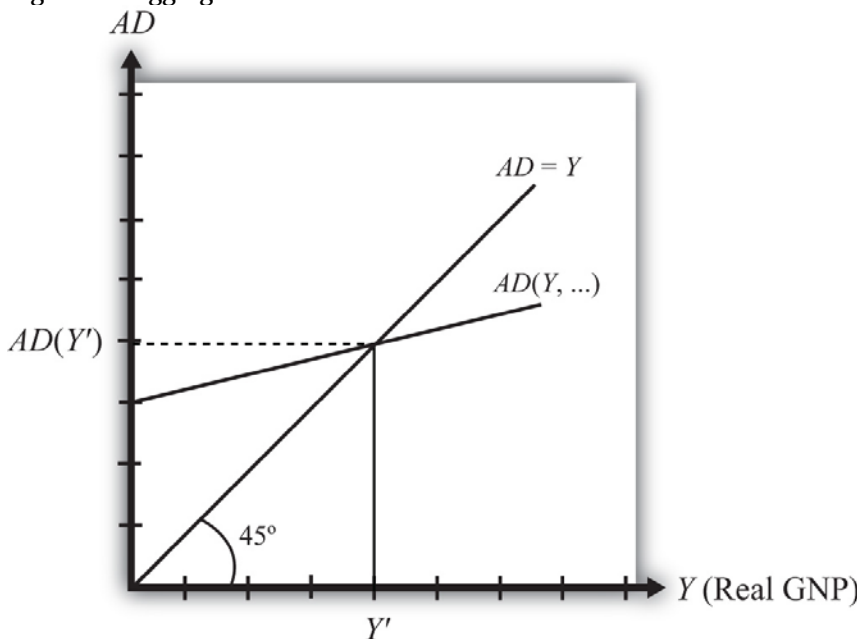
8.8 The Keynesian Cross Diagram

LEARNING OBJECTIVE

1. Learn how to use the Keynesian cross diagram to describe equilibrium in the G&S market.

The Keynesian cross diagram depicts the equilibrium level of national income in the G&S market model. We begin with a plot of the aggregate demand function with respect to real GNP (Y) in . Real GNP (Y) is plotted along the horizontal axis, and aggregate demand is measured along the vertical axis. The aggregate demand function is shown as the upward sloping line labeled $AD(Y, \dots)$. The (...) is meant to indicate that AD is a function of many other variables not listed. There are several important assumptions about the form of the AD function that are needed to assure an equilibrium. We discuss each assumption in turn.

Figure 8.1 Aggregate Demand Function



First, the AD function is positively sloped with respect to changes in Y , ceteris paribus. Recall that ceteris paribus means that all other variables affecting aggregate demand are assumed to remain constant as GNP changes. The positive slope arises from the rationale given previously that an increase in disposable income should

naturally lead to an increase in consumption demand and a smaller decrease in CA demand, resulting in a net increase in aggregate demand. Next, if GNP rises, ceteris paribus, it means that taxes and transfer payments remain fixed and disposable income must increase. Thus an increase in GNP leads to an increase in AD .

Second, the AD function has a positive vertical intercept term. In other words, the AD function crosses the vertical axis at a level greater than zero. For reasons that are not too important, this feature is critical for

generating the equilibrium later. The reason it arises is because autonomous consumption, investment, and government demand are all assumed to be independent of income and positive in value. These assumptions guarantee a positive vertical intercept.

Third, the AD function has a slope that is less than one. This assumption means that for every \$1 increase in GNP (Y), there is a less than \$1 increase in aggregate demand. This arises because the marginal propensity to consume domestic GNP is less than one for two reasons. First, some of the additional income will be spent on imported goods, and second, some of the additional income will be saved. Thus the AD function will have a slope less than one.

Also plotted in the diagram is a line labeled $AD = Y$. This line is also sometimes called the forty-five-degree line since it sits at a forty-five-degree angle to the horizontal axis. This line represents all the points on the diagram where AD equals GNP. Since GNP can be thought of as aggregate supply, the forty-five-degree line contains all the points where AD equals aggregate supply.

Because of the assumptions about the shape and position of the AD function, AD will cross the forty-five-degree line, only once, from above. The intersection determines the equilibrium value of GNP, labeled Y in the diagram.

KEY TAKEAWAYS

- The Keynesian cross diagram plots the aggregate demand function versus GNP together with a forty-five-degree line representing the set of points where $AD = GNP$. The intersection of these two lines represents equilibrium GNP in the economy.

- An equilibrium exists if the AD function crosses the forty-five-degree line from above.

This occurs if three conditions hold:

1. The AD function has a positive slope. (It does.)
2. The AD function has a slope less than one. (It does.)
3. The AD function intersects the vertical axis in the positive range. (It does.)

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. Of *positive, negative, or zero*, the slope of an aggregate demand function with respect to changes in real GNP.
- b. Of *positive, negative, or zero*, the value of the vertical intercept of an aggregate demand function.
- c. Of *greater than one, less than one, or equal to one*, the value of the slope of an aggregate demand function with respect to changes in real GNP.
- d. The equality that is satisfied on the forty-five-degree line in a Keynesian cross diagram.
- e. The value of this variable is determined at the intersection of the aggregate demand function and the forty-five-degree line in a Keynesian cross diagram.

8.9 Goods and Services Market Equilibrium Stories

LEARNING OBJECTIVE

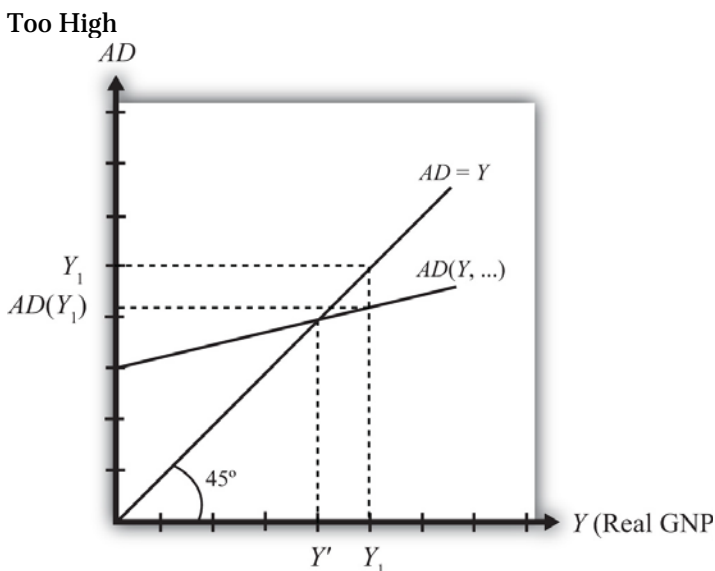
1. Learn the equilibrium stories in the G&S market that describe how GNP adjusts when it is not at its equilibrium value.

Any equilibrium in economics has an associated behavioral story to explain the forces that will move the endogenous variable to the equilibrium value. In the G&S market model, the endogenous variable is Y , real GNP. This is the variable that will change to achieve the equilibrium. Variables that do not change in the adjustment to the equilibrium are the exogenous variables. In this model, the exogenous variables are $I_0, G_0, T, TR, E_{\$/\text{€}}, P_S,$ and P_L . (If one uses a linear consumption demand function, the C_0 and mpc are also exogenous.) Changes in the exogenous variables are necessary to cause an adjustment to a new equilibrium. However, in telling an equilibrium story, it is typical to simply assume that the endogenous variable is not at the equilibrium (for some unstated reason) and then to explain how and why the variable will adjust to the equilibrium value.

GNP Too High

Suppose for some reason actual GNP, Y_1 , is higher than the equilibrium GNP, Y' , as shown in [Figure 8.2](#) "G&S Market Adjustment to Equilibrium: GNP Too High". In this case, aggregate demand is read from the AD function as $AD(Y_1)$ along the vertical axis. We project aggregate supply, Y_1 , to the vertical axis using

Figure 8.2 G&S Market Adjustment to Equilibrium: GNP



the forty-five-degree line so that we can compare supply with demand. This helps us to see that $Y_1 > AD(Y_1)$ —that is, aggregate supply is greater than aggregate demand.

We now tell what can be called the "Inventory Story." When total demand is less than supply, goods will begin to pile up on the shelves in stores. That's because at current prices (and all other fixed exogenous parameters), households, businesses, and

government would prefer to buy less than what is available for sale. Thus inventories begin to rise. Merchants, faced with storerooms filling up, send orders for fewer goods to producers. Producers respond to fewer orders by producing less, and thus GNP begins to fall.

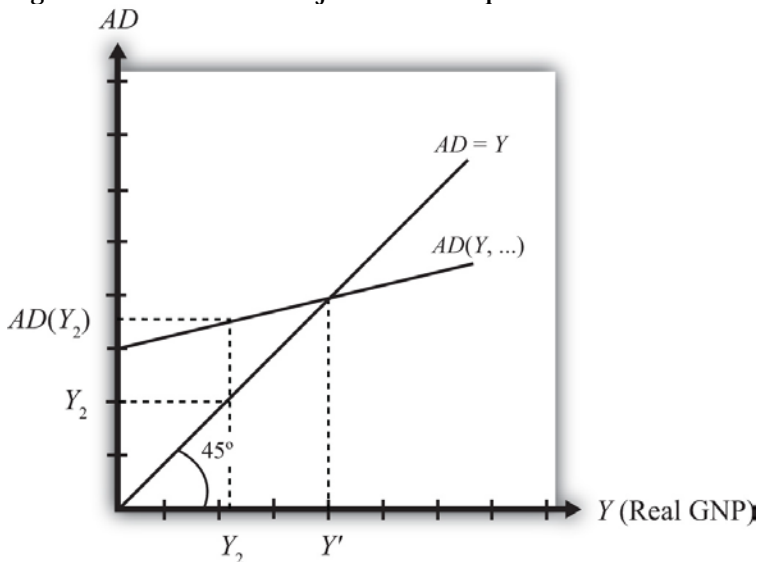
As GNP falls, disposable income also falls, which causes a drop in aggregate demand as well. In the diagram, this is seen as a movement along the AD curve from Y_1 to Y' . However, GNP falls at a faster rate, along the $AD = Y$ line in the diagram. Eventually, the drop in aggregate supply catches up to the drop in demand when the equilibrium is reached at Y' . At this point, aggregate demand equals aggregate supply and there is no longer an accumulation of inventories.

It is important to recognize a common perception or intuition that does not hold in the equilibrium adjustment process. Many students imagine a case of rising inventories and ask, "Won't producers just lower their prices to get rid of the excess?" In real-world situations this will frequently happen; however, that response violates the ceteris paribus assumption of this model. We assume here that the U.S. price level (P_s) and consequently all prices in the economy remain fixed in the adjustment to the new equilibrium. Later, with more elaborate versions of the model, some price flexibility is considered.

GNP Too Low

Suppose for some reason, actual GNP, Y_2 , is lower than the equilibrium GNP, Y' , as shown in Figure 8.3 "G&S Market Adjustment to Equilibrium: GNP Too Low". In this case, aggregate demand is read from the AD function as $AD(Y_2)$ along the vertical axis. We project aggregate supply (Y_2) to the vertical axis using the forty-five-

Figure 8.3 G&S Market Adjustment to Equilibrium: GNP Too Low



degree line. This shows that $AD(Y_2) > Y_2$ —that is, aggregate demand is greater than aggregate supply.

When total demand exceeds supply, inventories of goods that had previously been accumulated will begin to deplete in stores. That's because, at current prices (and all other fixed exogenous parameters),

households, businesses, and government would prefer to buy more than is needed to keep stocks at a constant level. Merchants, faced with depleted inventories and the possibility of running out of goods to sell, send orders to producers for greater quantities of goods. Producers respond to more orders by producing more and thus GNP begins to rise.

As GNP rises, disposable income also rises, which causes an increase in aggregate demand as well. In the diagram, this is seen as a movement along the AD curve from Y_2 to Y . However, GNP rises at a faster rate, along the $AD = Y$ line in the diagram. Eventually, the increase in aggregate supply catches up to the increase in demand when the equilibrium is reached at Y . At this point, aggregate demand equals aggregate supply and there is no further depletion of inventories.

KEY TAKEAWAYS

- If the actual GNP is higher than the equilibrium rate, then excess supply leads to an accumulation of inventories. Firms respond to the surplus by cutting production, causing GNP to fall until the GNP supplied is equal to aggregate demand.
- If the actual GNP is lower than the equilibrium rate, then excess demand leads to a depletion of inventories. Firms respond to the surplus by raising production, which causes GNP to rise until the GNP supplied is equal to aggregate demand.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. Of *increase, decrease, or stay the same*, this will happen to store inventories when aggregate demand exceeds GNP.
 - b. Of *increase, decrease, or stay the same*, this will happen to store inventories when actual GNP is greater than equilibrium GNP.
 - c. Of *increase, decrease, or stay the same*, this is the direction of GNP change when inventories are accumulating in the Keynesian model.
 - d. Of *increase, decrease, or stay the same*, this is the direction of GNP change when inventories are depleting in the Keynesian model.

e. Of *faster, slower, or the same rate*, the rate of increase of aggregate demand compared to the increase in GNP as GNP rises to an equilibrium value in the Keynesian model.



8.10 Effect of an Increase in Government Demand on Real GNP

LEARNING OBJECTIVE

1. Learn how a change in government demand affects equilibrium GNP.

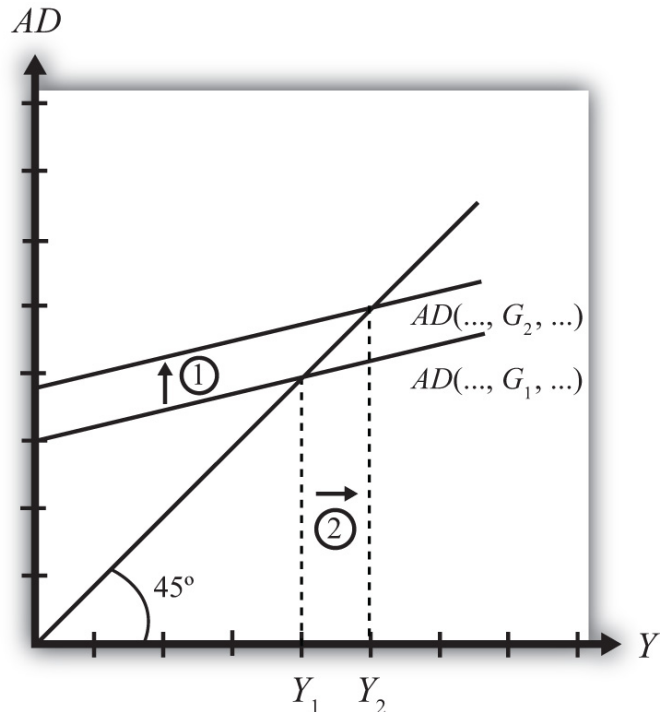
Suppose the economy is initially in equilibrium in the G&S market with government demand at level G_1 and real GNP at Y_1 , shown in Figure 8.4 "Effect of an Increase in Government Demand in the G&S Market". The initial AD function is written as $AD(\dots, G_1, \dots)$ to signify the level of government demand and to denote that other variables affect AD and are at some initial and unspecified values.

Next, suppose the government raises demand for G&S from G_1 to G_2 , ceteris paribus. The increase might arise because a new budget is passed by the legislature with new spending initiatives. The ceteris paribus assumption means that all other exogenous variables are assumed remain fixed. Most importantly in context, this means that the increase in government demand is paid for with increases in taxes or decreases in transfer payments.

Since higher government demand raises aggregate demand, the AD function shifts up from $AD(\dots, G_1, \dots)$ to $AD(\dots, G_2, \dots)$ (step 1). The equilibrium GNP in turn rises to Y_2 (step 2). Thus the increase in government demand causes an increase in real GNP.

The adjustment process follows the "GNP too low" story. When government demand increases, but before GNP rises to adjust, AD is greater than Y_1 . The excess demand for G&S depletes inventories, in this case for firms that supply the government, causing merchants to increase order size. This leads firms to increase output, thus raising GNP.

Figure 8.4 Effect of an Increase in Government Demand in the G&S Market



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KEY TAKEAWAY

- In the G&S model, an increase (decrease) in government demand causes an increase (decrease) in real GNP.

EXERCISES

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. *Of increase, decrease, or stay the same*, the effect on equilibrium real GNP from a decrease in government demand in the G&S model.
- b. *Of increase, decrease, or stay the same*, the effect on equilibrium real GNP caused by an increase in government demand in the G&S model.
- c. *Of GNP too low or GNP too high*, the equilibrium story that must be told following an increase in government demand in the G&S model.
- d. *Of GNP too low or GNP too high*, the equilibrium story that must be told following a decrease in government demand in the G&S model.

In the text, the effect of a change in government demand is analyzed. Use the G&S model (diagram) to individually assess the effect on equilibrium GNP caused by the following changes. Assume *ceteris paribus*.

- a. An increase in investment demand.
- b. An increase in transfer payments.
- c. An increase in tax revenues.

Consider an economy in equilibrium in the G&S market.

- a. Suppose investment demand decreases, *ceteris paribus*. What is the effect on equilibrium GNP?
- b. Now suppose investment demand decreases, but *ceteris paribus* does not apply because at the same time government demand rises. What is the effect on equilibrium GNP?
- c. In general, which of these two assumptions, *ceteris paribus* or no *ceteris paribus*, is more realistic? Explain why.

d. If ceteris paribus is less realistic, why do economic models so frequently apply the assumption?

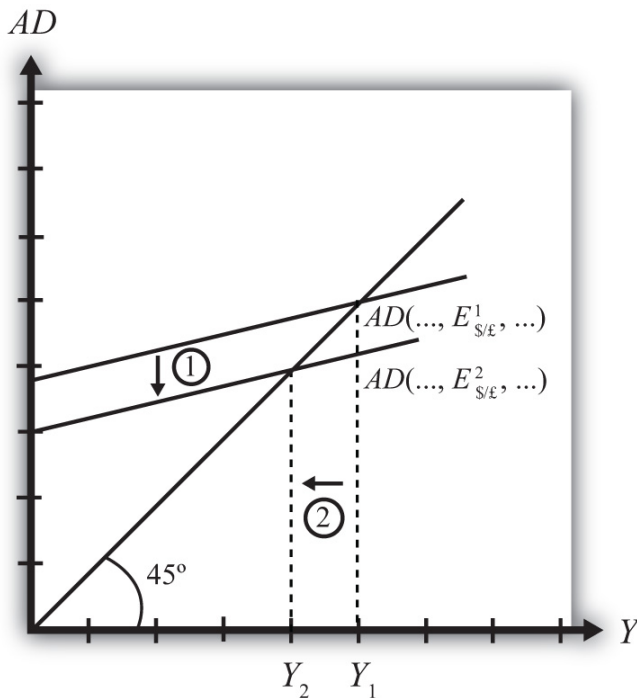
8.11 Effect of an Increase in the U.S. Dollar Value on Real GNP

LEARNING OBJECTIVE

1. Learn how a change in the U.S. dollar value affects equilibrium GNP.

Suppose the economy is initially in equilibrium in the G&S market with the exchange rate at level $E_{\$/\pounds}^1$ and real GNP at Y_1 as shown in . The initial AD function is written as $AD(\dots, E_{\$/\pounds}^1, \dots)$ to signify the level of the exchange rate and to denote that other variables affect AD and are at some initial and unspecified values.

Figure 8.5 Effect of an Increase in the U.S. Dollar Value in the G&S Market



Next, suppose the U.S. dollar value rises, corresponding to a decrease in the exchange rate from $E_{\$/\pounds}^1$ to $E_{\$/\pounds}^2$, ceteris paribus. As explained in , the increase in the spot dollar value also increases the real dollar value, causing foreign G&S to become relatively cheaper and U.S. G&S to become more expensive. This change reduces demand for U.S. exports and increases import demand, resulting in a reduction in aggregate demand. The ceteris paribus assumption means that all other exogenous variables are assumed to remain fixed.

Since the higher dollar value lowers aggregate demand, the AD function shifts

down from $AD(\dots, E_{\$/\pounds}^1, \dots)$ to $AD(\dots, E_{\$/\pounds}^2, \dots)$ (step 1), and equilibrium GNP in turn falls to Y_2 (step 2).

Thus the increase in the U.S. dollar value causes a decrease in real GNP.

The adjustment process follows the “GNP too high” story. When the dollar value rises but before GNP falls to adjust, $Y_1 > AD$. The excess supply of G&S raises inventories, causing merchants to decrease order size.

This leads firms to decrease output, lowering GNP.

KEY TAKEAWAY

- In the G&S model, an increase (decrease) in the U.S. dollar value causes a decrease (increase) in real GNP.

EXERCISES

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. Of *increase, decrease, or stay the same*, the effect on equilibrium real U.S. GNP from a decrease in the value of the U.S. dollar in the G&S model.
- b. Of *increase, decrease, or stay the same*, the effect on equilibrium real GNP caused by an increase in the value of the U.S. dollar in the G&S model.
- c. Of *GNP too low or GNP too high*, the equilibrium story that must be told following an increase in the value of the U.S. dollar in the G&S model.
- d. Of *GNP too low or GNP too high*, the equilibrium story that must be told following a decrease in the value of the U.S. dollar in the G&S model.

In the text, the effect of a change in the currency value is analyzed. Use the G&S model (diagram) to individually assess the effect on equilibrium GNP caused by the following changes. Assume *ceteris paribus*.

- a. A decrease in the real currency value.
- b. An increase in the domestic price level.
- c. An increase in the foreign price level.

8.12 The J-Curve Effect

LEARNING OBJECTIVE

1. Learn about the J-curve effect that explains how current account adjustment in response to a change in the currency value will vary over time.

In the goods market model, it is assumed that the exchange rate ($E_{\$/\pounds}$) is directly related to current account demand in the United States. The logic of the relationship goes as follows. If the dollar depreciates, meaning $E_{\$/\pounds}$ rises, then foreign goods will become more expensive to U.S. residents, causing a decrease in import demand. At the same time U.S. goods will appear relatively cheaper to foreign residents, causing an increase in demand for U.S. exports. The increase in export demand and decrease in import demand both contribute to an increase in the current account demand. Since in the goods market model, any increase in demand results in an increase in supply to satisfy that demand, the dollar depreciation should also lead to an increase in the actual current account balance.

In real-world economies, however, analysis of the data suggests that in many instances a depreciating currency tends to cause, at least, a temporary increase in the deficit rather than the predicted decrease. The explanation for this temporary reversal of the cause-and-effect relationship is called the J-curve theory. In terms of future use of the AA-DD model, we will always assume the J-curve effect is not operating, unless otherwise specified. One should think of this effect as a possible short-term exception to the standard theory.

The theory of the J-curve is an explanation for the J-like temporal pattern of change in a country's trade balance in response to a sudden or substantial depreciation (or devaluation) of the currency.

Consider , depicting two variables measured, hypothetically, over some period: the U.S. dollar / British pound ($E_{\$/\pounds}$) and the U.S. current account balance ($CA = EX - IM$). The exchange rate is meant to represent the average value of the dollar against all other trading country currencies and would correspond to a dollar value index that is often constructed and reported. Since the units of these two data series would be in very different scales, we imagine the exchange rate is measured along the left axis, while the CA balance is measured in different units on the right-hand axis. With appropriately chosen scales, we can line up the two series next to each other to see whether changes in the exchange rate seem to correlate with positive or negative changes in the CA balance.

As previously mentioned, the standard theory suggests a positive relationship between $E_{\$/\pounds}$ and the U.S. current account, implying that, ceteris paribus, any dollar depreciation (an increase in $E_{\$/\pounds}$) should cause an increase in the CA balance.

However, what sometimes happens instead, is immediately following the dollar depreciation at time t_1 , the CA balance falls for a period of time, until time t_2 is reached. In this phase, a CA deficit would become larger, not smaller.

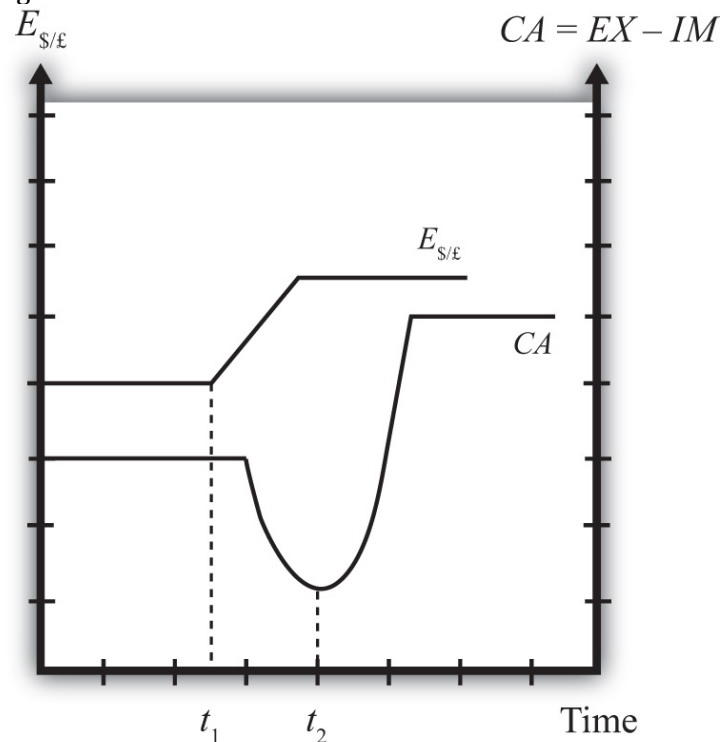
Eventually, after period t_2 , the CA balance reverses direction and begins to increase—in other words, a trade deficit falls. The diagram demonstrates clearly how the CA balance follows the pattern of a “J” in the transition following a dollar depreciation, hence the name J-curve theory.

In the real world, the period of time thought necessary for the CA balance to traverse the J pattern is between one and two years. However, this estimate is merely a rough rule of thumb as the actual paths will be influenced by many other variable changes also occurring at the same time. Indeed, in some cases the J-curve effect may not even arise, so there is nothing automatic about it.

The reasons for the J-curve effect can be better understood by decomposing the current account balance. The basic definition of the current account is the difference between the value of exports and the value of imports. That is,
 $CA = EX - IM$.

The current account also includes income payments and receipts and unilateral transfers, but these categories are usually small and will not play a big role in this discussion—so we’ll ignore them. The main thing to take note about this definition is that the CA is measured in “value” terms, which means in terms

Figure 8.6 J-Curve Effect



of dollars. The way these values are determined is by multiplying the quantity of imports by the price of each imported item. We expand the CA definition by using the summation symbol and imagining summing up across all exported goods and all imported goods:

$$CA = \sum P_{EX}Q_{EX} - \sum P_{IM}Q_{IM}.$$

Here $\sum P_{EX}Q_{EX}$ represents the summation of the price times quantities of all goods exported from the country, while $\sum P_{IM}Q_{IM}$ is the summation of the price times quantities of all goods imported from the country.

However, for imported goods we could also take note that foreign products are denominated in foreign currency terms. To convert them to U.S. dollars we need to multiply by the current spot exchange rate. Thus we can expand the CA definition further by incorporating the exchange rate into the import term as follows:

$$CA = \sum P_{EX}Q_{EX} - \sum E_{\$/\pounds}P^*_{IM}Q_{IM}.$$

Here $E_{\$/\pounds}$ represents whatever dollar/pound rate prevailed at the time of imports, and P^*_{IM} represents the price of each imported good denominated in foreign (*) pound currency terms. Thus the value of imports is really the summation across all foreign imports of the exchange rate times the foreign price times quantity.

The J-curve theory recognizes that import and export quantities and prices are often arranged in advance and set into a contract. For example, an importer of watches is likely to enter into a contract with the foreign watch company to import a specific quantity over some future period. The price of the watches will also be fixed by the terms of the contract. Such a contract provides assurances to the exporter that the watches he makes will be sold. It provides assurances to the importer that the price of the watches will remain fixed. Contract lengths will vary from industry to industry and firm to firm, but may extend for as long as a year or more.

The implication of contracts is that in the short run, perhaps over six to eighteen months, both the local prices and quantities of imports and exports will remain fixed for many items. However, the contracts may stagger in time—that is, they may not all be negotiated and signed at the same date in the past. This means that during any period some fraction of the contracts will expire and be renegotiated. Renegotiated contracts can adjust prices and quantities in response to changes in market conditions, such as a change

in the exchange rate. Thus in the months following a dollar depreciation, contract renegotiations will gradually occur, causing eventual, but slow, changes in the prices and quantities traded.

With these ideas in mind, consider a depreciation of the dollar. In the very short run—say, during the first few weeks—most of the contract terms will remain unchanged, meaning that the prices and quantities of exports and imports will also stay fixed. The only change affecting the CA formula, then, is the increase in $E_{\$/\text{€}}$. Assuming all importers have not hedged their trades by entering into forward contracts, the increase in $E_{\$/\text{€}}$ will result in an immediate increase in the value of imports measured in dollar terms. Since the prices and quantities do not change immediately, the CA balance falls. This is what can account for the initial stage of the J-curve effect, between periods t_1 and t_2 .

As the dollar depreciation continues, and as contracts begin to be renegotiated, traders will adjust quantities demanded. Since the dollar depreciation causes imported goods to become more expensive to U.S. residents, the quantity of imported goods demanded and purchased will fall. Similarly, exported goods will appear cheaper to foreigners, and so as their contracts are renegotiated, they will begin to increase demand for U.S. exports. The changes in these quantities will both cause an increase in the current account (decrease in a trade deficit). Thus, as several months and years pass, the effects from the changes in quantities will surpass the price effect caused by the dollar depreciation and the CA balance will rise as shown in the diagram after time t_2 .

It is worth noting that the standard theory, which says that a dollar depreciation causes an increase in the current account balance, assumes that the quantity effects—that is, the effects of the depreciation on export and import demand—are the dominant effects. The J-curve theory qualifies that effect by suggesting that although the quantity or demand effects will dominate, it may take several months or years before becoming apparent.

KEY TAKEAWAYS

- The J-curve theory represents a short-term exception to the standard assumption applied in the G&S model in which a currency depreciation causes a decrease in the trade deficit.
- The theory of the J-curve is an explanation for the J-like temporal pattern of change in a country's trade balance in response to a sudden or substantial depreciation (or devaluation) of the currency.

- The J-curve effect suggests that after a currency depreciation, the current account balance will first fall for a period of time before beginning to rise as normally expected. If a country has a trade deficit initially, the deficit will first rise and then fall in response to a currency depreciation.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. Of *short run* or *long run*, the period in which the J-curve theory predicts that a country’s trade deficit will rise with a currency depreciation.
 - b. Of *short run* or *long run*, the period in which the J-curve theory predicts that a country’s trade deficit will fall with a currency depreciation.
 - c. Of *value of U.S. imports* or *quantity of U.S. imports*, this is expected to rise in the short run after a dollar depreciation according to the J-curve theory.
 - d. Of *value of Turkish imports* or *quantity of Turkish imports*, this is expected to fall in the long run after a Turkish lira depreciation according to the J-curve theory.
 - e. Of *increase, decrease, or stay the same*, the effect on U.S. exports in the short run due to a U.S. dollar depreciation according to the J-curve theory.
 - f. Of *increase, decrease, or stay the same*, the effect on U.S. imports in the short run due to a U.S. dollar depreciation according to the J-curve theory.

Chapter 9: The AA-DD Model

Ideally, it would be nice to develop a way to keep track of all the cause-and-effect relationships that are presumed to exist at the same time. From the previous chapters it is clear, for example, that the money supply affects the interest rates in the money market, which in turn affects the exchange rates in the foreign exchange (Forex) market, which in turn affects demand on the current account in the goods and services (G&S) market, which in turn affects the level of GNP, which in turn affects the money market, and so on. The same type of string of repercussions can be expected after many other changes that might occur. Keeping track of these effects and establishing the final equilibrium values would be a difficult task if not for a construction like the AA-DD model. This model merges the money market, the Forex market, and the G&S market into one supermodel. The construction of the AA-DD model is presented in this chapter.

9.1 Overview of the AA-DD Model

LEARNING OBJECTIVE

1. Understand the basic structure and results of the AA-DD model of national output and exchange rate determination.

This chapter describes the derivation and the mechanics of the AA-DD model. The AA-DD model represents a synthesis of the three previous market models: the foreign exchange (Forex) market, the money market, and the goods and services market. In a sense, there is really very little new information presented here. Instead, the chapter provides a graphical approach to integrate the results from the three models and to show their interconnectedness. However, because so much is going on simultaneously, working with the AA-DD model can be quite challenging.

The AA-DD model is described with a diagram consisting of two curves (or lines): an AA curve representing asset market equilibriums derived from the money market and foreign exchange markets and a DD curve representing goods market (or demand) equilibriums. The intersection of the two curves identifies a market equilibrium in which each of the three markets is simultaneously in equilibrium. Thus we refer to this equilibrium as a superequilibrium.

Results

The main results of this section are descriptive and purely mechanical. The chapter describes the derivation of the AA and DD curves, explains how changes in exogenous variables will cause shifts in the curves, and explains adjustment from one equilibrium to another.

- a. The DD curve is the set of exchange rate and GNP combinations that maintain equilibrium in the goods and services market, given fixed values for all other exogenous variables.
- b. The DD curve shifts rightward whenever government demand (G), investment demand (I), transfer payments (TR), or foreign prices (P_f) increase or when taxes (T) or domestic prices (P_s) decrease. Changes in the opposite direction cause a leftward shift.
- c. The AA curve is the set of exchange rate and GNP combinations that maintain equilibrium in the asset markets, given fixed values for all other exogenous variables.
- d. The AA curve shifts upward whenever money supply (MS), foreign interest rates (i_f), or the expected exchange rate ($E_{\$/\text{€}}$) increase or when domestic prices (P_s) decrease. Changes in the opposite direction cause a downward shift.

- e. The intersection of the AA and DD curves depicts a superequilibrium in an economy since at that point the goods and services market, the domestic money market, and the foreign exchange market are all in equilibrium simultaneously.
- f. Changes in any exogenous variable that is not plotted on the axes (anything but Y and $E_{\$/\text{€}}$) will cause a shift of the AA or DD curves and move the economy out of equilibrium, temporarily. Adjustment to a new equilibrium follows the principle that adjustment in the asset markets occurs much more rapidly than adjustment in the goods and services market. Thus adjustment to the AA curve will always occur before adjustment to the DD curve.

Connections

The AA-DD model will allow us to understand how changes in macroeconomic policy—both monetary and fiscal—can affect key aggregate economic variables when a country is open to international trade and financial flows while accounting for the interaction of the variables among themselves. Specifically, the model is used to identify potential effects of fiscal and monetary policy on exchange rates, trade balances, GDP levels, interest rates, and price levels both domestically and abroad. In subsequent chapters, analyses will be done under both floating and fixed exchange rate regimes.

KEY TAKEAWAYS

- The AA-DD model integrates the workings of the money-Forex market and the G&S model into one supermodel.
- The AA curve is derived from the money-Forex model. The DD curve is derived from the G&S model.
- The intersection of the AA and DD curves determines the equilibrium values for real GNP and the exchange rate.
- Comparative statics exercises using the AA-DD model allow one to identify the effects of changes in exogenous variables on the level of GDP and the exchange rate, while assuring that the Forex, the money market, and the G&S market all achieve simultaneous equilibrium.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. At the intersection of the AA and DD curves, the goods and services market, the money market, and this market are simultaneously in equilibrium.
- b. The term used to describe the type of equilibrium at the intersection of the AA curve and the DD curve.

9.2 Derivation of the DD Curve

LEARNING OBJECTIVE

1. Learn how to derive the DD curve from the G&S model.

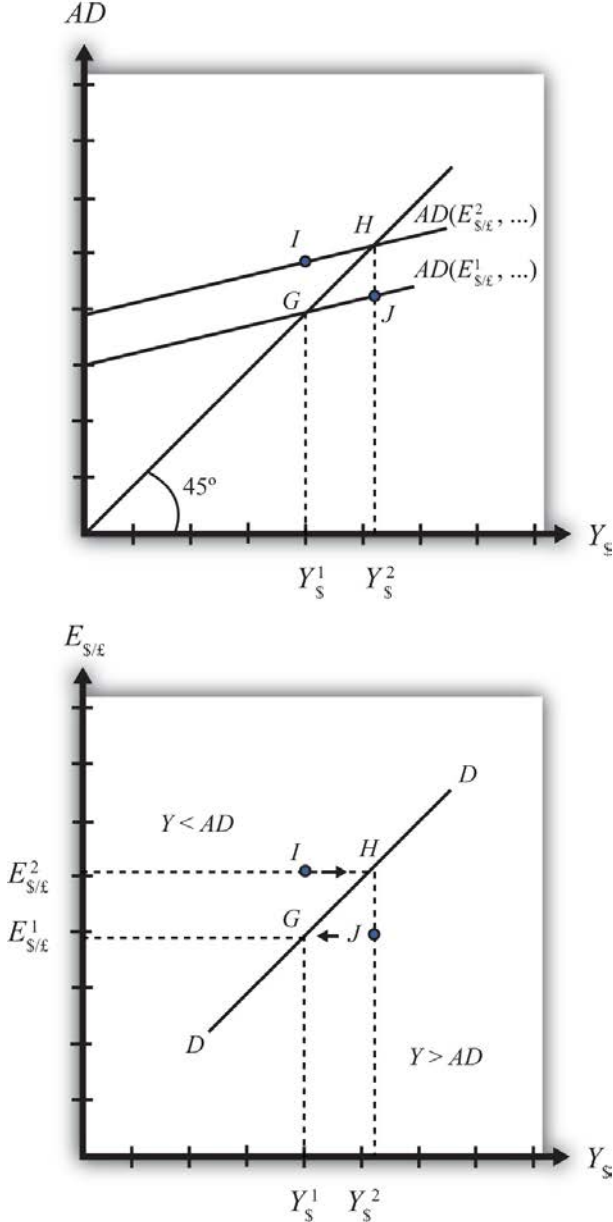
The DD curve is derived by transferring information described in the goods and services (G&S) market model onto a new diagram to show the relationship between the exchange rate and equilibrium gross national product (GNP). The original G&S market, depicted in the top part of , plots the aggregate demand (AD) function with respect to changes in U.S. GNP (Y_S). Aggregate demand is measured along the vertical axis and aggregate supply (or the GNP) is measured on the horizontal axis. As discussed in , the AD function is dependent upon several different exogenous variables, most notably the exchange rate between domestic and foreign currency ($E_{\$/\pounds}$). However, AD is also affected by investment demand (I), government demand (G), government tax revenues (T), government transfer payments (TR), and the price level in the domestic (P_S) and foreign (P_\pounds) countries. The endogenous variable in the model is U.S. GNP (Y_S). (See for a quick reference.) In this exercise, since our focus is on the exchange rate, we label the AD function in as $AD(E_{\$/\pounds}, \dots)$, where the ellipsis (...) is meant to indicate there are other unspecified variables that also influence AD.

Table 9.1 G&S Market

Exogenous Variables	$E_{\$/\pounds}, I, G, T, TR, P_S, P_\pounds$
Endogenous Variable	Y_S

Initially, let's assume the exchange rate is at a value in the market given by $E_{\$/\pounds}^1$. We need to remember that all the other variables that affect AD are also at some initial level. Written explicitly, we could write AD as $AD(E_{\$/\pounds}^1, I^1, G^1, T^1, TR^1, P_S^1, P_\pounds^1)$. The AD function with exchange rate $E_{\$/\pounds}^1$ intersects the forty-five-degree line at point G which determines the equilibrium level of GNP given by Y_S^1 . These two values are transferred to the lower diagram at point G determining one point on the DD curve ($Y_S^1, E_{\$/\pounds}^1$).

Figure 9.1 Derivation of the DD Curve



Next, suppose $E_{S/\pounds}$ rises from $E_{S/\pounds}^1$ to $E_{S/\pounds}^2$, ceteris paribus. This corresponds to a depreciation of the U.S. dollar with respect to the British pound. The ceteris paribus assumption means that investment, government, taxes, and so on stay fixed at levels I , G , T , and so on. Since a dollar depreciation makes foreign G&S relatively more expensive and domestic goods relatively cheaper, AD shifts up to $AD(E_{S/\pounds}^2, \dots)$. The equilibrium shifts to point H at a GNP level Y_s^2 . These two values are transferred to the lower diagram at point H , determining a second point on the DD curve ($Y_s^2, E_{S/\pounds}^2$).

The line drawn through points G and H on the lower diagram is called the DD curve. The DD curve plots an equilibrium GNP level for every possible exchange rate that may prevail, ceteris paribus. Stated differently, the DD curve is the combination of exchange rates and GNP levels that maintain equilibrium in the G&S market, ceteris paribus. We can think of it as the set of aggregate demand equilibriums.

A Note about Equilibriums

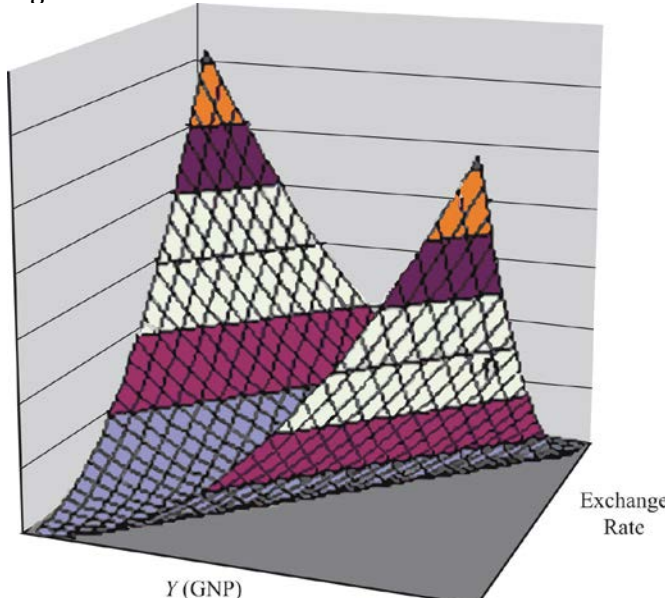
An equilibrium in an economic model typically corresponds to a point toward which the endogenous variable values will converge based on some behavioral assumption about the participants in the model. In this case, equilibrium is not represented by a single point. Instead every point along the DD curve is an equilibrium value.

If the economy were at a point above the DD curve, say, at I in the lower diagram, the exchange rate would be $E_{S/\pounds}^2$ and the GNP level at Y_s^1 . This corresponds to point I in the upper diagram where $AD > Y$, read off the vertical axis. In the G&S model, whenever aggregate demand exceeds aggregate supply, producers

respond by increasing supply, causing GNP to rise. This continues until $AD = Y$ at point H . For all points to the left of the DD curve, $AD > Y$, therefore the behavior of producers would cause a shift to the right from any point like I to a point like H on the DD curve.

Similarly, at a point such as J , to the right of the DD curve, the exchange rate is $E_{\$/\epsilon}$ and the GNP level is at Y_2 . This corresponds to point J in the upper diagram above where aggregate demand is less than supply

Figure 9.2 A 3-D DD Curve



($AD < Y$). In the G&S model, whenever supply exceeds demand, producers respond by reducing supply, thus GNP falls. This continues until $AD = Y$ at point G . For all points to the right of the DD curve, $AD < Y$, therefore the behavior of producers would cause a shift to the left from any point like J to a point like G on the DD curve. A useful analogy is to think of the DD curve as a river flowing through a valley. (See the 3-D diagram in .) The hills rise up to the right and left along the upward-sloping DD

curve. Just as gravity will move a drop of water downhill onto the river valley, firm behavior will move GNP much in the same way: right or left to the lowest point along the DD curve.

KEY TAKEAWAYS

- The DD curve plots an equilibrium GNP level for every possible exchange rate that may prevail, ceteris paribus.
- Every point on a DD curve represents an equilibrium value in the G&S market.
- The DD curve is positively sloped because an increase in the exchange rate (meaning a decrease in the U.S. dollar value) raises equilibrium GNP in the G&S model.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. This is what has happened to its currency value if an economy's exchange rate and GNP combination moves upward along an upward-sloping DD curve.
- b. Of *greater than, less than, or equal to*, this is how aggregate demand compares to GNP when the economy has an exchange rate and GNP combination that places it to the left of the DD curve.
- c. Of *greater than, less than, or equal to*, this is how aggregate demand compares to GNP when the economy has an exchange rate and GNP combination that places it on the DD curve.
- d. The equilibriums along a DD curve satisfy this condition.

9.3 Shifting the DD Curve

LEARNING OBJECTIVE

1. Learn which exogenous variables will shift the DD curve and in which direction.

The DD curve depicts the relationship between changes in one exogenous variable and one endogenous variable within the goods and services (G&S) market model. The exogenous variable assumed to change is the exchange rate. The endogenous variable affected is the gross national product (GNP). At all points along the DD curve, it is assumed that all other exogenous variables remain fixed at their original values.

The DD curve will shift, however, if there is a change in any of the other exogenous variables. We illustrate how this works in Figure 9.3 "DD Curve Effects from a Decrease in Investment Demand". Here, we

assume that the level of investment demand in the economy falls from its initial level I_1 to a lower level I_2 .

At the initial investment level (I_1) and initial exchange rate ($E_{\$/\text{€}}^1$) the AD curve is given by $AD(\dots, E_{\$/\text{€}}^1, I_1, \dots)$. The AD curve intersects the

forty-five-degree line at point G ,

which is transferred to

point G on the DD curve below.

If the investment level and all

other exogenous variables

remain fixed while the exchange

rate increases to $E_{\$/\text{€}}^2$, then the

AD curve shifts up

to $AD(\dots, E_{\$/\text{€}}^2, I_1, \dots)$,

generating the equilibrium

points H in both diagrams. This

exercise plots out the initial DD

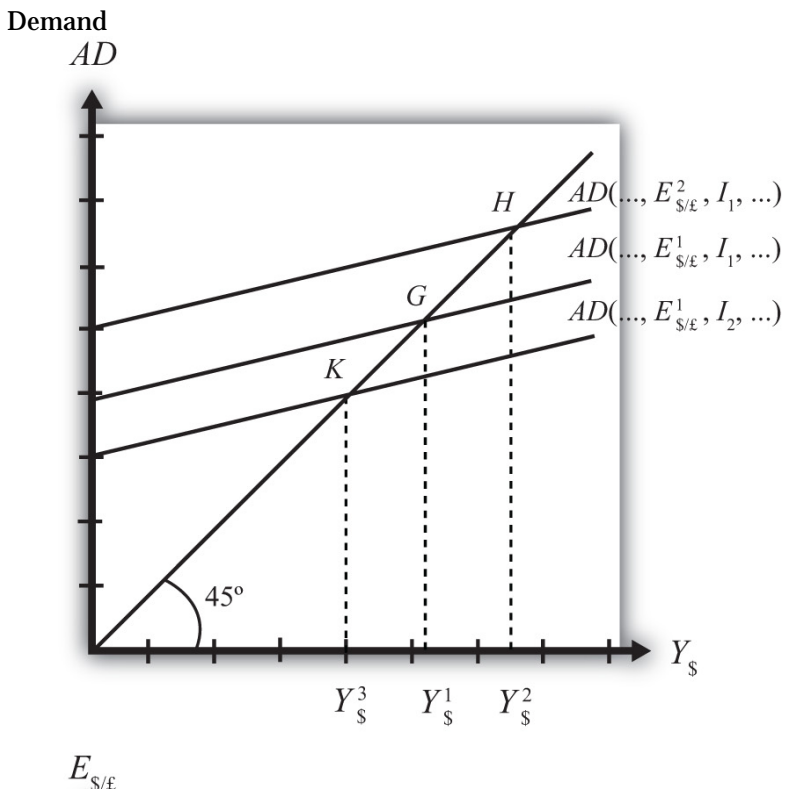
curve labeled $DD|I_1$ in the lower

diagram connecting

points G and H . $DD|I_1$ is read as

"the DD curve given that $I=I_1$."

Figure 9.3 DD Curve Effects from a Decrease in Investment



Now, suppose I falls to I_2 . The reduction in I leads to a reduction in AD, ceteris paribus. At the exchange rate $E_{\$/\text{£}^1}$, the AD curve will shift down to $AD(\dots, E_{\$/\text{£}^1}, I_2, \dots)$, intersecting the forty-five-degree line at point K . Point K above, which corresponds to the combination $(E_{\$/\text{£}^1}, I_2)$, is transferred to point K on the lower diagram. This point lies on a new DD curve because a second exogenous variable, namely I , has changed. If we maintain the investment level at I_2 and change the exchange rate up to $E_{\$/\text{£}^2}$, the equilibrium will shift to point L (shown only on the lower diagram), plotting out a whole new DD curve. This DD curve is labeled $DD|I_2$, which means “the DD curve given is $I = I_2$.”

The effect of a decrease in investment demand is to lower aggregate demand and shift the DD curve to the left. Indeed, a change in any exogenous variable that reduces aggregate demand, except the exchange rate, will cause the DD curve to shift to the left. Likewise, any change in an exogenous variable that causes an increase in aggregate demand will cause the DD curve to shift right. An exchange rate change *will not* shift DD because its effect is accounted for by the DD curve itself. Note that curves or lines can shift only when a variable that is *not* plotted on the axis changes.

The following table presents a list of all variables that can shift the DD curve right and left. The up arrow indicates an increase in the variable, and the down arrow indicates a decrease.

DD right-shifters	$\uparrow G \uparrow I \downarrow T \uparrow TR \downarrow P_{\$} \uparrow P_{\text{£}}$
DD left-shifters	$\downarrow G \downarrow I \uparrow T \downarrow TR \uparrow P_{\$} \downarrow P_{\text{£}}$

Refer to [Chapter 8 "National Output Determination"](#) for a complete description of how and why each variable affects aggregate demand. For easy reference, recall that G is government demand, I is investment demand, T refers to tax revenues, TR is government transfer payments, $P_{\$}$ is the U.S. price level, and $P_{\text{£}}$ is the foreign British price level.

KEY TAKEAWAYS

- The effect of an increase in investment demand (an increase in government demand, a decrease in taxes, an increase in transfer payments, a decrease in U.S. prices, or an increase in foreign prices) is to raise aggregate demand and shift the DD curve to the right.
- The effect of a decrease in investment demand (a decrease in government demand, an increase in taxes, a decrease in transfer payments, an increase in U.S. prices, or a decrease in foreign prices) is to lower aggregate demand and shift the DD curve to the left.

EXERCISE

1. Identify whether the DD curve shifts in response to each of the following changes. Indicate whether the curve shifts up, down, left, or right. Possible answers are DD right, DD left, or neither.

- a. Decrease in government transfer payments.
- b. Decrease in the foreign price level.
- c. Increase in foreign interest rates.
- d. Decrease in the expected exchange rate $E_{\$/\text{€}}$.
- e. Decrease in U.S. GNP.
- f. Decrease in the U.S. money supply.

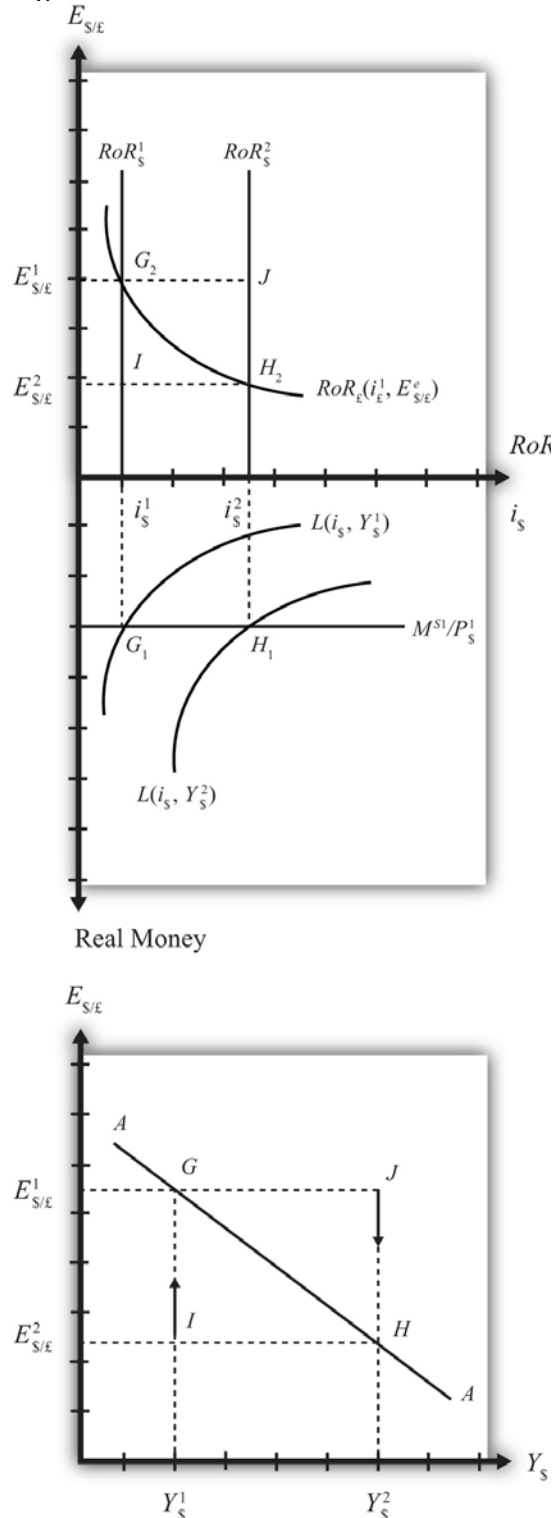
9.4 Derivation of the AA Curve

LEARNING OBJECTIVE

1. Learn how to derive the AA curve from the money-Forex model.

The AA curve is derived by transferring information described in the money market and foreign exchange market models onto a new diagram to show the relationship between the exchange rate and equilibrium GNP. (At this point we will substitute GNP for its virtually equivalent measure, GDP, as a determinant of real money demand.) Since both models describe supply and demand for money, which is an asset, I'll refer to the two markets together as the asset market. The foreign exchange market, depicted in the top part of , plots the rates of return on domestic U.S. assets (RoR_S) and foreign British assets (RoR_E). (See , for a complete description.) The domestic U.S. money market, in the lower quadrant, plots the real U.S. money supply (M_S/P_S) and real money demand ($L(i_S, Y_S)$). The asset market equilibria have several exogenous variables that determine the positions of the curves and the outcome of the model. These exogenous variables are the foreign British interest rate (i_E) and the expected future exchange rate ($E_{S/E}$), which influence the foreign British rate of return (RoR_E); the U.S. money supply (M_S) and domestic U.S. price level (P_S), which influence real money supply; and U.S. GNP (Y_S), which influences real money demand. The endogenous variables in the asset model are the domestic interest

Figure 9.4 Derivation of the AA Curve



rates (i_s) and the exchange rate ($E_{\$/\text{€}}$). See for easy reference.

Table 9.2 Asset Market (Money + Forex)

Exogenous Variables	$i_{\text{€}}, E_{\$/\text{€}e}, M_{\text{S}}^{\text{S}}, P_{\text{S}}, Y_{\text{S}}$
Endogenous Variables	$i_{\text{S}}, E_{\$/\text{€}}$

Initially, let's assume GNP is at a value in the market given by Y_{S}^1 . We need to remember that all the other exogenous variables that affect the asset market are also at some initial level such as $i_{\text{€}}^1, E_{\$/\text{€}}^1, M_{\text{S}}^{\text{S}}$, and P_{S}^1 . The real money demand function with GNP level Y_{S}^1 intersects with real money supply at point G_1 in the money market diagram determining the interest rate i_{S}^1 . The interest rate in turn determines RoR_{S}^1 , which intersects with $RoR_{\text{€}}$ at point G_2 , determining the equilibrium exchange rate $E_{\$/\text{€}}^1$. These two values are transferred to the lowest diagram at point G , establishing one point on the AA curve ($Y_{\text{S}}^1, E_{\$/\text{€}}^1$).

Next, suppose GNP rises, for some unstated reason, from Y_{S}^1 to Y_{S} , ceteris paribus. The ceteris paribus assumption means that all exogenous variables in the model remain fixed. Since the increase in GNP raises real money demand, $L(i_{\text{S}}, Y_{\text{S}})$, it shifts out to $L(i_{\text{S}}, Y_{\text{S}}^2)$. The equilibrium shifts to point H_1 , raising the equilibrium interest rate to i_{S}^2 . The RoR_{S} line shifts right with the interest rate, determining a new equilibrium in the Forex at point H_2 with equilibrium exchange rate $E_{\$/\text{€}}^2$. These two values are then transferred to the diagram below at point H , establishing a second point on the AA curve ($Y_{\text{S}}^2, E_{\$/\text{€}}^2$).

The line drawn through points G and H on the lower diagram in is called the AA curve. The AA curve plots an equilibrium exchange rate for every possible GNP level that may prevail, ceteris paribus. Stated differently, the AA curve is the combination of exchange rates and GNP levels that maintain equilibrium in the asset market, ceteris paribus. We can think of it as the set of aggregate asset equilibriums.

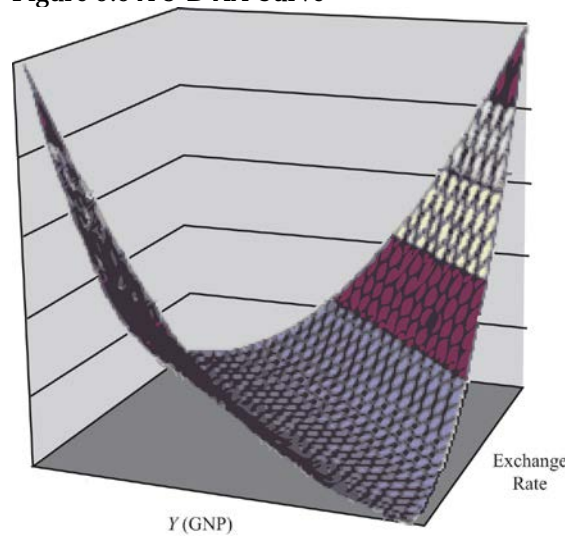
A Note about Equilibriums

If the economy were at a point off the AA curve, like at I in the lower diagram, the GNP level is at Y_{S}^1 and the exchange rate is $E_{\$/\text{€}}^2$. This corresponds to point I in the upper diagram where $RoR_{\text{€}} > RoR_{\text{S}}$. In the Forex model, when foreign assets have a higher rate of return than domestic assets, investors respond by buying pounds in exchange for dollars in the foreign exchange market. This leads to a depreciation of the dollar and an increase in $E_{\$/\text{€}}$. This continues until $RoR_{\text{€}} = RoR_{\text{S}}$ at point G . For all points below the AA

curve, $RoR_{\text{f}} > RoR_{\text{s}}$; therefore, the behavior of investors would cause an upward adjustment toward the AA curve from any point like *I* to a point like *G*.

Similarly, at a point such as *J*, above DD curve, the GNP level is at Y_2 and exchange rate is $E_{\$/\text{£}}$. This corresponds to point *J* in the upper diagram where $RoR_{\text{s}} > RoR_{\text{f}}$ and the rate of return on dollar assets is greater than the rate of return abroad. In the Forex model, when U.S. assets have a higher rate of return than foreign assets, investors respond by buying dollars in exchange for pounds in the foreign exchange market. This leads

Figure 9.5 A 3-D AA Curve



an appreciation of the dollar and a decrease in $E_{\$/\text{£}}$. This continues until $RoR_{\text{f}} = RoR_{\text{s}}$ at point *H*. For all points above the AA curve, $RoR_{\text{s}} > RoR_{\text{f}}$; therefore, the behavior of investors would cause a downward adjustment to the AA curve from a point like *J* to a point like *H*.

As with the DD curve, it is useful to think of the AA curve as a river flowing through a valley. (See the 3-D diagram in .) The hills rise up both above and below. Just as gravity will move a drop of water down the hill to the river valley, in much the same way, investor behavior will move the exchange rate up or down to the lowest point lying on the AA curve.

KEY TAKEAWAYS

- The AA curve plots an equilibrium exchange rate level for every possible GNP value that may prevail, ceteris paribus.
- Every point on an AA curve represents an equilibrium value in the money-Forex market.
- The AA curve is negatively sloped because an increase in the real GNP lowers the equilibrium exchange rate in the money-Forex model.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. This is what has happened to its GNP if an economy’s exchange rate and GNP combination move downward along a downward-sloping AA curve.
- b. Of *greater than, less than, or equal to*, this is how the rate of return on domestic assets compares to the rate of return on foreign assets when the economy has an exchange rate and GNP combination that places it above the AA curve.
- c. Of *greater than, less than, or equal to*, this is how the rate of return on domestic assets compares to the rate of return on foreign assets when the economy has an exchange rate and GNP combination that places it on the AA curve.
- d. The equilibriums along an AA curve satisfy this condition.

9.5 Shifting the AA Curve

LEARNING OBJECTIVE

1. Learn which exogenous variables will shift the AA curve and in which direction.

The AA curve depicts the relationship between changes in one exogenous variable and one endogenous variable within the asset market model.

The exogenous variable changed is gross national product (GNP). The endogenous variable affected is the exchange rate. At all points along the AA curve, it is assumed that all other exogenous variables remain fixed at their original values.

The AA curve will shift if there is a change in any of the other exogenous variables. We illustrate how this works in , where we assume that the money supply in the economy falls from its initial level MS^1 to a lower level MS^2 .

At the initial money supply (MS^1) and initial GNP level Y_S^1 , real money demand intersects real money supply at point G , determining the interest rate i_S^1 .

This in turn determines the rate of return on U.S. assets, RoR_S^1 , which intersects the foreign assets, RoR_ϵ at G in the upper diagram, determining the equilibrium exchange rate $E_{S/\epsilon}^1$. If the money supply and all other exogenous variables remain fixed, while GNP increases to Y_S^2 , the equilibriums shift to points H in the lower and upper diagrams, determining exchange rate $E_{S/\epsilon}^2$. This exercise plots out the initial AA curve labeled $AA|MS_1$ in the lower

Figure 9.6 AA Curve Effects from a Decrease in the Money Supply

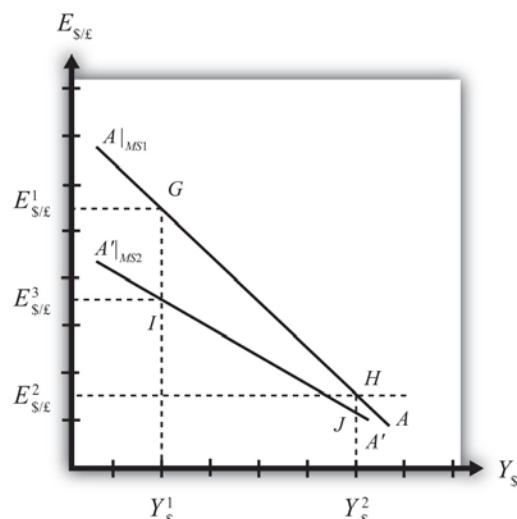
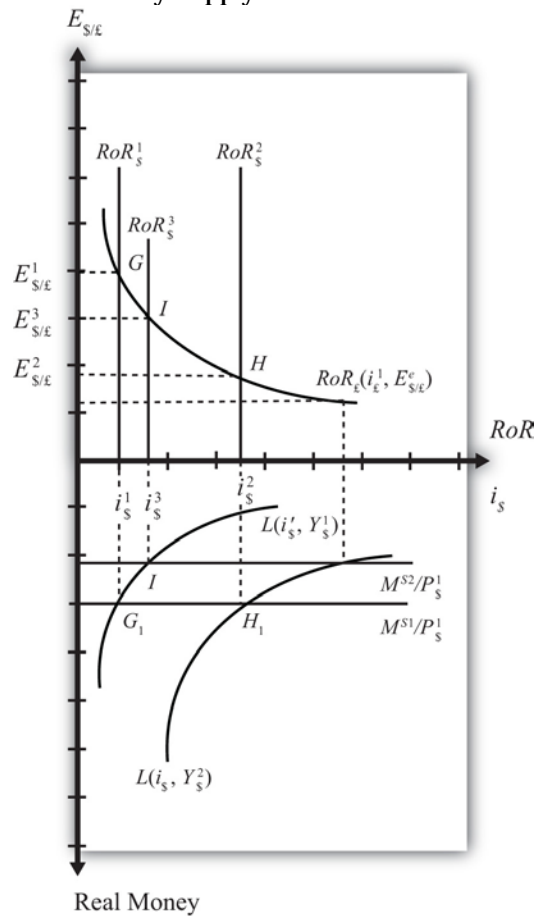


diagram connecting points G and H . Note, $AA|MS_1$ is read as “the AA curve given that $MS = MS^1$.”

Now, suppose the money supply MS falls to MS^2 . The reduction in MS leads to a reduction in the real money supply, which, at GNP level Y_S^1 , shifts the money market equilibrium to point I , determining a new interest rate, i_S^3 . In the Forex market, the rate of return rises to RoR_S^3 , which determines the equilibrium exchange rate $E_{S/\text{£}}^3$. The equilibriums at points I corresponding to the combination $(Y_S^1, E_{S/\text{£}}^3)$ are transferred to point I on the lower diagram. This point lies on a new AA curve because a second exogenous variable, namely, MS , has changed. If we maintain the money supply at MS^2 and change the GNP up to Y_S^2 , the equilibrium will shift to point J (shown only on the lower diagram), plotting out a whole new AA curve. This AA curve is labeled $A'A'|MS_2$, which means “the AA curve given that $MS = MS^2$.”

The effect of a decrease in the money supply is to shift the AA curve downward. Indeed, a change in any exogenous variable in the asset markets that reduces the equilibrium exchange rate, except a change in GNP, will cause the AA curve to shift down. Likewise, any change in an exogenous variable that causes an increase in the exchange rate will cause the AA curve to shift up. A change in GNP will *not* shift AA because its effect is accounted for by the AA curve itself. Note that curves or lines can shift only when a variable *not* plotted on the axis changes.

The following table presents a list of all variables that can shift the AA curve up and down. The up arrow indicates an increase in the variable, and a down arrow indicates a decrease.

AA up-shifters	$\uparrow MS \downarrow P_S \uparrow i_\text{£} \uparrow E_{S/\text{£}} e$
AA down-shifters	$\downarrow MS \uparrow P_S \downarrow i_\text{£} \downarrow E_{S/\text{£}} e$

Refer to and for a complete description of how and why each variable affects the exchange rate. For easy reference though, recall that MS is the U.S. money supply, P_S is the U.S. price level, $i_\text{£}$ is the foreign British interest rate, and $E_{S/\text{£}} e$ is the expected future exchange rate.

KEY TAKEAWAYS

- The effect of an increase in the money supply (or a decrease in the price level, an increase in foreign interest rates, or an increase in the expected exchange rate [as defined]) is to shift the AA curve upward.

- The effect of a decrease in the money supply (or an increase in the price level, a decrease in foreign interest rates, or a decrease in the expected exchange rate [as defined]) is to shift the AA curve downward.

EXERCISE

1. Identify whether the AA curve shifts in response to each of the following changes. Indicate whether the curve shifts up, down, left, or right. Possible answers are AA right, AA left, or neither.
 - a. Decrease in government transfer payments.
 - b. Decrease in the foreign price level.
 - c. Increase in foreign interest rates.
 - d. Decrease in the expected exchange rate $E_{\$/\text{€}}$.
 - e. Decrease in U.S. GNP.
 - f. Decrease in the U.S. money supply.

9.6 Superequilibrium: Combining DD and AA

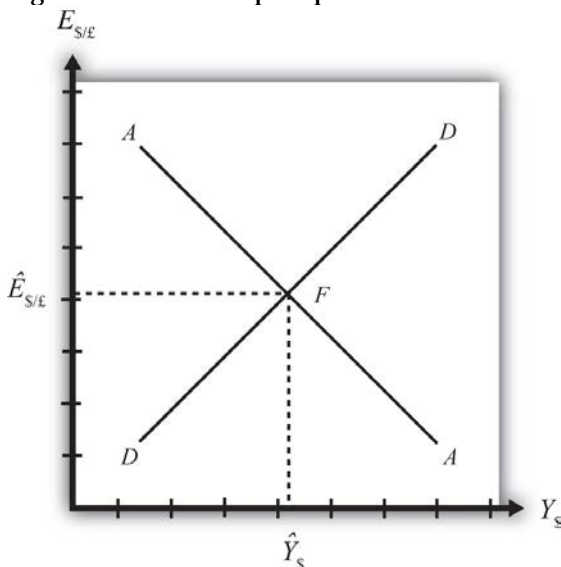
LEARNING OBJECTIVE

1. Apply the AA curve and the DD curve to define a superequilibrium.

The DD curve represents the set of equilibriums in the goods and services (G&S) market. It describes an equilibrium gross national product (GNP) level for each and every exchange rate that may prevail. Due to the assumption that firms respond to excess demand by increasing supply (and to excess supply by decreasing supply), GNP rises or falls until the economy is in equilibrium on the DD curve.

The AA curve represents the set of equilibriums in the asset market. It indicates an equilibrium exchange rate for each and every GNP level that might prevail. Due to the assumption that investors will demand foreign currency when the foreign rate of return exceeds the domestic return and that they will supply foreign currency when the domestic rate of return exceeds the foreign return, the exchange rate will rise or fall until the economy is in equilibrium on the AA curve.

Figure 9.7 AA-DD Superequilibrium

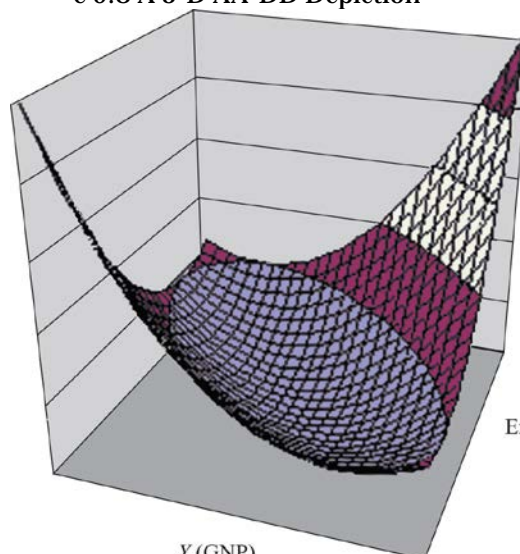


simultaneously. For this reason, point F is more than a plain old equilibrium; instead it is a *superequilibrium*.

The superequilibrium point is where we would expect behavioral responses by firms,

Since both the G&S market and the asset markets are operating concurrently, equilibriums in both markets can only occur where the DD curve intersects the AA curve. This is shown in Figure 9.7 "AA-DD Superequilibrium" at point F , with equilibrium GNP (\hat{Y}_s) and exchange rate ($\hat{E}_{S/E}$). It is worth emphasizing that at point F , the three markets—that is, the G&S market, the money market, and the foreign exchange market—are in equilibrium

Figure 9.8 A 3-D AA-DD Depiction



households, and investors to move the exchange rate and GNP level, assuming the exogenous variables remain fixed at their original levels and assuming sufficient time is allowed for adjustment to the equilibrium to take place.

The equilibrium at F is like the lowest point of two intersecting valleys that reach their combined lowest point at a pool where the two valleys meet. A 3-D rendition of this is shown in [Figure 9.8 "A 3-D AA-DD Depiction"](#). The steepness of the valleys is meant to represent the speed of adjustment. Thus the AA valley is drawn much steeper than the DD valley to reflect the much more rapid adjustment in the asset markets in comparison to goods market adjustment. Anytime the economy is away from the equilibrium, forces will act to move it to the pool in the center. However, as will be shown later, adjustment to the AA curve will occur much faster than adjustment to the DD curve.

KEY TAKEAWAY

- A superequilibrium describes the GNP level and exchange rate value at the intersection of the AA and DD curves. It represents the values that provide for equilibriums in the money market, the Forex market, and the G&S market simultaneously.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. This market is in equilibrium when an economy is on an AA curve.
 - b. This market is in equilibrium when an economy is on a DD curve.
 - c. The term used to describe the equilibrium at the intersection of a DD curve and an AA curve.

9.7 Adjustment to the Superequilibrium

LEARNING OBJECTIVE

1. Learn how to describe the complete adjustment to equilibrium in the AA-DD model.

In order to discuss adjustment to the superequilibrium, we must first talk about how an economy can end up out of equilibrium. This will occur anytime there is a change in one or more of the exogenous variables that cause the AA or DD curves to shift. In a real economy, we should expect these variables to be changing frequently. Variables such as interest rates will certainly change every day. A variable such as the average expected future exchange rate held by investors probably changes every minute. Each time an exogenous variable changes, the superequilibrium point will shift, setting off behavioral responses by households, businesses, and investors that will affect the exchange rate and gross national product (GNP) in the direction of the new superequilibrium. However, as we will indicate below, the adjustment process will take time, perhaps several months or more, depending on the size of the change. Since we should expect that as adjustment to one variable change is in process, other exogenous variables will also change, we must recognize that the superequilibrium is really like a moving target. Each day, maybe each hour, the target moves, resulting in a continual adjustment process.

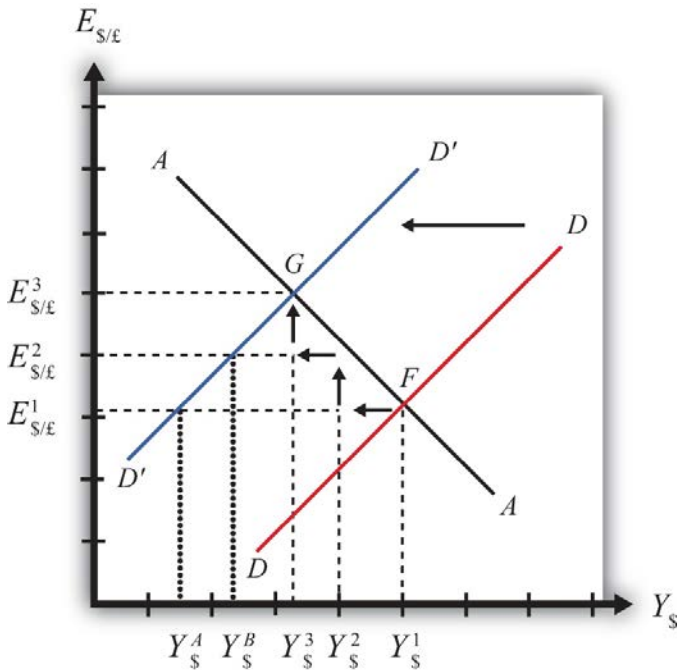
Although an equilibrium may never be reached in the real-world economy, the model remains very useful in understanding how changes in some variables will affect the behavior of agents and influence other variables. The model in essence offers us the opportunity to conduct experiments in simplified settings. Changing one exogenous variable and inferring its effect is a comparative statics *experiment* because of the ceteris paribus assumption. Ceteris paribus allows us to isolate one change and work through its impact with certainty that nothing else could influence the result.

Below, we'll consider adjustment to two changes: a reduction in investment demand, which shifts the DD curve, and an increase in foreign interest rates, which shifts the AA curve.

Reduction in Investment

Consider adjustment to a decrease in investment demand. Begin with an original superequilibrium, where DD crosses AA at point F with GNP at Y_s^1 and exchange rate at $E_{s/e}^1$. When investment decreases, ceteris paribus, the DD curve shifts to the left, as was shown in , . This shift is shown in as a shift from DD to $D'D'$.

Figure 9.9 Effects of an Investment Demand Decrease in the AA-DD Model



The quick result is that the equilibrium shifts to point G , GNP falls to Y_S^3 , and the exchange rate rises to $E_{S/\pounds}^3$. The increase in the exchange rate represents a depreciation of the U.S. dollar value.

However, this result does not explain the adjustment process, so let's take a more careful look at how the economy gets from point F to G .

Step 1: When investment demand falls, aggregate demand falls short of aggregate supply, leading to a buildup of inventories. Firms respond by cutting back supply, and GNP slowly begins to fall. Initially, there is no change in the exchange rate. On the

graph, this is represented by a leftward shift from the initial equilibrium at point F (Y_S^1 to Y_S^2). Adjustment to changes in aggregate demand will be gradual, perhaps taking several months or more to be fully implemented.

Step 2: As GNP falls, it causes a decrease in U.S. interest rates. With lower interest rates, the rate of return on U.S. assets falls below that in the United Kingdom and international investors shift funds abroad, leading to a dollar depreciation (pound appreciation)—that is, an increase in the exchange rate $E_{S/\pounds}$. This moves the economy upward, back to the AA curve. The adjustment in the asset market will occur quickly after the change in interest rates, so the leftward shift from point F in the diagram results in adjustment upward to regain equilibrium in the asset market on the AA curve.

Step 3: Continuing reductions in GNP caused by excess aggregate demand, results in continuing decreases in interest rates and rates of return, repeating the stepwise process above until the new equilibrium is reached at point G in the diagram.

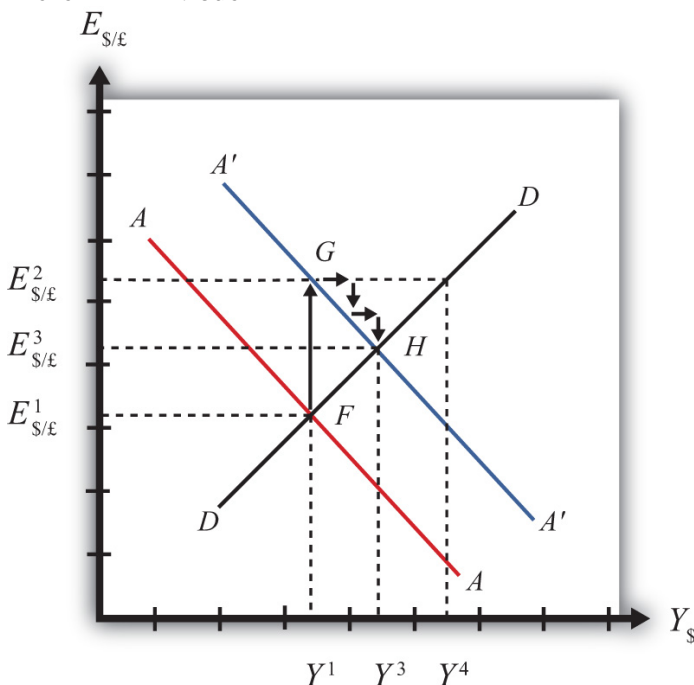
During the adjustment process, there are several other noteworthy changes taking place. At the initial equilibrium, when investment demand first falls, aggregate supply exceeds demand by the difference

of $Y_s^2 - Y_sA$. Adjustment in the goods market will be trying to reach equilibrium by getting back to the DD curve. However, the economy will never get to Y_sA . That's because the asset market will adjust in the meantime. As GNP falls, the exchange rate is pushed up to get back onto the AA curve. Remember, that asset market adjustment takes place quickly after an interest rate change (perhaps in several hours or days), while goods market adjustment can take months. When the exchange rate rises, the dollar depreciation makes foreign goods more expensive and reduces imports. It also makes U.S. goods cheaper to foreigners and stimulates exports, both of which cause an increase in current account demand. This change in demand is represented as a movement along the new DD' curve. Thus when the exchange rate rises up to $E_{s/\2 during the adjustment process, aggregate demand will have risen from Y_sA to Y_sB along the new DD' curve. In other words, the "target" for GNP adjustment moves closer as the exchange rate rises. In the end, the target for GNP reaches Y_s^3 just as the exchange rate rises to $E_{s/\3 .

Increase in Foreign Interest Rates

Consider adjustment to an increase in the foreign interest rate, i_f . Begin with an original superequilibrium where DD crosses AA at point F with GNP at Y^1 and exchange rate at $E_{s/\1 . When the foreign interest rate increases, ceteris paribus, the AA curve shifts upward, as was shown in , . This shift is shown in as a shift from AA to $A'A'$.

Figure 9.10 Effects of an Increase in Foreign Interest Rates in the AA-DD Model



The quick result is that the equilibrium shifts to point H , GNP rises to Y^3 , and the exchange rate rises to E^3 . The increase in the exchange rate represents a depreciation of the U.S. dollar value. The convenience of the graphical approach is that it allows us to quickly identify the final outcome using only our knowledge about the mechanics of the AA-DD diagram. However, this quick result does not explain the adjustment process, so let's take a more careful look

at how the economy gets from point F to H .

Step 1: When the foreign interest rate (i_f) rises, the rate of return on foreign British assets rises above the rate of return on domestic U.S. assets in the foreign exchange market. This causes an immediate increase in the demand for foreign British currency, causing an appreciation of the pound and a depreciation of the U.S. dollar. Thus the exchange rate ($E_{\$/\pounds}$) rises. This change is represented by the movement from point F to G on the AA-DD diagram. The AA curve shifts up to reflect the new set of asset market equilibriums corresponding to the now-higher foreign interest rate. Since the foreign exchange market adjusts very swiftly to changes in interest rates, the economy will not remain off the new $A'A'$ curve for very long.

Step 2: Now that the exchange rate has risen to $E_{\$/\pounds}^2$, the real exchange has also increased. This implies foreign goods and services are relatively more expensive while U.S. G&S are relatively cheaper. This will raise demand for U.S. exports, curtail demand for U.S. imports, and result in an increase in current account and thereby aggregate demand. Note that the new equilibrium demand at exchange rate is temporarily at GNP level Y^4 , which is on the DD curve given the exchange rate $E_{\$/\pounds}^2$. Because aggregate demand exceeds aggregate supply, inventories will begin to fall, stimulating an increase in production and thus GNP. This is represented by a rightward shift from point G (small arrow).

Step 3: As GNP rises, so does real money demand, causing an increase in U.S. interest rates. With higher interest rates, the rate of return on U.S. assets rises above that in the United Kingdom and international investors shift funds back to the United States, leading to a dollar appreciation (pound depreciation), or the decrease in the exchange rate ($E_{\$/\pounds}$). This moves the economy downward, back to the $A'A'$ curve. The adjustment in the asset market will occur quickly after the change in interest rates. Thus the rightward shift from point G in the diagram results in quick downward adjustment to regain equilibrium in the asset market on the $A'A'$ curve, as shown.

Step 4: Continuing increases in GNP caused by excess aggregate demand, results in continuing increases in U.S. interest rates and rates of return, repeating the stepwise process above until the new equilibrium is reached at point H in the diagram.

During the adjustment process, there are several other noteworthy changes taking place. At point G , aggregate demand exceeds supply by the difference $Y^4 - Y^1$. Adjustment in the goods market will be trying to reach equilibrium by getting back to the DD curve. However, the economy will never get to Y^4 .

That's because the asset market will adjust during the transition. As GNP rises, the exchange rate is gradually pushed down to get back onto the A'A' curve. When the exchange rate falls, the dollar appreciation makes foreign goods cheaper, raising imports. It also makes U.S. goods more expensive to foreigners, reducing exports—both of which cause a decrease in current account demand. This change in demand is represented as a movement along the DD curve. Thus when the exchange rate falls during the adjustment process, aggregate demand falls from Y^4 along the DD curve. In other words, the “target” for GNP adjustment moves closer as the exchange rate falls. In the end, the target for GNP reaches Y^3 just as the exchange rate falls to $E_{\$/\text{£}}^3$.

KEY TAKEAWAYS

- Adjustment in the asset market occurs quickly, whereas adjustment in the G&S market occurs much more slowly.
- In the AA-DD model, a decrease in investment demand ultimately reduces GNP and raises the exchange rate, which, as defined, means a depreciation of the dollar.
- In the AA-DD model, an increase in foreign interest rates ultimately raises GNP and raises the exchange rate, which, as defined, means a depreciation of the dollar.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. Of *increase, decrease, or stay the same*, the final effect on equilibrium GNP following an increase in investment demand in the AA-DD model.
 - b. Of *increase, decrease or stay the same*, the immediate effect on $E_{\$/\text{£}}$ following an increase in investment demand in the AA-DD model.
 - c. Of *increase, decrease, or stay the same*, the final effect on equilibrium GNP following a decrease in foreign interest rates in the AA-DD model.
 - d. Of *increase, decrease, or stay the same*, the immediate effect on $E_{\$/\text{£}}$ following a decrease in British interest rates in the AA-DD model.
 - e. Of *faster, slower, or the same rate*, this describes the speed of adjustment to a DD curve relative to an AA curve.



9.8 AA-DD and the Current Account Balance

LEARNING OBJECTIVE

1. Derive a graphical mechanism in the AA-DD model to represent the effects of changes in the superequilibrium on the current account balance.

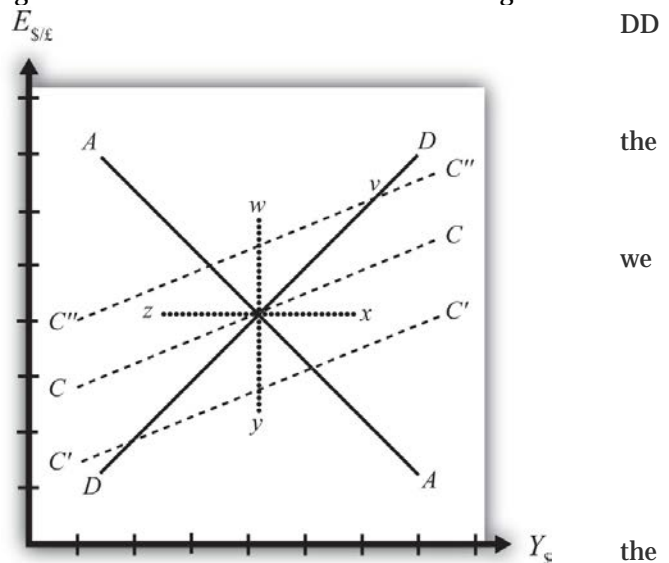
In later chapters we will use the AA-DD model to describe the effects of policy changes on macroeconomic variables in an open economy. The two most important macro variables are the exchange rate and the current account (trade) balance. The effects of changes on the exchange rate are vividly portrayed in the AA-DD diagram since this variable is plotted along the vertical axis and its value is determined as an element of the equilibrium. The current account (CA) variable is not displayed in the AA-DD diagram, but with some further thought we can devise a method to identify the current account balance at different positions in the AA-DD diagram.

First, note that there is no “equilibrium” current account balance in a floating exchange rate system. Any balance on the current account is possible because any balance can correspond to balance on the balance of payments. The balance of payments is made up of two broad subaccounts: the current account and the financial account, the sum of whose balances must equal zero. When the balances sum to zero, the foreign demand for domestic goods, services, income, *and* assets is equal to domestic supply of goods, services, income, and assets. Thus there must always be “balance” on the balance of payments regardless of the balances on the individual subaccounts.

Iso-CAB Line

An iso-CAB line is a line drawn on an AA-DD diagram, representing a set of points along which the current account balance (CAB) is same. Note that “iso” is a prefix that means *the same*. In the adjoining diagram, we have superimposed three-dotted iso-CAB lines labeled CC , $C'C'$, and $C''C''$. Each line represents a set of GNP and exchange rate combinations that generate the same balance on the current account. The higher

Figure 9.11 Iso-CAB Lines in an AA-DD Diagram



CAB line, the larger is the balance on the current account. Thus the CAB balance on $C''C''$ is greater than the balance along CC . Also note that each CAB line is positively sloped with a slope less than the slope of the DD curve. Next, we'll continue with a justification for this description.

Justifying the Shape of the Iso-CAB Line

Consider the superequilibrium point at the intersection of AA and DD. The positions of these two curves are determined by the values of the exogenous variables in the model, including the domestic price level (P_s), the foreign price level (P_f), tax revenues (T), and transfer payments (TR), among others. The intersection of the two curves determines the equilibrium GNP level (Y_s) and the exchange rate ($E_{s/f}$) (not labeled in diagram). Recall from, that the DD curve is derived from the aggregate demand function, one component of which is the current account function. The current account function, as shown below, is a function of all the variables listed immediately above:

$$CA^D\left(\frac{E_{s/f}P_f}{P_s}, Y - \bar{T} + TR\right) = K.$$

Thus at the intersection of AA and DD there are presumed known values for the exogenous variables and determined values for the endogenous variables, $E_{s/f}$ and Y_s .

All these values could, in principle, be plugged into the current account demand function (CA^D) to determine the CA balance at the equilibrium. Let's assume that value is given by K , as shown in the above expression.

Now let's consider movements in the superequilibrium to other points on the diagram. Let's suppose that the equilibrium moved to point x directly to the right. That could arise from a rightward shift of DD and an upward shift of AA. We will also assume that this shift did not arise due to changes in P_s , P_f , T , or TR , the other exogenous variables that affect the current account. (More on this issue below.) One possibility is an increase in the money supply and an increase in investment demand. Note that these shifts are not depicted.

At point x , GNP is higher while the exchange rate and the other exogenous variables are the same as before. Since an increase in Y_s raises disposable income, which reduces current account demand, the current account balance must be at a lower level at point x compared to the initial equilibrium.

If the equilibrium had shifted to point z instead, then GNP is lower while the exchange rate and the other exogenous variables are the same as before. Since a decrease in Y_S lowers disposable income, which raises current account demand, the current account balance must be at a higher level at point z compared to the initial equilibrium.

Next, suppose the equilibrium had shifted to point y instead. In this case, the exchange rate ($E_{S/\mathcal{L}}$) is lower while GNP and the other exogenous variables are the same as before. Since a decrease in $E_{S/\mathcal{L}}$ reduces the real exchange rate, which reduces current account demand, the current account balance must be at a lower level at point y compared to the initial equilibrium.

Finally, suppose the equilibrium had shifted to point w . In this case, the exchange rate, $E_{S/\mathcal{L}}$, is higher while GNP and the other exogenous variables are the same as before. Since an increase in $E_{S/\mathcal{L}}$ raises the real exchange rate, which increases current account demand, the current account balance must be at a higher level at point w compared to the initial equilibrium.

Since a movement to w and z results in an increase in the current account balance, while a shift to x or y causes a reduction in the balance, the line representing a constant CAB must be positively sloped. Another way to see this is to use the CAD function above. Suppose the CAB is originally at the value K . If the exchange rate ($E_{S/\mathcal{L}}$) rises, ceteris paribus, then CA will rise. We can now ask how GNP would have to change to get back to a CA balance of K . Clearly, if Y rises, disposable income rises and the current account balance falls. Raise GNP by precisely the right amount, and we can get the CAB back to K . Thus an increase in $E_{S/\mathcal{L}}$ must accompany an increase in GNP to maintain a fixed current account balance and therefore an iso-CAB line must be positively sloped.

The last thing we need to show is that the iso-CAB line is less steeply sloped than the DD line. Suppose the economy moved to a point such as v , which is on the same DD curve as the original superequilibrium. Recall from , , the DD curve is derived from a change in the exchange rate and its effect on equilibrium GNP in the G&S market alone. The increase in the exchange rate causes an increase in current account demand through its effect on the real exchange rate. This causes an increase in aggregate demand, which inspires the increase in GNP. When equilibrium is reached in the G&S market, at point v , aggregate supply, Y , will equal aggregate demand and the following expression must hold:

$$Y_S = C^D(Y_S - \bar{T} + TR) + I_0 + G_0 + CA^D\left(\frac{E_{S/\mathcal{L}} P_{\mathcal{L}}}{P_S}, Y_S - \bar{T} + TR\right).$$

The left side is aggregate supply given by the equilibrium value at point v and the right side is aggregate demand. Since GNP is higher at v , consumption demand (CD) must also be higher. However, because the marginal propensity to consume is less than one, not all the extra GNP will be spent on consumption goods; some will be saved. Nevertheless, aggregate demand (on the right side) must rise up to match the increase in supply on the left side. Since all the increase in demand cannot come from consumption, the remainder must come from the current account. This implies that a movement along the DD curve to v results in an increase in the current account balance. It also implies that the iso-CAB line must be less steeply sloped than the DD curve.

Using the Iso-CAB Line

The iso-CAB line can be used to assess the change in the country's current account balance from any exogenous variable change except changes in P_s , P_e , T , and TR . The reason we must exclude these variables is because the current account demand function is also dependent on these exogenous variables. If tax revenues increased, for example, all the iso-CAB lines would shift, making it much more difficult to pinpoint the final effect on the current account balance.

However, for monetary policy changes and government spending fiscal policy changes, the iso-CAB line will work. Anytime the superequilibrium shifts above the original iso-CAB line, the economy will move onto another iso-CAB line with a higher balance. (This is like the shift to point v in .) Recall that the $CA = EX - IM$, which can be positive or negative. If CAB were in surplus originally, an increase in the CAB (as with a movement to v) would imply an increase in the CA surplus. However, if the CAB were in deficit originally, then an increase in CAB implies a reduction in the deficit. If the increase in the CAB were sufficiently large, the CAB could move from deficit to surplus.

In a similar way, anytime the superequilibrium shifts below an initial iso-CAB line, the CAB surplus will fall, or the CAB deficit will rise.

Remember that the iso-CAB line is only used a reference to track the current account balance. The iso-CAB line is not used to determine the superequilibrium. For this reason, the iso-CAB line is plotted as a dashed line rather than a solid line.

KEY TAKEAWAYS

- An iso-CAB line is a line drawn on an AA-DD diagram, representing a set of points along which the current account balance (CAB) is the same.

- An iso-CAB line is positively sloped and with a slope that is less than the slope of the DD curve.
- The iso-CAB line can be used to assess the change in the country's current account balance from any exogenous variable change except changes in P_s , P_ϵ , T , and TR .

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is "a tax on imports," then the correct question is "What is a tariff?"
 - a. Of *greater than, less than, or equal*, the current account balance for an exchange rate and GNP combination that lies above an iso-CAB line relative to a combination that lies on the line.
 - b. Of *greater than, less than, or equal*, the current account surplus for an exchange rate and GNP combination that lies below an iso-CAB line relative to the surplus for a combination that lies on the line.
 - c. Of *greater than, less than, or equal*, the current account deficit for an exchange rate and GNP combination that lies below an iso-CAB line relative to the deficit for a combination that lies on the line.
 - d. Of *higher, lower, or equal*, the position of an iso-CAB line for a country with a current account deficit relative to an iso-CAB line when the country runs a surplus.
 - e. Of *positive, negative, or zero*, this describes the slope of an iso-CAB line.
 - f. Of *steeper, flatter, or the same*, this describes an iso-CAB line relative to a DD curve.

Chapter 10: Policy Effects with Floating Exchange Rates

The effects of government policies on key macroeconomic variables are an important issue in international finance. The AA-DD model constructed in [Chapter 9 "The AA-DD Model"](#) is used in this chapter to analyze the effects of fiscal and monetary policy under a regime of floating exchange rates. The results are more comprehensive than the previous analyses of the same policies because they take into account all the between-market effects across the money market, the foreign exchange (Forex) market, and the goods and services (G&S) market.

10.1 Overview of Policy with Floating Exchange Rates

LEARNING OBJECTIVE

1. Preview the comparative statics results from the AA-DD model with floating exchange rates.

This chapter uses the AA-DD model to describe the effects of fiscal and monetary policy under a system of floating exchange rates. Fiscal and monetary policies are the primary tools governments use to guide the macroeconomy. In introductory macroeconomics courses, students learn how fiscal and monetary policy levers can be used to influence the level of gross national product (GNP), the inflation rate, the unemployment rate, and interest rates. In this chapter, that analysis is expanded to an open economy (i.e., one open to trade) and to the effects on exchange rates and current account balances.

Results

Using the AA-DD model, several important relationships between key economic variables are shown:

- Expansionary monetary policy ($\uparrow MS$) causes an increase in GNP and a depreciation of the domestic currency in a floating exchange rate system in the short run.
- Contractionary monetary policy ($\downarrow MS$) causes a decrease in GNP and an appreciation of the domestic currency in a floating exchange rate system in the short run.
- Expansionary fiscal policy ($\uparrow G$, $\uparrow TR$, or $\downarrow T$) causes an increase in GNP and an appreciation of the domestic currency in a floating exchange rate system.
- Contractionary fiscal policy ($\downarrow G$, $\downarrow TR$, or $\uparrow T$) causes a decrease in GNP and a depreciation of the domestic currency in a floating exchange rate system.
- In the long run, once inflation effects are included, expansionary monetary policy ($\uparrow MS$) in a full employment economy causes no long-term change in GNP and a depreciation of the domestic currency in a floating exchange rate system. In the transition, the exchange rate overshoots its long-run target and GNP rises then falls.
- A sterilized foreign exchange intervention will have no effect on GNP or the exchange rate in the AA-DD model, unless international investors adjust their expected future exchange rate in response.
- A central bank can influence the exchange rate with direct Forex interventions (buying or selling domestic currency in exchange for foreign currency). To sell foreign currency and buy domestic currency, the central bank must have a stockpile of foreign currency reserves.

- A central bank can also influence the exchange rate with indirect open market operations (buying or selling domestic treasury bonds). These transactions work through money supply changes and their effect on interest rates.
- Purchases (sales) of foreign currency on the Forex will raise (lower) the domestic money supply and cause a secondary indirect effect upon the exchange rate.

Connections

The AA-DD model was developed to describe the interrelationships of macroeconomic variables within an open economy. Since some of these macroeconomic variables are controlled by the government, we can use the model to understand the likely effects of government policy changes. The two main levers the government controls are monetary policy (changes in the money supply) and fiscal policy (changes in the government budget). In this chapter, the AA-DD model is applied to understand government policy effects in the context of a floating exchange rate system. In , we'll revisit these same government policies in the context of a fixed exchange rate system.

It is important to recognize that these results are what “would” happen under the full set of assumptions that describe the AA-DD model. These effects may or may not happen in reality. Despite this problem, the model surely captures some of the simple cause-and-effect relationships and therefore helps us to understand the broader implications of policy changes. Thus even if in reality many more elements not described in the model may act to influence the key endogenous variables, the AA-DD model at least gives a more complete picture of some of the expected tendencies.

KEY TAKEAWAYS

- The main objective of the AA-DD model is to assess the effects of monetary and fiscal policy changes.
- It is important to recognize that these results are what “would” happen under the full set of assumptions that describes the AA-DD model; they may or may not accurately describe actual outcomes in actual economies.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. Of *increase, decrease, or stay the same*, this is the effect on equilibrium GNP in the short run if government spending decreases in the AA-DD model with floating exchange rates.
- b. Of *increase, decrease, or stay the same*, this is the effect on the domestic currency value in the short run if government spending decreases in the AA-DD model with floating exchange rates.
- c. Of *increase, decrease, or stay the same*, this is the effect on the foreign currency value (vis-à-vis the domestic) in the short run if domestic government spending decreases in the AA-DD model with floating exchange rates.
- d. Of *increase, decrease, or stay the same*, this is the effect on equilibrium GNP in the short run if the nominal money supply decreases in the AA-DD model with floating exchange rates.
- e. Of *increase, decrease, or stay the same*, this is the effect on the domestic currency value in the short run if the nominal money supply decreases in the AA-DD model with floating exchange rates.
- f. Of *increase, decrease, or stay the same*, this is the effect on equilibrium GNP in the long run if the nominal money supply increases in the AA-DD model with floating exchange rates.
- g. Of *increase, decrease, or stay the same*, this is the effect on the domestic currency value in the long run if the nominal money supply increases in the AA-DD model with floating exchange rates.

10.2 Monetary Policy with Floating Exchange Rates

LEARNING OBJECTIVES

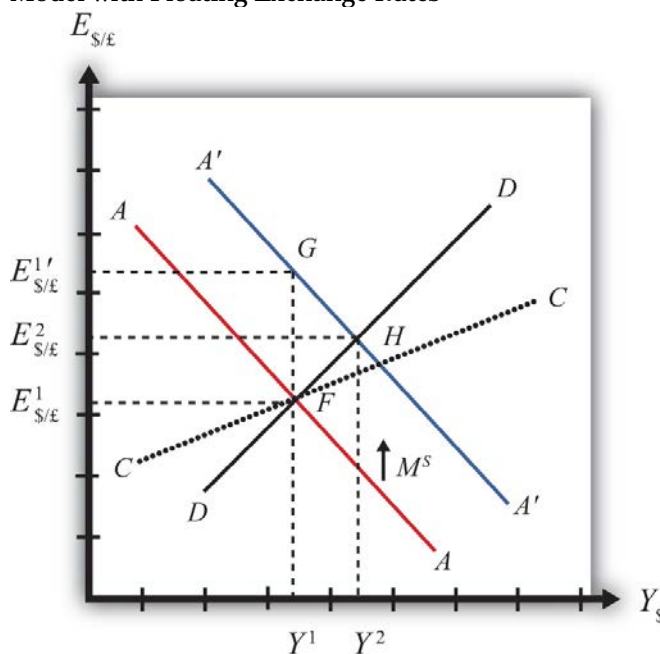
1. Learn how changes in monetary policy affect GNP, the value of the exchange rate, and the current account balance in a floating exchange rate system in the context of the AA-DD model.
2. Understand the adjustment process in the money market, the foreign exchange market, and the G&S market.

In this section, we use the AA-DD model to assess the effects of monetary policy in a floating exchange rate system. Recall from [Chapter 7 "Interest Rate Determination"](#) that the money supply is effectively controlled by a country's central bank. In the case of the United States, this is the Federal Reserve Board, or the Fed for short. When the money supply increases due to action taken by the central bank, we refer to it as expansionary monetary policy. If the central bank acts to reduce the money supply, it is referred to as contractionary monetary policy. Methods that can be used to change the money supply are discussed in [Chapter 7 "Interest Rate Determination"](#), [Section 7.5 "Controlling the Money Supply"](#).

Expansionary Monetary Policy

Suppose the economy is originally at a superequilibrium shown as point *F* in [Figure 10.1 "Expansionary Monetary Policy in the AA-DD Model with Floating Exchange Rates"](#). The original GNP level is Y^1 and the exchange rate is $E_{\$/\text{€}}^1$. Next, suppose the U.S. central bank (or the Fed) decides to expand the money supply. As shown in [Chapter 9 "The AA-DD Model"](#), [Section 9.5 "Shifting the AA Curve"](#), money supply changes cause a shift in the AA curve. More specifically, an increase in the money

Figure 10.1 Expansionary Monetary Policy in the AA-DD Model with Floating Exchange Rates



supply will cause AA to shift upward (i.e., $\uparrow MS$ is an AA up-shifter). This is depicted in the diagram as a shift from the red AA to the blue $A'A'$ line.

There are several different levels of detail that can be provided to describe the effects of this policy. Below, we present three descriptions with increasing degrees of completeness. First the quick result, then the quick result with the transition process described, and finally the complete adjustment story.

Quick Result

The increase in AA causes a shift in the superequilibrium point from F to H . In adjusting to the new equilibrium at H , GNP rises from Y to Y^2 and the exchange rate increases from $E_{\$/\pounds^1}$ to $E_{\$/\pounds^2}$. The increase in the exchange rate represents an increase in the British pound value and a decrease in the U.S. dollar value. In other words, it is an appreciation of the pound and a depreciation of the dollar. Since the final equilibrium point H is above the initial iso-CAB line CC , the current account balance increases.

(See [Chapter 9 "The AA-DD Model"](#), [Section 9.8 "AA-DD and the Current Account Balance"](#) for a description of CC .) If the CAB were in surplus at F , then the surplus increases; if the CAB were in deficit, then the deficit falls. Thus U.S. expansionary monetary policy causes an increase in GNP, a depreciation of the U.S. dollar, and an increase in the current account balance in a floating exchange rate system according to the AA-DD model.

Transition Description

Consider the upward shift of the AA curve due to the increase in the money supply. Since exchange rates adjust much more rapidly than GNP, the economy will initially adjust back to the new $A'A'$ curve before any change in GNP occurs. That means the first adjustment will be from point F to point G directly above.

The exchange rate will increase from $E_{\$/\pounds^1}$ to $E_{\$/\pounds^1'}$, representing a depreciation of the U.S. dollar.

Now at point G , the economy lies to the left of the DD curve. Thus GNP will begin to rise to get back to goods and services (G&S) market equilibrium on the DD curve. However, as GNP rises, the economy moves to the right above the $A'A'$ curve, which forces a downward readjustment of the exchange rate to get back to $A'A'$. In the end, the economy will adjust in a stepwise fashion from point G to point H , with each rightward movement in GNP followed by a quick reduction in the exchange rate to remain on the $A'A'$ curve. This process will continue until the economy reaches the superequilibrium at point H .

Notice that in the transition the exchange rate first rises to $E_{s/\epsilon}'$. Above the rate it will ultimately reach $E_{s/\epsilon}^2$ before settling back to superequilibrium value. This is an example of exchange rate overshooting. In the transition, the exchange rate *overshoots* its ultimate long-run value.

Exchange rate overshooting is used as one explanation for the volatility of exchange rates in floating markets. If many small changes occur frequently in an economy, the economy may always be in transition moving to a superequilibrium. Because of the more rapid adjustment of exchange rates, it is possible that many episodes of overshooting—both upward and downward—can occur in a relatively short period.

Complete Adjustment Story

Step 1: When the money supply increases, real money supply will exceed real money demand in the economy. Since households and businesses hold more money than they would like, at current interest rates, they begin to convert liquid money assets into less-liquid nonmoney assets. This raises the supply of long-term deposits and the amount of funds available for banks to loan. More money to lend will lower average U.S. interest rates, which in turn will result in a lower U.S. rate of return in the Forex market. Since $RoR_s < ROR_\epsilon$ now, there will be an immediate increase in the demand for foreign British currency, thus causing an appreciation of the pound and a depreciation of the U.S. dollar. Thus the exchange rate ($E_{s/\epsilon}$) rises. This change is represented by the movement from point F to G on the AA-DD diagram. The AA curve has shifted up to reflect the new set of asset market equilibria corresponding to the higher U.S. money supply. Since the money market and foreign exchange (Forex) markets adjust very swiftly to the money supply change, the economy will not remain off the new $A'A'$ curve for very long.

Step 2: Now that the exchange rate has risen to $E_{s/\epsilon}'$, the real exchange has also increased. This implies foreign goods and services are relatively more expensive while U.S. G&S are relatively cheaper. This will raise demand for U.S. exports, curtail demand for U.S. imports, and result in an increase in current account and, thereby, aggregate demand. Because aggregate demand exceeds aggregate supply, inventories will begin to fall, stimulating an increase in production and thus GNP. This is represented by a rightward shift from point G .

Step 3: As GNP rises, so does real money demand, causing an increase in U.S. interest rates. With higher interest rates, the rate of return on U.S. assets rises above that in the United Kingdom, and international investors shift funds back to the United States, resulting in a dollar appreciation (pound depreciation)—that is, a decrease in the exchange rate ($E_{s/\epsilon}$). This moves the economy downward, back to the $A'A'$ curve.

The adjustment in the asset market will occur quickly after the change in interest rates. Thus the rightward shift from point G in the diagram results in quick downward adjustment to regain equilibrium in the asset market on the $A'A'$ curve, as shown in the figure.

Step 4: Continuing increases in GNP caused by excess aggregate demand, results in continuing increases in U.S. interest rates and rates of return, repeating the stepwise process above until the new equilibrium is reached at point H in the diagram.

Step 5: The equilibrium at H lies to the northeast of F along the original DD curve. As shown in [Chapter 9 "The AA-DD Model"](#), [Section 9.8 "AA-DD and the Current Account Balance"](#), the equilibrium at H lies above the original iso-CAB line. Therefore, the current account balance will rise.

Contractionary Monetary Policy

Contractionary monetary policy corresponds to a decrease in the money supply. In the AA-DD model, a decrease in the money supply shifts the AA curve downward. The effects will be the opposite of those described above for expansionary monetary policy. A complete description is left for the reader as an exercise.

The quick effects, however, are as follows. U.S. contractionary monetary policy will cause a reduction in GNP and a reduction in the exchange rate, $E_{\$/\text{€}}$, implying an appreciation of the U.S. dollar and a decrease in the current account balance.

KEY TAKEAWAYS

- The U.S. expansionary monetary policy causes an increase in GNP, a depreciation of the U.S. dollar, and an increase in the current account balance in a floating exchange rate system according to the AA-DD model.
- Contractionary monetary policy will cause a reduction in GNP and a reduction in the exchange rate ($E_{\$/\text{€}}$), implying an appreciation of the U.S. dollar and a decrease in the current account balance.

EXERCISES

1. Use the AA-DD model (not necessarily the diagram) to explain these *sequential* short-run adjustment process of an increase in the money supply on the following economic variables under floating exchange rates. (In other words, first answer how the money supply increase immediately affects the interest rate. Next, answer how the previous

economic variable—i.e., the interest rate—affects the nominal exchange rate. Continue this process through investment.)

- a. The interest rate
- b. The nominal exchange rate
- c. The real exchange rate
- d. The current account balance
- e. GNP
- f. Disposable income
- g. Consumption
- h. Saving
- i. Investment

Repeat the exercise above assuming a decrease in the money supply.

Suppose a country with floating exchange rates has a current account deficit that its government considers too large. Use an AA-DD diagram to show how monetary policy could be used to reduce the current account deficit. Does this action help or hinder its goal of maintaining low unemployment? Explain.

10.3 Fiscal Policy with Floating Exchange Rates

LEARNING OBJECTIVES

1. Learn how changes in fiscal policy affect GNP, the value of the exchange rate, and the current account balance in a floating exchange rate system in the context of the AA-DD model.
2. Understand the adjustment process in the money market, the Forex market, and the G&S market.

In this section, we use the AA-DD model to assess the effects of fiscal policy in a floating exchange rate system. Recall that fiscal policy refers to any change in expenditures or revenues within any branch of the government. This means any change in government spending—transfer payments, or taxes, by either federal, state, or local governments—represents a fiscal policy change. Since changes in expenditures or revenues will often affect a government budget balance, we can also say that a change in the government surplus or deficit represents a change in fiscal policy.

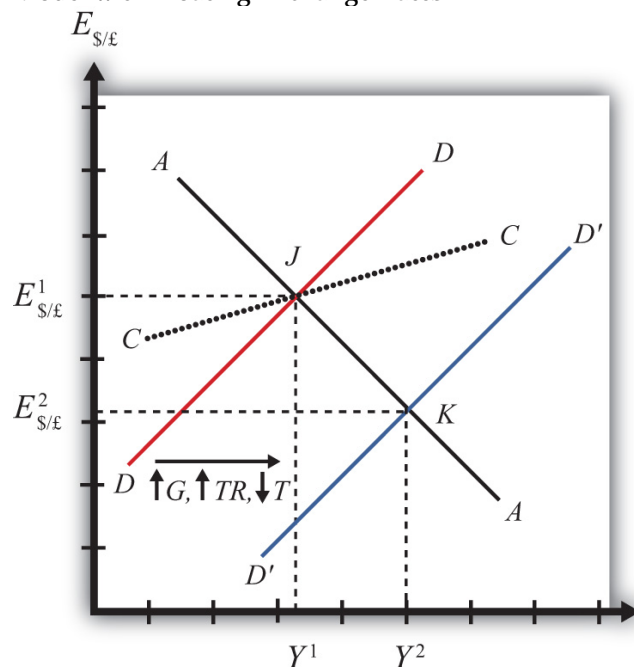
When government spending or transfer payments increase, or tax revenues decrease, we refer to it as expansionary fiscal policy. These actions would also be associated with an increase in the government budget deficit or a decrease in its

surplus. If the government acts to government spending or transfer payments, or increase tax revenues, referred to as contractionary fiscal policy. These actions would also be associated with a decrease in the government budget deficit, or an increase in its budget surplus.

Expansionary Fiscal Policy

Suppose the economy is originally at superequilibrium shown as point *J* in Figure 10.2 "Expansionary Fiscal Policy in the AA-DD Model with Floating Exchange Rates". The

Figure 10.2 Expansionary Fiscal Policy in the AA-DD Model with Floating Exchange Rates



budget
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a

Fiscal

original

gross national product (GNP) level is Y^1 and the exchange rate is $E_{\$/\pounds^1}$. Next, suppose the government decides to increase government spending (or increase transfer payments or decrease taxes). As shown in [Chapter 9 "The AA-DD Model", Section 9.3 "Shifting the DD Curve"](#), fiscal policy changes cause a shift in the DD curve. More specifically, an increase in government spending (or an increase in transfer payments or a decrease in taxes) will cause DD to shift rightward (i.e., $\uparrow G$, $\uparrow TR$, and $\downarrow T$ all are DD right-shifters). This is depicted in the diagram as a shift from the red DD to the blue DD' line.

There are several different levels of detail that can be provided to describe the effects of this policy. Below, we present three descriptions with increasing degrees of completeness: first the quick result, then the quick result with the transition process described, and finally the complete adjustment story.

Quick Result

The increase in DD causes a shift in the superequilibrium point from J to K . In adjusting to the new equilibrium at K , GNP rises from Y^1 to Y^2 and the exchange rate decreases from $E_{\$/\pounds^1}$ to $E_{\$/\pounds^2}$. The decrease in the exchange rate represents a decrease in the British pound value and an increase in the U.S. dollar value. In other words, it is a depreciation of the pound and an appreciation of the dollar. Since the final equilibrium point K is below the initial iso-CAB line CC , the current account balance decreases. (Caveat: this will be true for all fiscal expansions, but the iso-CAB line can only be used with an increase in G ; see [Chapter 9 "The AA-DD Model", Section 9.8 "AA-DD and the Current Account Balance"](#) for an explanation.) If the CAB were in surplus at J , then the surplus decreases; if the CAB were in deficit, then the deficit rises. Thus the U.S. expansionary fiscal policy causes an increase in the U.S. GNP, an appreciation of the U.S. dollar, and a decrease in the current account balance in a floating exchange rate system according to the AA-DD model.

Transition Description

If the expansionary fiscal policy occurs because of an increase in government spending, then government demand for goods and services (G&S) will increase. If the expansionary fiscal policy occurs due to an increase in transfer payments or a decrease in taxes, then disposable income will increase, leading to an increase in consumption demand. In either case aggregate demand increases, and this causes the rightward shift in the DD curve. Immediately after aggregate demand increases, but before any adjustment has occurred at point J , the economy lies to the left of the new $D'D'$ curve. Thus GNP will begin to rise to get back to G&S market equilibrium on the $D'D'$ curve. However, as GNP rises, the

economy will move above the AA curve, forcing a downward readjustment of the exchange rate to get back to asset market equilibrium on the AA curve. In the end, the economy will adjust in a stepwise fashion from point J to point K , with each rightward movement in GNP followed by a quick reduction in the exchange rate to remain on the AA curve. This process will continue until the economy reaches the superequilibrium at point K .

Complete Adjustment Story

Step 1: If the expansionary fiscal policy occurs because of an increase in government spending, then government demand for G&S will increase. If the expansionary fiscal policy occurs due to an increase in transfer payments or a decrease in taxes, then disposable income will increase, leading to an increase in consumption demand. In either case aggregate demand increases. Before any adjustment occurs, the increase in aggregate demand implies aggregate demand exceeds aggregate supply, which will lead to a decline in inventories. To prevent this decline, retailers (or government suppliers) will signal firms to produce more. As supply increases so does the GNP, and the economy moves to the right of point J .

Step 2: As GNP rises, so does real money demand, causing an increase in U.S. interest rates. With higher interest rates, the rate of return on U.S. assets rises above that in the United Kingdom and international investors shift funds back to the United States, resulting in a dollar appreciation (pound depreciation)—that is, a decrease in the exchange rate $E_{\$/\pounds}$. This moves the economy downward, back to the AA curve. The adjustment in the asset market will occur quickly after the change in interest rates. Thus the rightward shift from point J in the diagram results in quick downward adjustment to regain equilibrium in the asset market on the AA curve, as shown.

Step 3: Continuing increases in GNP caused by excess aggregate demand, results in continuing increases in U.S. interest rates and rates of return, repeating the stepwise process above until the new equilibrium is reached at point K in the diagram.

Step 4: The equilibrium at K lies to the southeast of J along the original AA curve. As shown in [Chapter 9 "The AA-DD Model"](#), [Section 9.8 "AA-DD and the Current Account Balance"](#), the current account balance must be lower at K since both an increase in GNP and a dollar appreciation cause decreases in current account demand. Thus the equilibrium at K lies below the original iso-CAB line. However, this is only assured if the fiscal expansion occurred due to an increase in G .

If transfer payments increased or taxes were reduced, these would both increase disposable income and lead to a further decline in the current account balance. Thus also with these types of fiscal expansions, the current account balance is reduced; however, one cannot use the iso-CAB line to show it.

Contractionary Fiscal Policy

Contractionary fiscal policy corresponds to a decrease in government spending, a decrease in transfer payments, or an increase in taxes. It would also be represented by a decrease in the government budget deficit or an increase in the budget surplus. In the AA-DD model, a contractionary fiscal policy shifts the DD curve leftward. The effects will be the opposite of those described above for expansionary fiscal policy. A complete description is left for the reader as an exercise.

The quick effects, however, are as follows. U.S. contractionary fiscal policy will cause a reduction in GNP and an increase in the exchange rate ($E_{\$/\text{€}}$), implying a depreciation of the U.S. dollar.

KEY TAKEAWAYS

- Expansionary fiscal policy causes an increase in GNP, an appreciation of the currency, and a decrease in the current account balance in a floating exchange rate system according to the AA-DD model.
- Contractionary fiscal policy will cause a reduction in GNP, a depreciation of the currency, and an increase in the current account balance in a floating exchange rate system according to the AA-DD model.

EXERCISES

1. Suppose a country with floating exchange rates has a current account deficit that its government considers too large. Use an AA-DD diagram to show how fiscal policy could be used to reduce the current account deficit. Does this action help or hinder its goal of maintaining low unemployment?
2. The United States maintains a floating exchange rate. In the past few years, its government budget deficit has risen to a very high level. At the same time, its trade deficit has also become much larger.
 - a. Suppose the government reduces government spending to reduce the budget deficit. Assume the U.S. economy can be described with the AA-DD model. In the

adjustment to the new equilibrium, the following variables will be affected in the order listed. Indicate whether each variable rises (+) or falls (-) during the adjustment process.

	Indicate + or -
Government Demand (G)	
Aggregate Demand (AD)	
Aggregate Supply (Y_s)	
Real Money Demand ($L[i_s, Y_s]$)	
U.S. Interest Rates (i_s)	
U.S. Rate of Return (R_oR_s)	
Exchange Rate ($E_{\$/\epsilon}$)	
Foreign Rate of Return (R_oR_ϵ)	
Real Exchange Rate ($q_{\$/\epsilon}$)	
Current Account Demand (CAD)	
Aggregate Demand (AD)	

b. Once the final short-run equilibrium is reached, indicate the effect of the decrease in government spending on the following variables:

	Indicate + or -
U.S. Government Budget Deficit	
U.S. Dollar Value	
U.S. Current Account Deficit	
U.S. GNP	

Consider the following actions/occurrences listed in the first column. For each one, use the AA-DD model to determine the impact on the variables from the twin-deficit identity

listed along the top row. Consider the final equilibrium short-run effects. Use the following notation:

+ the variable increases

- the variable decreases

0 the variable does not change

A the variable change is ambiguous (i.e., it may rise, it may fall)

	Impact on			
	<i>Sp</i>	<i>I</i>	<i>IM - EX</i>	<i>G + TR - T</i>
a. A decrease in investment demand with floating ERs				
b. A decrease in investment demand under floating ERs				
c. An increase in foreign interest rates under floating ERs				
d. An increase in government demand under floating ERs				



10.4 Expansionary Monetary Policy with Floating Exchange Rates in the Long Run

LEARNING OBJECTIVES

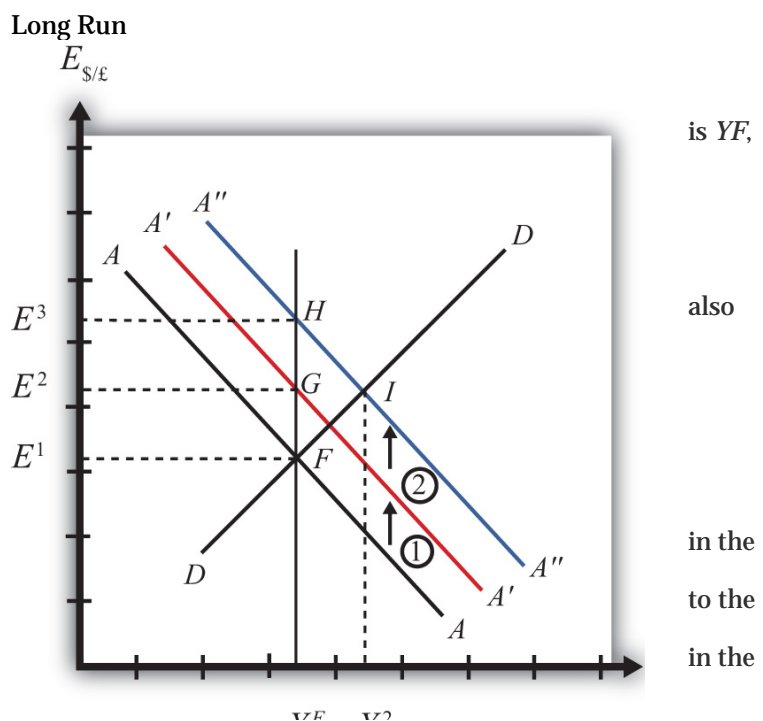
1. Learn how changes in monetary policy affect GNP and the value of the exchange rate in a floating exchange rate system in the context of the AA-DD model in the long run.
2. Understand the adjustment process in the money market, the Forex market, and the G&S market.

If expansionary monetary policy occurs when the economy is operating at full employment output, then the money supply increase will eventually put upward pressure on prices. Thus we say that eventually, or in the long run, the aggregate price level will rise and the economy will experience an episode of inflation in the transition. See , for a complete description of this process.

Here, we will describe the long-run effects of an increase in the money supply using the AA-DD model. We break up the effects into short-run and long-run components. In the short run, the initial money supply effects are felt and investor anticipations about future effects are implemented. In the long run, we allow the price level to rise.

Suppose the economy is originally at a superequilibrium, shown as point F in . The original GNP level and the exchange rate is E^1 . YF represents the full-employment level of output, which implies that the natural rate of unemployment prevails. Any movement of the economy to the right of YF will cause an eventual increase aggregate price level. Any movement left of YF causes an eventual decrease price level.

Figure 10.3 Expansionary Monetary Policy in the



Next, suppose the U.S. central bank (or the Fed) decides to expand the money supply. As shown in , , money supply changes cause a shift in the AA curve. More specifically, an increase in the money supply will cause AA to shift upward (i.e., $\uparrow MS$ is an AA up-shifter). This is depicted in the diagram as a shift from the AA line to the red A'A' line.

In the long-run adjustment story, several different changes in exogenous variables will occur sequentially, thus it is difficult to describe the quick final result, so we will only describe the transition process in partial detail.

Partial Detail

The increase in the money supply causes the first upward shift of the AA curve, shown as step 1 in the diagram. Since exchange rates adjust much more rapidly than gross national product (GNP), the economy will quickly adjust to the new A'A' curve before any change in GNP occurs. That means the first adjustment will be from point *F* to point *G* directly above. The exchange rate will increase from E^1 to E^2 , representing a depreciation of the U.S. dollar.

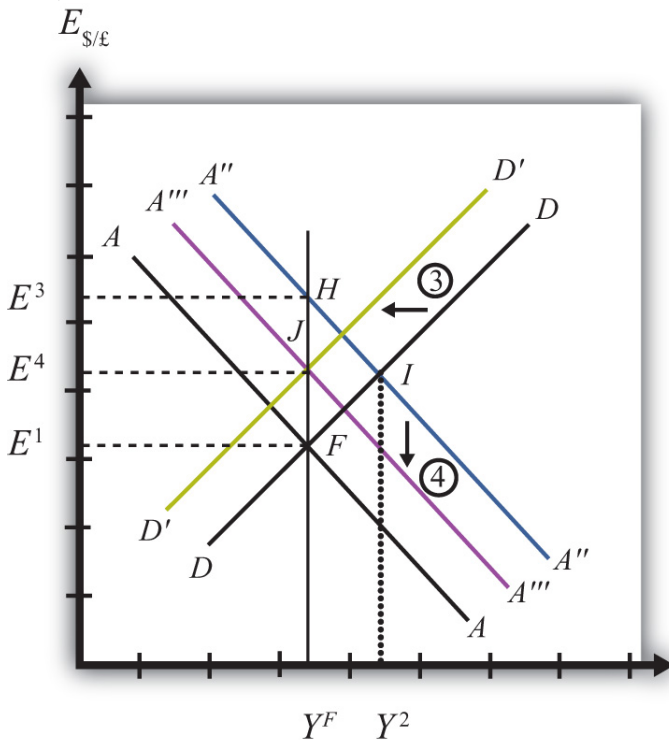
The second effect is caused by changes in investor expectations. Investors generally track important changes in the economy, including money supply changes, because these changes can have important implications for the returns on their investments. Investors who see an increase in money supply in an economy at full employment are likely to expect inflation to occur in the future. When investors expect future U.S. inflation, and when they consider both domestic and foreign investments, they will respond today with an increase in their expected future exchange rate ($E_{\$/\text{€}}$). There are two reasons to expect this immediate effect:

1. Investors are very likely to understand the story we are in the process of explaining now. As we will see below, the long-run effect of a money supply increase for an economy (initially, at full employment) is an increase in the exchange rate ($E_{\$/\text{€}}$)—that is, a depreciation of the dollar. If investors believe the exchange rate will be higher next year due to today's action by the Fed, then it makes sense for them to raise their expected future exchange rate in anticipation of that effect. Thus the average $E_{\$/\text{€}}$ will rise among investors who participate in the foreign exchange (Forex) markets.
2. Investors may look to the purchasing power parity (PPP) theory for guidance. PPP is generally interpreted as a long-run theory of exchange rate trends. If PPP holds in the long run, then $E_{\$/\text{€}} = P_{\$/\text{€}}$. In other

words, the exchange rate will equal the ratio of the two countries' price levels. If P_S is expected to rise due to inflation, then PPP predicts that the exchange rate ($E_{\$/\text{£}}$) will also rise and the dollar will depreciate. The timing of the change in $E_{\$/\text{£}}$ will depend on how quickly investors recognize the money supply change, compute its likely effect, and incorporate it into their investment plans. Since investors are typically very quick to adapt to market changes, the expectations effect should take place in the short run, perhaps long before the inflation ever occurs. In some cases, the expectations change may even occur before the Fed increases the money supply, if investors anticipate the Fed's action.

The increase in the expected exchange rate (this means a decrease in the expected future dollar value) causes a second upward shift of the AA curve, shown as step 2 in the diagram. Again, rapid exchange rate

Figure 10.4 Expansionary Monetary Policy in the Long Run, Continued



adjustment implies the economy will quickly adjust to the new A''A'' curve at point H directly above. The exchange rate will now increase from E^2 to E^3 , representing a further depreciation of the U.S. dollar.

Once at point H, aggregate demand, which is on the DD curve to the right of H, exceeds aggregate supply, which is still at Y^F . Thus GNP will begin to rise to get back to G&S market equilibrium on the DD curve. However, as GNP rises, the economy moves above the A''A'' curve that forces a downward readjustment of the exchange rate to get back to asset market equilibrium on A''A''.

In the end, the economy will adjust in a stepwise fashion from point H to point I, with each rightward movement in GNP followed by a quick reduction in the exchange rate to remain on the A''A'' curve. This process will continue until the economy reaches the temporary superequilibrium at point I.

The next effect occurs because GNP, now at Y^2 at point I , has risen above the full employment level at YF . This causes an increase in U.S. prices, meaning that P_s (the U.S. price level) begins to rise. The increase in U.S. prices has two effects as shown in. An increase in P_s is both a DD left-shifter and an AA down-shifter. In step 3, we depict a leftward shift of DD to $D'D'$. DD shifts left because higher U.S. prices will reduce the real exchange rate. This makes U.S. G&S relatively more expensive compared with foreign G&S, thus reducing export demand, increasing import demand, and thereby reducing aggregate demand.

In step 4, we depict a downward shift of $A''A''$ to $A'''A'''$. AA shifts down because a higher U.S. price level reduces real money supply. As the real money supply falls, U.S. interest rates rise, leading to an increase in the rate of return for U.S. assets as considered by international investors. This in turn raises the demand for U.S. dollars on the Forex, leading to a dollar appreciation. Since this effect occurs for any GNP level, the entire AA curve shifts downward.

Steps 3 and 4 will both occur simultaneously, and since both are affected by the increase in the price level, it is impossible to know which curve will shift faster or precisely how far each curve will shift. However, we do know two things. First, the AA and DD shifting will continue as long as GNP remains above the full employment level. Once GNP falls to YF , there is no longer upward pressure on the price level and the shifting will cease. Second, the final equilibrium exchange rate must lie above the original exchange rate. This occurs because output will revert back to its original level, the price level will be higher, and according to PPP, eventually the exchange rate will have to be higher as well.

The final equilibrium will be at a point like J , which lies to the left of I . In this transition, the exchange rate will occasionally rise when DD shifts left and will occasionally fall when AA shifts down. Thus the economy will wiggle its way up and down, from point I to J . Once at point J , there is no reason for prices to rise further and no reason for a change in investor expectations. The economy will have reached its long-run equilibrium.

Note that one cannot use the iso-CAB line to assess the long-run effect on the current account balance. In the final adjustment, although the final equilibrium lies above the original iso-CAB line, in the long run the P_s changes will raise the iso-CAB lines, making it impossible to use these to identify the final effect. However, in adjusting to the long-run equilibrium, the only two variables affecting the current account that will ultimately change are the exchange rate and the price level. If these two rise proportionally to

each other, as they would if purchasing power parity held, then there will be no long-run effect on the current account balance.

The final long-run effect of an increase in the U.S. money supply in a floating exchange rate system is a depreciation of the U.S. dollar and no change in real GNP. Along the way, GNP temporarily rises and unemployment falls below the natural rate. However, this spurs an increase in the price level, which reduces GNP to its full employment level and raises unemployment back to its natural rate. U.S. inflation occurs in the transition while the price level is increasing.

KEY TAKEAWAY

- The final long-run effect of an increase in the money supply in a floating exchange rate system is a depreciation of the currency and no change in real GNP. In the transition process, there is an inflationary effect.

EXERCISES

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. Of *increase, decrease, or stay the same*, this is the effect on equilibrium GNP in the long run if the nominal money supply increases in the AA-DD model with floating exchange rates.
- b. Of *increase, decrease, or stay the same*, this is the effect on the domestic currency value in the long run if the nominal money supply increases in the AA-DD model with floating exchange rates.
- c. Of *increase, decrease, or stay the same*, this is the effect on equilibrium GNP in the long run if the nominal money supply decreases in the AA-DD model with floating exchange rates.
- d. Of *increase, decrease, or stay the same*, this is the effect on the domestic currency value in the long run if the nominal money supply decreases in the AA-DD model with floating exchange rates.

Repeat the analysis in the text for contractionary monetary policy. Explain each of the four adjustment steps and depict them on an AA-DD diagram.



10.5 Foreign Exchange Interventions with Floating Exchange Rates

LEARNING OBJECTIVES

1. Learn how a country's central bank can intervene to affect the value of the country's currency in a floating exchange rate system.
2. Learn the mechanism and purpose of a central bank sterilized intervention in a Forex market.

In a pure floating exchange rate system, the exchange rate is determined as the rate that equalizes private market demand for a currency with private market supply. The central bank has no necessary role to play in the determination of a pure floating exchange rate. Nonetheless, sometimes central banks desire or are pressured by external groups to take actions (i.e., intervene) to either raise or lower the exchange rate in a floating exchange system. When central banks do intervene on a semiregular basis, the system is sometimes referred to as a “dirty float.” There are several reasons such interventions occur.

The first reason central banks intervene is to stabilize fluctuations in the exchange rate. International trade and investment decisions are much more difficult to make if the exchange rate value is changing rapidly. Whether a trade deal or international investment is good or bad often depends on the value of the exchange rate that will prevail at some point in the future. (See , for a discussion of how future exchange rates affect returns on international investments.) If the exchange rate changes rapidly, up or down, traders and investors will become more uncertain about the profitability of trades and investments and will likely reduce their international activities. As a consequence, international traders and investors tend to prefer more stable exchange rates and will often pressure governments and central banks to intervene in the foreign exchange (Forex) market whenever the exchange rate changes too rapidly.

The second reason central banks intervene is to reverse the growth in the country's trade deficit. Trade deficits (or current account deficits) can rise rapidly if a country's exchange rate appreciates significantly. A higher currency value will make foreign goods and services (G&S) relatively cheaper, stimulating imports, while domestic goods will seem relatively more expensive to foreigners, thus reducing exports. This means a rising currency value can lead to a rising trade deficit. If that trade deficit is viewed as a problem for the economy, the central bank may be pressured to intervene to reduce the value of the currency in the Forex market and thereby reverse the rising trade deficit.

There are two methods central banks can use to affect the exchange rate. The indirect method is to change the domestic money supply. The direct method is to intervene directly in the foreign exchange market by buying or selling currency.

Indirect Forex Intervention

The central bank can use an indirect method to raise or lower the exchange rate through domestic money supply changes. As was shown in , , increases in the domestic U.S. money supply will cause an increase in $E_{\$/\text{€}}$, or a dollar depreciation. Similarly, a decrease in the money supply will cause a dollar appreciation. Despite relatively quick adjustments in assets markets, this type of intervention must traverse from open market operations to changes in domestic money supply, domestic interest rates, and exchange rates due to new rates of returns. Thus this method may take several weeks or more for the effect on exchange rates to be realized.

A second problem with this method is that to affect the exchange rate the central bank must change the domestic interest rate. Most of the time, central banks use interest rates to maintain stability in domestic markets. If the domestic economy is growing rapidly and inflation is beginning to rise, the central bank may lower the money supply to raise interest rates and help slow down the economy. If the economy is growing too slowly, the central bank may raise the money supply to lower interest rates and help spur domestic expansion. Thus to change the exchange rate using the indirect method, the central bank may need to change interest rates away from what it views as appropriate for domestic concerns at the moment. (Below we'll discuss the method central banks use to avoid this dilemma.)

Direct Forex Intervention

The most obvious and direct way for central banks to intervene and affect the exchange rate is to enter the private Forex market directly by buying or selling domestic currency. There are two possible transactions. First, the central bank can sell domestic currency (let's use dollars) in exchange for a foreign currency (say, pounds). This transaction will raise the supply of dollars on the Forex (also raising the demand for pounds), causing a reduction in the value of the dollar and thus a dollar depreciation. Of course, when the dollar depreciates in value, the pound appreciates in value with respect to the dollar. Since the central bank is the ultimate source of all dollars (it can effectively print an unlimited amount), it can flood the Forex market with as many dollars as it desires. Thus the central bank's power to reduce the dollar value by direct intervention in the Forex is virtually unlimited.

If instead, the central bank wishes to raise the value of the dollar, it will have to reverse the transaction described above. Instead of selling dollars, it will need to buy dollars in exchange for pounds. The increased demand for dollars on the Forex by the central bank will raise the value of the dollar, thus causing a dollar appreciation. At the same time, the increased supply of pounds on the Forex explains why the pound will depreciate with respect to the dollar.

The ability of a central bank to raise the value of its currency through direct Forex interventions is limited, however. In order for the U.S. Federal Reserve Bank (or the Fed) to buy dollars in exchange for pounds, it must have a stockpile of pound currency (or other pound assets) available to exchange. Such holdings of foreign assets by a central bank are called foreign exchange reserves. Foreign exchange reserves are typically accumulated over time and held in case an intervention is desired. In the end, the degree to which the Fed can raise the dollar value with respect to the pound through direct Forex intervention will depend on the size of its pound denominated foreign exchange reserves.

Indirect Effect of Direct Forex Intervention

There is a secondary indirect effect that occurs when a central bank intervenes in the Forex market. Suppose the Fed sells dollars in exchange for pounds in the private Forex. This transaction involves a purchase of foreign assets (pounds) in exchange for U.S. currency. Since the Fed is the ultimate source of dollar currency, these dollars used in the transaction will enter into circulation in the economy in precisely the same way as new dollars enter when the Fed buys a Treasury bill on the open market. The only difference is that with an open market operation, the Fed purchases a domestic asset, while in the Forex intervention it buys a foreign asset. But both are assets all the same and both are paid for with newly created money. Thus when the Fed buys pounds and sells dollars on the Forex, there will be an increase in the U.S. money supply.

The higher U.S. money supply will lower U.S. interest rates, reduce the rate of return on U.S. assets as viewed by international investors, and result in a depreciation of the dollar. The direction of this indirect effect is the same as the direct effect.

In contrast, if the Fed were to buy dollars and sell pounds on the Forex, there will be a decrease in the U.S. money supply. The lower U.S. money supply will raise U.S. interest rates, increase the rate of return on U.S. assets as viewed by international investors, and result in an appreciation of the dollar.

The only difference between the direct and indirect effects is the timing and sustainability. The direct effect will occur immediately with central bank intervention since the Fed will be affecting today's supply of dollars or pounds on the Forex. The indirect effect, working through money supply and interest rates, may take several days or weeks. The sustainability of the direct versus indirect effects is discussed next when we introduce the idea of a sterilized Forex intervention.

Sterilized Forex Interventions

There are many times in which a central bank either wants or is pressured to affect the exchange rate value by intervening directly in the foreign exchange market. However, as shown above, direct Forex interventions will change the domestic money supply. A change in the money supply will affect the average interest rate in the short run and the price level, and hence the inflation rate, in the long run. Because central banks are generally entrusted to maintain domestic price stability or to assist in maintaining appropriate interest rates, a low unemployment rate, and GDP growth, Forex intervention will often interfere with one or more of their other goals.

For example, if the central bank believes that current interest rates should be raised slowly during the next several months to slow the growth of the economy and prevent a resurgence of inflation, then a Forex intervention to lower the value of the domestic currency would result in increases in the money supply and a decrease in interest rates, precisely the opposite of what the central bank wants to achieve. Conflicts such as this one are typical and usually result in a central bank choosing to sterilize its Forex interventions.

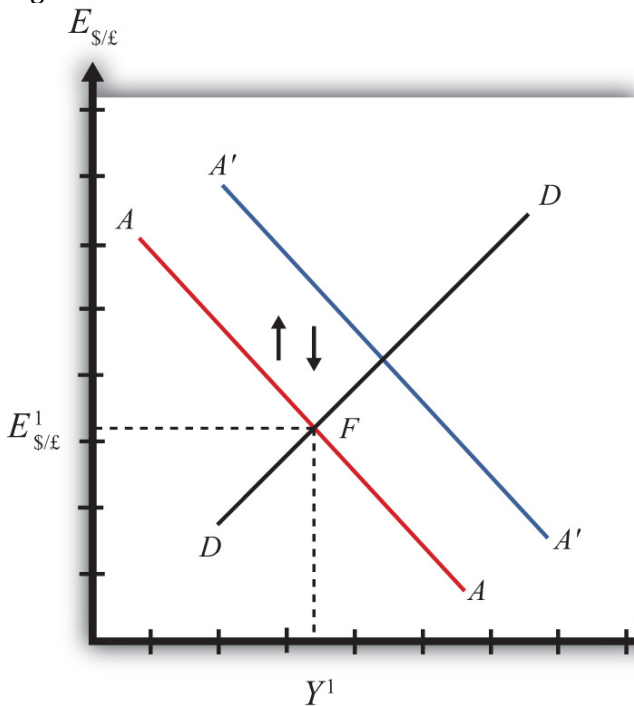
The intended purpose of a sterilized intervention is to cause a change in the exchange rate while at the same time leaving the money supply and hence interest rates unaffected. As we will see, the intended purpose is unlikely to be realized in practice.

A sterilized foreign exchange intervention occurs when a central bank counters direct intervention in the Forex with a simultaneous offsetting transaction in the domestic bond market. For example, suppose the U.S. Fed decides to intervene to lower the value of the U.S. dollar. This would require the Fed to sell dollars and buy foreign currency on the Forex. Sterilization, in this case, involves a Fed open market operation in which it sells Treasury bonds (T-bonds) at the same time and in the same value as the dollar sale in the Forex market. For example, if the Fed intervenes and sells \$10 million on the Forex,

sterilization means it will also sell \$10 million of Treasury bonds on the domestic open market at the same time.

Consider the effects of a sterilized Forex intervention by the U.S. Fed shown in the adjoining AA-DD diagram. Suppose the economy is initially in equilibrium at point F with GDP (Y) and exchange rate ($E_{\$/\pounds}$). Now, suppose the Fed intervenes in the Forex by selling dollars and buying British pounds. The direct effect on the exchange rate is not represented in the AA-DD diagram. The only way it can have an

Figure 10.5 Sterilization in the AA-DD Model



effect is through the increase in the money supply, which will shift the AA curve up from AA to $A'A'$. However, sterilization means the Fed will simultaneously conduct an offsetting open market operation, in this case selling Treasury bonds equal in value to the Forex sales. The sale of T-bonds will lower the U.S. money supply, causing an immediate shift of the AA curve back from $A'A'$ to AA . In fact, because the two actions take place on the same day or within the same week at least, the AA curve does not really shift out at all. Instead, a sterilized Forex intervention maintains the U.S. money supply and thus achieves the Fed's

objective of maintaining interest rates.

However, because there is no shift in the AA or DD curves, the equilibrium in the economy will never move away from point F . This implies that a sterilized Forex intervention not only will not affect GNP, but also will not affect the exchange rate. This suggests the impossibility of the Fed's overall objective to lower the dollar value while maintaining interest rates.

Empirical studies of the effects of sterilized Forex interventions tend to support the results of this simple model. In other words, real-world sterilizations have generally been ineffective in achieving any lasting effect upon a country's currency value.

However, there are several reasons why sterilized interventions may be somewhat effective nonetheless. Temporary effects are certainly possible. If a central bank makes a substantial intervention in the Forex over a short period, this will certainly change the supply or demand of currency and have an immediate effect on the exchange rate on those days.

A more lasting impact can occur if the intervention leads investors to change their expectations about the future. This could happen if investors are not sure whether the central bank is sterilizing its interventions. Knowing that sterilization is occurring would require a careful observation of several markets unless the Fed announces its policy. However, rather than announcing a sterilized intervention, a central bank that wants to affect expectations should announce the Forex intervention while hiding its offsetting open market operation. In this way, investors may be fooled into thinking that the Forex intervention will lower the future dollar value and thus may adjust their expectations.

If investors are fooled, they will raise $E_{\$/\text{€}}$ in anticipation of the future dollar depreciation. The increase in $E_{\$/\text{€}}$ will shift the AA curve upward, resulting in an increase in GNP and a depreciation of the dollar. In this way, sterilized interventions may have a more lasting effect on the exchange rate. However, the magnitude of the exchange rate change in this case—if it occurs—will certainly be less than that achieved with a nonsterilized intervention.

KEY TAKEAWAYS

- If the central bank sells domestic currency in exchange for a foreign currency on the Forex, it will cause a direct reduction in the value of the domestic currency, or a currency depreciation.
- If the Fed were to sell dollars on the Forex, there will be an increase in the U.S. money supply that will reduce U.S. interest rates, decrease the rate of return on U.S. assets, and lead to a depreciation of the dollar.
- A sterilized foreign exchange intervention occurs when a central bank counters direct intervention in the Forex with a simultaneous offsetting transaction in the domestic bond market.
- The intended purpose of a sterilized intervention is to cause a change in the exchange rate while at the same time leaving interest rates unaffected.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. Of *buy domestic currency or sell domestic currency* on the foreign exchange market, this is one thing a central bank can do to cause a domestic currency depreciation.
- b. Of *buy foreign currency or sell foreign currency* on the foreign exchange market, this is one thing a central bank can do to cause a domestic currency appreciation.
- c. Of *increase, decrease, or keep the same*, this is one thing a central bank can do to the domestic money supply to induce a domestic currency appreciation.
- d. Of *increase, decrease, or keep the same*, this is one thing a central bank can do to the domestic money supply to induce a domestic currency depreciation.
- e. The term used to describe a central bank transaction on the domestic bond market intended to offset the central bank’s intervention on the foreign exchange market.
- f. Of *increase, decrease, or stay the same*, this is the effect on equilibrium GNP in the short run if the central bank sterilizes a sale of foreign reserves on the foreign exchange market in the AA-DD model with floating exchange rates.
- g. Of *increase, decrease, or stay the same*, this is the effect on the domestic currency value in the short run if the central bank sterilizes a purchase of foreign reserves on the foreign exchange market in the AA-DD model with floating exchange rates.

Chapter 11: Fixed Exchange Rates

Fixed exchange rates around the world were once the only game in town; however, since the collapse of the Bretton Woods system in 1973, floating exchange rates predominate for the world's most-traded currencies. Nonetheless, many countries continue to use some variant of fixed exchange rates even today. This chapter addresses both the historical fixed exchange rate systems like the gold standard as well as the more modern variants like crawling pegs and currency boards.

11.1 Overview of Fixed Exchange Rates

LEARNING OBJECTIVE

1. Preview the discussion about fixed exchange rate systems, their varieties, and their mechanisms.

This chapter begins by defining several types of fixed exchange rate systems, including the gold standard, the reserve currency standard, and the gold exchange standard. The price-specie flow mechanism is described for the gold standard. It continues with other modern fixed exchange variations such as fixing a currency to a basket of several other currencies, crawling pegs, fixing within a band or range of exchange rates, currency boards, and finally the most extreme way to fix a currency: adopting another country's currency as your own, as is done with dollarization or euroization.

The chapter proceeds with the basic mechanics of a reserve currency standard in which a country fixes its currency to another's. In general, a country's central bank must intervene in the foreign exchange (Forex) markets, buying foreign currency whenever there is excess supply (resulting in a balance of payments surplus) and selling foreign currency whenever there is excess demand (resulting in a balance of payments deficit). These actions will achieve the fixed exchange rate version of the interest parity condition in which interest rates are equalized across countries. However, to make central bank actions possible, a country will need to hold a stock of foreign exchange reserves. If a country's central bank does not intervene in the Forex in a fixed exchange system, black markets are shown to be a likely consequence.

Results

- Gold standard rules: (1) fix currency to a weight of gold; (2) central bank freely exchanges gold for currency with public.
- Adjustment under a gold standard involves the flow of gold between countries, resulting in equalization of prices satisfying purchasing power parity (PPP) and/or equalization of rates of return on assets satisfying interest rate parity (IRP) at the current fixed exchange rate.
- Reserve currency rules: (1) fix currency to another currency, known as the reserve currency; (2) central bank must hold a stock of foreign exchange reserves to facilitate Forex interventions.
- Gold-exchange standard rules: (1) reserve country fixes its currency to a weight of gold, (2) all other countries fix their currencies to the reserve, (3) reserve central bank freely exchanges gold for currency

with other central banks, (4) nonreserve countries hold a stock of the reserve currency to facilitate intervention in the Forex.

- The post–World War II fixed exchange rate system, known as the Bretton Woods system, was a gold exchange standard.
- Some countries fix their currencies to a weighted average of several other currencies, called a “basket of currencies.”
- Some countries implement a crawling peg in which the fixed exchange rate is adjusted regularly.
- Some countries set a central exchange rate and allow free floating within a predefined range or band.
- Some countries implement currency boards to legally mandate Forex interventions.
- Some countries simply adopt another country’s currency, as with dollarization, or choose a brand-new currency, as with the euro.
- The interest rate parity condition becomes the equalization of interest rates between two countries in a fixed exchange rate system.
- A balance of payments surplus (deficit) arises when the central bank buys (sells) foreign reserves on the Forex in exchange for its own currency.
- A black market in currency trade arises when there is unsatisfied excess demand or supply of foreign currency in exchange for domestic currency on the Forex.

KEY TAKEAWAY

- See the main results previewed above.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. The term for the currency standard that fixes its circulating currency to a quantity of gold.
 - b. The term for the currency standard in which a reserve currency is fixed to a quantity of gold while all other currencies are fixed to the reserve currency.
 - c. The currency standard used during the post–World War II Bretton Woods era.

- d. The term describing the deficits and surpluses run by a country to maintain a fixed exchange rate.
- e. The term used to describe a decision by another country to adopt the U.S. dollar as its currency.
- f. The nonintervention in the Forex market by a country's central bank is likely to lead to the development of these kinds of market activities.

11.2 Fixed Exchange Rate Systems

LEARNING OBJECTIVES

1. Recognize the varieties of ways that exchange rates can be fixed to a particular value.
2. Understand the basic operation and the adjustment mechanism of a gold standard.

There are two basic systems that can be used to determine the exchange rate between one country's currency and another's: a floating exchange rate system and a fixed exchange rate system.

Under a floating exchange rate system, the value of a country's currency is determined by the supply and demand for that currency in exchange for another in a private market operated by major international banks.

In contrast, in a fixed exchange rate system, a country's government announces (or decrees) what its currency will be worth in terms of *something else* and also sets up the *rules of exchange*. The "something else" to which a currency value is set and the "rules of exchange" determine the type of fixed exchange rate system, of which there are many. For example, if the government sets its currency value in terms of a fixed weight of gold, then we have a gold standard. If the currency value is set to a fixed amount of another country's currency, then it is a reserve currency standard.

As we review several ways in which a fixed exchange rate system can work, we will highlight some of the advantages and disadvantages of the system. In anticipation, it is worth noting that one key advantage of fixed exchange rates is the intention to eliminate exchange rate risk, which can greatly enhance international trade and investment. A second key advantage is the discipline a fixed exchange rate system imposes on a country's monetary authority, with the intention of inducing a much lower inflation rate.

The Gold Standard

Most people are aware that at one time the world operated under something called a gold standard. Some people today, reflecting back on the periods of rapid growth and prosperity that occurred when the world was on a gold standard, have suggested that the world abandon its current mixture of fixed and floating exchange rate systems and return to this system. (For a discussion of some pros and cons see [Alan Greenspan's remarks](#) on this from the early 1980s. ^[1] See [Murray Rothbard's article](#) for an argument in favor of a return to the gold standard. ^[2]) Whether or not countries seriously consider this in the future, it is instructive to understand the workings of a gold standard, especially since, historically, it is the first major international system of fixed exchange rates.

Most of the world maintained a pure gold standard during the late 1800s and early 1900s, with a major interruption during World War I. Before the enactment of a gold standard, countries were generally using a [Bimetallic standard](#) consisting of both gold and silver. ^[3] The earliest establishment of a gold standard was in Great Britain in 1821, followed by Australia in 1852 and Canada in 1853. The United States established its gold standard system with the Coinage Act of 1873, sometimes known as “[The Crime of '73](#).” ^[4] The gold standard was abandoned in the early days of the Great Depression. Britain dropped the standard in 1931, the United States in 1933.

The rules of a gold standard are quite simple. First, a country’s government declares that its issued currency (it may be coin or paper currency) will exchange for a weight in gold. For example, in the United States during the late 1800s and early 1900s, the government set the dollar exchange rate to gold at the rate \$20.67 per troy ounce. During the same period, Great Britain set its currency at the rate £4.24 per troy ounce. Second, in a pure gold standard, a country’s government declares that it will freely exchange currency for actual gold at the designated exchange rate. This “rule of exchange” means that anyone can go to the central bank with coin or currency and walk out with pure gold. Conversely, one could also walk in with pure gold and walk out with the equivalent in coin or currency.

Because the government bank must always be prepared to give out gold in exchange for coin and currency on demand, it must maintain a storehouse of gold. That store of gold is referred to as “gold reserves.” That is, the central bank maintains a reserve of gold so that it can always fulfill its promise of exchange. As discussed in , , a well-functioning system will require that the central bank always have an adequate amount of reserves.

The two simple rules, when maintained, guarantee that the exchange rate between dollars and pounds remains constant. Here’s why.

First, the dollar/pound exchange rate is defined as the ratio of the two-currency-gold exchange rates.

Thus

$$E_{\$/\pounds} = \frac{20.67 \text{ \$/oz}}{4.24 \text{ \pounds/oz}} = 4.875 \frac{\text{\$}}{\text{oz}} \frac{\text{oz}}{\text{\pounds}} = 4.875 \frac{\text{\$}}{\text{\pounds}} .$$

Next, suppose an individual wants to exchange \$4.875 for one pound. Following the exchange rules, this person can enter the central bank in the United States and exchange dollars for gold to get

$$\frac{\$4.875}{20.67 \text{ \$/oz}} = 0.23585 \text{ oz of gold.}$$

This person can then take the gold into the central bank in the United Kingdom, and assuming no costs of transportation, can exchange the gold into pounds as follows:

$$0.23585 \text{ oz} \times 4.24 \frac{\text{£}}{\text{oz}} = \text{£}1.00.$$

Hence, the \$4.875 converts to precisely £1 and this will remain the fixed exchange rate between the two currencies, as long as the simple exchange rules are followed. If many countries define the value of their own currency in terms of a weight of gold and agree to exchange gold freely at that rate with all who desire to exchange, then all these countries will have fixed currency exchange rates with respect to each other.

Price-Specie Flow Mechanism

The price-specie flow mechanism is a description about how adjustments to shocks or changes are handled within a pure gold standard system. Although there is some disagreement whether the gold standard functioned as described by this mechanism, the mechanism does fix the basic principles of how a gold standard is supposed to work.

Consider the United States and United Kingdom operating under a pure gold standard. Suppose there is a gold discovery in the United States. This will represent a shock to the system. Under a gold standard, a gold discovery is like digging up money, which is precisely what inspired so many people to *rush* to California after 1848 to strike it rich.

Once the gold is unearthed, the prospectors bring it into town and proceed to the national bank where it can be exchanged for coin and currency at the prevailing dollar/gold exchange rate. The new currency in circulation represents an increase in the domestic money supply.

Indeed, it is this very transaction that explains the origins of the gold and silver standards in the first place. The original purpose of banks was to store individuals' precious metal wealth and to provide exchangeable notes that were backed by the gold holdings in the vault. Thus rather than carrying around heavy gold, one could carry lightweight paper money. Before national or central banks were founded, individual commercial banks issued their own currencies, which circulated together with many other bank currencies. However, it was also common for governments to issue coins that were made directly from gold or silver.

Now, once the money supply increases following the gold discovery, it can have two effects: operating through the goods market and financial market. The price-specie flow mechanism describes the adjustment through goods markets.

First, let's assume that the money increase occurs in an economy that is not growing—that is, with a fixed level of GDP. Also assume that both purchasing power parity (PPP) and interest rate parity (IRP) holds. PPP implies an equalization of the cost of a market basket of goods between the United States and the United Kingdom at the current fixed exchange rate. IRP implies an equalization of the rates of return on comparable assets in the two countries.

As discussed in , , when the U.S. money supply increases, and when there is no subsequent increase in output, the prices of goods and services will begin to rise. This inflationary effect occurs because more money is chasing (i.e., demanding) the same amount of goods and services. As the price level rises in an economy open to international trade, domestic goods become more expensive relative to foreign goods. This will induce domestic residents to increase demand for foreign goods; hence import demand will rise. Foreign consumers will also find domestic goods more expensive, so export supply will fall. The result is a demand for a current account deficit. To make these transactions possible in a gold standard, currency exchange will take place as follows.

U.S. residents wishing to buy cheaper British goods will first exchange dollars for gold at the U.S. central bank. Then they will ship that gold to the United Kingdom to exchange for the pounds that can be used to buy UK goods. As gold moves from the United States to the United Kingdom, the money supply in the United States falls while the money supply in the United Kingdom rises. Less money in the United States will eventually reduce prices, while more money in the United Kingdom will raise prices. This means that the prices of goods will move together until purchasing power parity holds again. Once PPP holds, there is no further incentive for money to move between countries. There will continue to be demand for UK goods by U.S. residents, but this will balance with the United Kingdom demands for similarly priced U.S. goods. Hence, the trade balance reverts to zero.

The adjustment process in the financial market under a gold standard will work through changes in interest rates. When the U.S. money supply rises after the gold discovery, average interest rates will begin to fall. Lower U.S. interest rates will make British assets temporarily more attractive, and U.S. investors will seek to move investments to the United Kingdom. The adjustment under a gold standard is the same

as with goods. Investors trade dollars for gold in the United States and move that gold to the United Kingdom where it is exchanged for pounds and used to purchase UK assets. Thus the U.S. money supply will begin to fall, causing an increase in U.S. interest rates, while the UK money supply rises, leading to a decrease in UK interest rates. The interest rates will move together until interest rate parity again holds. In summary, *adjustment under a gold standard involves the flow of gold between countries, resulting in equalization of prices satisfying purchasing power parity (PPP) and/or equalization of rates of return on assets satisfying interest rate parity (IRP) at the current fixed exchange rate.* The only requirement for the government to maintain this type of fixed exchange rate system is to maintain the fixed price of its currency in terms of gold *and* to freely and readily exchange currency for gold on demand.

Reserve Currency Standard

In a reserve currency system, another country's currency takes the role that gold played in a gold standard. In other words a country fixes its own currency value to a unit of another country's currency. For example, suppose Britain decided to fix its currency to the dollar at the exchange rate $E_{\$/\pounds} = 1.50$. To maintain this fixed exchange rate, the Bank of England would stand ready to exchange pounds for dollars (or dollars for pounds) on demand at the specified exchange rate. To accomplish this, the Bank of England would need to hold dollars *on reserve* in case there was ever any excess demand for dollars in exchange for pounds on the Forex. In the gold standard, the central bank held gold to exchange for its own currency; with a reserve currency standard, it must hold a stock of the reserve currency. Always, the reserve currency is the currency to which the country fixes.

A reserve currency standard is the typical method for fixing a currency today. Most countries that fix its exchange rate will fix to a currency that either is prominently used in international transactions or is the currency of a major trading partner. Thus many countries fixing their exchange rate today fix to the U.S. dollar because it is the most widely traded currency internationally. Alternatively, fourteen African countries that were former French colonies had established the CFA franc zone and fixed the CFA franc (current currency used by these African countries) to the French franc. Since 1999, the CFA franc has been fixed to the euro. Namibia, Lesotho, and Swaziland are all a part of the common monetary area (CMA) and fix their currency to the South African rand.

Gold Exchange Standard

A gold exchange standard is a mixed system consisting of a cross between a reserve currency standard and a gold standard. In general, it includes the following two rules:

1. A reserve currency is chosen. All nonreserve countries agree to fix their exchange rates to the reserve at some announced rate. To maintain the fixity, these nonreserve countries will hold a stockpile of reserve currency assets.
2. The reserve currency country agrees to fix its currency value to a weight in gold. Finally, the reserve country agrees to exchange gold for its own currency with other central banks within the system on demand.

One key difference in this system from a gold standard is that the reserve country does not agree to exchange gold for currency with the general public, only with other central banks.

The system works exactly like a reserve currency system from the perspective of the nonreserve countries. However, if over time the nonreserve countries accumulate the reserve currency, they can demand exchange for gold from the reserve country central bank. In this case, gold reserves will flow away from the reserve currency country.

The fixed exchange rate system set up after World War II was a gold exchange standard, as was the system that prevailed between 1920 and the early 1930s. The post–World War II system was agreed to by the allied countries at a conference in Bretton Woods, New Hampshire, in the United States in June 1944. As a result, the exchange rate system after the war also became known as the Bretton Woods system.

Also proposed at Bretton Woods was the establishment of an international institution to help regulate the fixed exchange rate system. This institution was the International Monetary Fund (IMF). The IMF's main mission was to help maintain the stability of the Bretton Woods fixed exchange rate system.

Other Fixed Exchange Rate Variations

Basket of Currencies

Countries that have several important trading partners, or who fear that one currency may be too volatile over an extended period, have chosen to fix their currency to a basket of several other currencies. This means fixing to a weighted average of several currencies. This method is best understood by considering the creation of a composite currency. Consider the following hypothetical example: a new unit of money consisting of 1 euro, 100 Japanese yen, and one U.S. dollar. Call this new unit a Eur-yen-dol. A country

could now fix its currency to one Eur-yen-dol. The country would then need to maintain reserves in one or more of the three currencies to satisfy excess demand or supply of its currency on the Forex.

A better example of a composite currency is found in the SDR. SDR stands for special drawing rights. It is a composite currency created by the International Monetary Fund (IMF). One SDR now consists of a fixed quantity of U.S. dollars, euros, Japanese yen, and British pounds. For more info on the SDR see the [IMF factsheet](#).^[5] Now Saudi Arabia officially fixes its currency to the SDR. Botswana fixes to a basket consisting of the SDR and the South African rand.

Crawling Pegs

A crawling peg refers to a system in which a country fixes its exchange rate but also changes the fixed rate at periodic or regular intervals. Central bank interventions in the Forex may occur to maintain the temporary fixed rate. However, central banks can avoid interventions and save reserves by adjusting the fixed rate instead. Since crawling pegs are adjusted gradually, they can help eliminate some exchange rate volatility without fully constraining the central bank with a fixed rate. In 2010 Bolivia, China, Ethiopia, and Nicaragua were among several countries maintaining a crawling peg.

Pegged within a Band

In this system, a country specifies a central exchange rate together with a percentage allowable deviation, expressed as plus or minus some percentage. For example, Denmark, an EU member country, does not yet use the euro but participates in the Exchange Rate Mechanism (ERM2). Under this system, Denmark sets its central exchange rate to 7.46038 krona per euro and allows fluctuations of the exchange rate within a 2.25 percent band. This means the krona can fluctuate from a low of 7.63 kr/€ to a high of 7.29 kr/€. (Recall that the krona is at a high with the smaller exchange rate value since the kr/euro rate represents the euro value.) If the market determined floating exchange rate rises above or falls below the bands, the Danish central bank must intervene in the Forex. Otherwise, the exchange rate is allowed to fluctuate freely.

As of 2010, Slovenia, Syria, and Tonga were fixing their currencies within a band.

Currency Boards

A currency board is a legislated method to provide greater assurances that an exchange rate fixed to a reserve currency will indeed remain fixed. In this system, the government requires that domestic currency is always exchangeable for the specific reserve at the fixed exchange rate. The central bank authorities are

stripped of all discretion in the Forex interventions in this system. As a result, they must maintain sufficient foreign reserves to keep the system intact.

In 2010 Bulgaria, Hong Kong, Estonia, and Lithuania were among the countries using a currency board arrangement. Argentina used a currency board system from 1991 until 2002. The currency board was very effective in reducing inflation in Argentina during the 1990s. However, the collapse of the exchange rate system and the economy in 2002 demonstrated that currency boards are not a panacea.

Dollarization/Euroization

The most extreme and convincing method for a country to fix its exchange rate is to give up one's national currency and adopt the currency of another country. In creating the euro-zone among twelve of the European Union (EU) countries, these European nations have given up their own national currencies and have adopted the currency issued by the European Central Bank. This is a case of euroization. Since all twelve countries now share the euro as a common currency, their exchange rates are effectively fixed to each other at a 1:1 ratio. As other countries in the EU join the common currency, they too will be forever fixing their exchange rate to the euro. (Note, however, that although all countries that use the euro are fixed to each other, the euro itself floats with respect to external currencies such as the U.S. dollar.)

Other examples of adopting another currency as one's own are the countries of Panama, Ecuador, and El Salvador. These countries have all chosen to adopt the U.S. dollar as their national currency of circulation. Thus they have chosen the most extreme method of assuring a fixed exchange rate. These are examples of dollarization.

KEY TAKEAWAYS

- In a gold standard, a country's government declares that its issued currency will exchange for a weight in gold and that it will freely exchange currency for actual gold at the designated exchange rate.
- Adjustment under a gold standard involves the flow of gold between countries, resulting in equalization of prices satisfying purchasing power parity (PPP) and/or equalization of rates of return on assets satisfying interest rate parity (IRP) at the current fixed exchange rate.
- In a reserve currency system, a country fixes its own currency value to a unit of another country's currency. The other country is called the reserve currency country.

- A gold exchange standard is a mixed system consisting of a cross between a reserve currency standard and a gold standard. First, a reserve currency is chosen. Second, the reserve currency country agrees to fix its currency value to a weight in gold. Finally, the reserve country agrees to exchange gold for its own currency with other central banks within the system on demand.
- The post–World War II Bretton Woods system was a gold exchange currency standard.
- Other fixed exchange rate choices include fixing to a market basket, fixing in a nonrigid way by implementing a crawling peg or an exchange rate band, implementing a currency board, or adopting another country’s currency.

EXERCISES

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. The term used to describe the adjustment mechanism within a gold standard.
 - b. The term given to the currency standard using both gold and silver.
 - c. The term given to the currency standard in which all countries fix to one central currency, while the central currency is not fixed to anything.
 - d. The name of the international organization created after World War II to oversee the fixed exchange rate system.
 - e. In the late nineteenth century, the U.S. dollar was fixed to gold at this exchange rate.
 - f. In the late nineteenth century, the British pound was fixed to gold at this exchange rate.
 - g. In the late nineteenth century, one U.S. dollar was worth approximately this many shillings (note: a shilling is one-tenth of a pound).
 - h. Of *gold inflow* or *gold outflow*, this is likely to occur for a country whose interest rates rise under a gold standard with free capital mobility.
 - i. The term used to describe a currency system in which a country fixes its exchange rate but also changes the fixed rate at periodic or regular intervals.
 - j. As of 2004, Estonia and Hong Kong implemented this type of currency system.

Use the IMF's "De Facto Classification of Exchange Rate Regimes and Monetary Policy Frameworks" at <http://www.imf.org/external/np/mfd/er/2008/eng/0408.htm> to answer the following questions:

- a. What are four countries that maintained currency board arrangements?
- b. What are four countries that maintained a conventional fixed peg?
- c. What are four countries that maintained a crawling peg?
- d. What are four countries whose currencies were independently floating?

[1] See Alan Greenspan's remarks in "Can the US Return to a Gold Standard," *Wall Street Journal*, September 1, 1981; reprinted online at <http://www.gold-eagle.com/greenspan011098.htm>[0].

[2] See Murray Rothbard, "The Case for a Genuine Gold Dollar," in *The Gold Standard: An Austrian Perspective* (Lexington, MA: D. C. Heath, 1985), 1–17; also available online at <http://www.mises.org/rothbard/genuine.asp>.

[3] See Angela Radish, "Bimetallism," Economic History Online at <http://www.eh.net/encyclopedia/?article=radish.bimetallism>

[4] For more info see Wikipedia, "Coinage Act of 1873," http://en.wikipedia.org/wiki/Coinage_Act_of_1873.

[5] International Monetary Fund, About the IMF, Factsheet, "Special Drawing Rights (SDRs)," <http://www.imf.org/external/np/exr/facts/sdr.htm>[0].

11.3 Interest Rate Parity with Fixed Exchange Rates

LEARNING OBJECTIVE

1. Learn how the interest rate parity condition changes in a system of credible fixed exchange rates.

One of the main differences between a fixed exchange rate system and a floating system is that under fixed exchange rates the central bank will have to “do something” periodically. In contrast, in a floating system, the central bank can just sit back and watch since it has no responsibility for the value of the exchange rate. In a pure float, the exchange rate is determined entirely by private transactions.

However, in a fixed exchange rate system, the central bank will need to intervene in the foreign exchange market, perhaps daily, if it wishes to maintain the credibility of the exchange rate.

We'll use the AA-DD model to explain why. Although the AA-DD model was created under the assumption of a floating exchange rate, we can reinterpret the model in light of a fixed exchange rate assumption. This means we must look closely at the interest rate parity condition, which represents the equilibrium condition in the foreign exchange market.

Recall that the AA-DD model assumes the exchange rate is determined as a result of investor incentives to maximize their rate of return on investments. The model ignores the potential effect of importers and exporters on the exchange rate value. That is, the model does not presume that purchasing power parity holds. As such, the model describes a world economy that is very open to international capital flows and international borrowing and lending. This is a reasonable representation of the world in the early twenty-first century, but would not be the best characterization of the world in the mid-1900s when capital restrictions were more common. Nonetheless, the requisite behavior of central banks under fixed exchange rates would not differ substantially under either assumption.

When investors seek the greatest rate of return on their investments internationally, we saw that the exchange rate will adjust until interest rate parity holds. Consider interest rate parity (IRP) for a particular investment comparison between the United States and the United Kingdom. IRP means that $RoR_S = RoR_{\pounds}$. We can write this equality out in its complete form to get

$$i_S = i_{\pounds} + (1 + i_{\pounds}) \frac{E_{S/\pounds}^e - E_{S/\pounds}}{E_{S/\pounds}},$$

where the left-hand side is the U.S. interest rate and the right side is the more complicated rate of return formula for a UK deposit with interest rate i_{\pounds} . (See and for the derivation of the interest rate parity

condition.) The last term on the right represents the expected appreciation (if positive) or depreciation (if negative) of the pound value with respect to the U.S. dollar.

In a floating exchange rate system, the value of this term is based on investor expectations about the future exchange rate as embodied in the term $E_{\$/\text{£}}e$, which determines the degree to which investors believe the exchange rate will change over their investment period.

If these same investors were operating in a fixed exchange rate system, however, and if they believed the fixed exchange rate would indeed remain fixed, then the investors' expected exchange rate should be set equal to the current fixed spot exchange rate. In other words, under credible fixed exchange rates, $E_{\$/\text{£}}e = E_{\$/\text{£}}$. Investors should not expect the exchange rate to change from its current fixed value. (We will consider a case in which the investors' expected exchange rate does not equal the fixed spot rate in , .)

With $E_{\$/\text{£}}e = E_{\$/\text{£}}$, the right side of the above expression becomes zero, and the interest rate parity condition under fixed exchange rates becomes
 $i_{\$} = i_{\text{£}}$.

Thus for interest rate parity to hold in a fixed exchange rate system, the interest rates between two countries must be equal.

Indeed, the reason this condition in a floating system is called "interest rate parity" rather than "rate of return parity" is because of our history with fixed exchange rates. Before 1973, most of the world had maintained fixed exchange rates for most of the time. We can see now that under fixed exchange rates, rates of return in each country are simply the interest rates on individual deposits. In other words, in a fixed system, which is what most countries had through much of their histories, interest rate parity means the equality of interest rates. When the fixed exchange rate system collapsed, economists and others continued to use the now-outdated terminology: interest rate parity. Inertia in language usage is why the traditional term continues to be applied (somewhat inappropriately) even today.

KEY TAKEAWAY

- For interest rate parity to hold in a fixed exchange rate system, the interest rates between two countries must be equal.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. These must be equalized between countries for interest rate parity to hold under fixed exchange.
- b. If the fixed exchange rates are credible, then the expected exchange rate should be equal to this exchange rate.
- c. Of *intervene* or *do not intervene*, this is what a central bank should do in the Forex market if it intends to maintain credible fixed exchange rates.

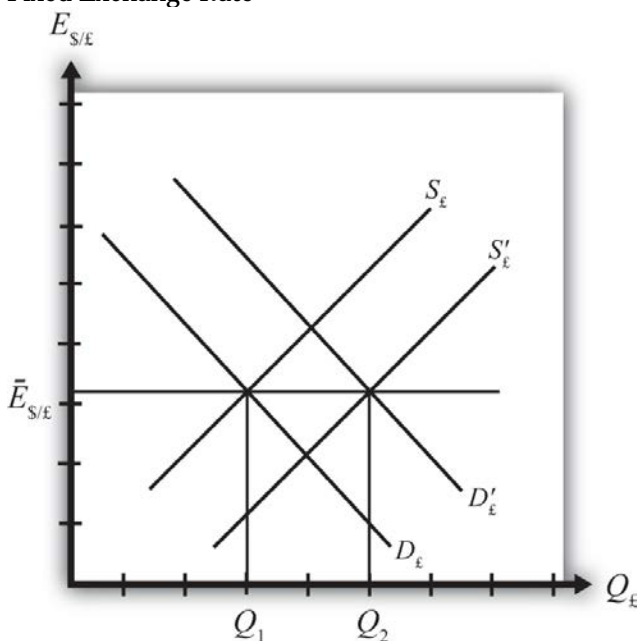
11.4 Central Bank Intervention with Fixed Exchange Rates

LEARNING OBJECTIVE

1. Learn what a central bank must do to maintain a credible fixed exchange rate in a reserve currency system.

In a fixed exchange rate system, most of the transactions of one currency for another will take place in the

Figure 11.1 Central Bank Intervention to Maintain a Fixed Exchange Rate



private market among individuals,

businesses, and international banks.

However, by fixing the exchange rate the government would have declared illegal any transactions that do not occur at the announced rate. However, it is very unlikely that the announced fixed exchange rate will at all times equalize private demand for foreign currency with private supply. In a floating exchange rate system, the exchange rate adjusts to maintain the supply and demand balance. In a fixed exchange rate system, it becomes the responsibility of the central bank to maintain this balance.

The central bank can intervene in the private

foreign exchange (Forex) market whenever needed by acting as a buyer and seller of currency of last resort. To see how this works, consider the following example.

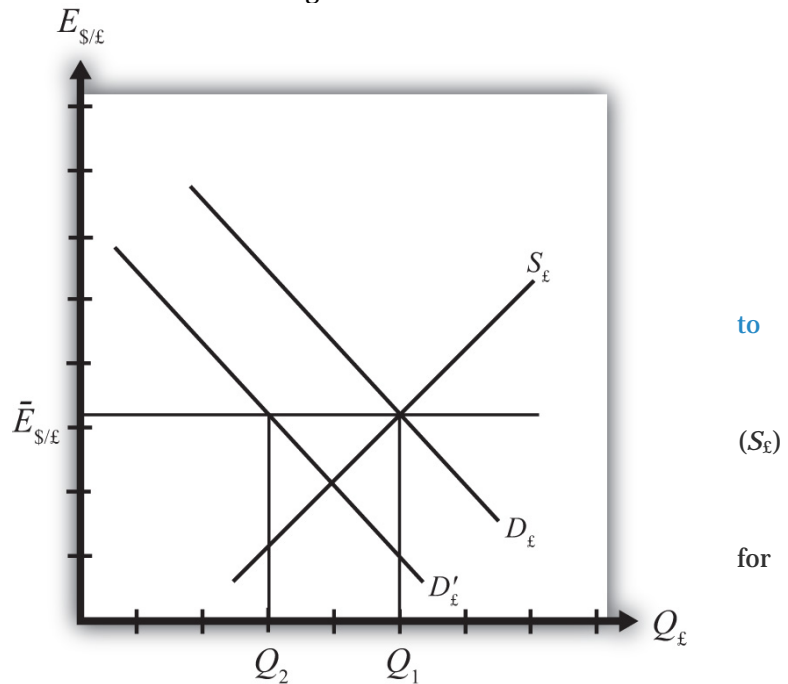
Suppose the United States establishes a fixed exchange rate to the British pound at the rate $\bar{E}_{S/\pounds}$. In [Figure 11.1 "Central Bank Intervention to Maintain a Fixed Exchange Rate"](#), we depict an initial private market Forex equilibrium in which the supply of pounds (S_{\pounds}) equals demand (D_{\pounds}) at the fixed exchange rate ($\bar{E}_{S/\pounds}$). But suppose, for some unspecified reason, the demand for pounds on the private Forex rises one day to D'_{\pounds} .

At the fixed exchange rate ($\bar{E}_{S/\pounds}$), private market demand for pounds is now Q_2 , whereas supply of pounds is Q_1 . This means there is excess demand for pounds in exchange for U.S. dollars on the private Forex.

To maintain a credible fixed exchange rate, the U.S. central bank would immediately satisfy the excess demand by supplying additional pounds to the Forex market. That is, it sells pounds and buys dollars on the private Forex. This would cause a shift of the pound supply curve from $S_{\text{£}}$ to $S'_{\text{£}}$. In this way, the equilibrium exchange rate is automatically maintained at the fixed level.

Alternatively, consider Figure 11.2 "Another Central Bank Intervention Maintain a Fixed Exchange Rate", in which again the supply of pounds equals demand ($D_{\text{£}}$) at the fixed exchange rate ($\bar{E}_{\text{S/£}}$). Now suppose, some unspecified reason, the demand for pounds on the private Forex falls one day to $D'_{\text{£}}$. At the

Figure 11.2 Another Central Bank Intervention to Maintain a Fixed Exchange Rate



fixed exchange rate ($\bar{E}_{\text{S/£}}$), private market demand for pounds is now Q_2 , whereas supply of pounds is Q_1 . This means there is excess supply of pounds in exchange for U.S. dollars on the private Forex. In this case, an excess supply of pounds also means an excess demand for dollars in exchange for pounds. The U.S. central bank can satisfy the extra dollar demand by entering the Forex and selling dollars in exchange for pounds. This means it is supplying more dollars and demanding more pounds. This would cause a shift of the pound demand curve from $D'_{\text{£}}$ back to $D_{\text{£}}$. Since this intervention occurs immediately, the equilibrium exchange rate is automatically and always maintained at the fixed level.

KEY TAKEAWAYS

- If, for example, the United States fixes its currency to the British pound (the reserve), when there is excess demand for pounds in exchange for U.S. dollars on the private Forex, the U.S. central bank would immediately satisfy the excess demand by supplying additional pounds to the Forex market. By doing so, it can maintain a credible fixed exchange rate.



- If, for example, the United States fixes its currency to the British pound (the reserve), when there is excess demand for dollars in exchange for British pounds on the private Forex, the U.S. central bank would immediately satisfy the excess demand by supplying dollars to the Forex market. By doing so, it can maintain a credible fixed exchange rate.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. Of *buy, sell, or do nothing*, this is what a central bank must do with its reserve currency if there is excess demand for its own currency in the private Forex market while maintaining a fixed exchange rate.
 - b. Of *buy, sell, or do nothing*, this is what a central bank must do with its reserve currency if there is excess demand for the reserve currency in the private Forex market while maintaining a fixed exchange rate.
 - c. Of *buy dollars, sell dollars, or do nothing*, this is what China’s central bank must do if there is excess demand for Chinese yuan in the private Forex market if China fixes its currency to the U.S. dollar.
 - d. Of *buy yuan, sell yuan, or do nothing*, this is what China’s central bank must do if there is excess demand for U.S. dollars in the private Forex market if China fixes its currency to the U.S. dollar.

11.5 Balance of Payments Deficits and Surpluses

LEARNING OBJECTIVE

1. Learn the definitions and usage of balance of payments deficits and surpluses in a fixed exchange rate system.

To maintain a fixed exchange rate, the central bank will need to automatically intervene in the private foreign exchange (Forex) by buying or selling domestic currency in exchange for the foreign reserve currency. Clearly, in order for these transactions to be possible, a country's central bank will need a stock of the foreign reserve currency at the time the fixed exchange rate system begins. Subsequently, if excess demand for foreign currency in some periods is balanced with excess supply in other periods, then falling reserves in some periods (when dollars are bought on the Forex) will be offset with rising reserves in other periods (when dollars are sold in the Forex) and a central bank will be able to maintain the fixed exchange rate. Problems arise, though, if a country begins to run out of foreign reserves. But before discussing that situation, we need to explain some terminology.

When the central bank buys domestic currency and sells the foreign reserve currency in the private Forex, the transaction indicates a balance of payments deficit. Alternatively, when the central bank sells domestic currency and buys foreign currency in the Forex, the transaction indicates a balance of payments surplus.

Central bank transactions are recorded in an account titled official reserve transactions. It is found in the financial account of the balance of payments. If this account indicates an addition to official reserves over some period, then the country is running a balance of payments surplus. If over some period the official reserve balance is falling, then the country is running a balance of payments deficit. The deficit or surplus terminology arises from the following circumstances.

Suppose a country runs a trade deficit in a fixed exchange rate system. A trade deficit means that demand for imports exceeds foreign demand for our exports. This implies that domestic demand for foreign currency (to buy imports) exceeds foreign demand for domestic currency (to buy our exports). Assuming no additional foreign demands for domestic currency on the financial account (to keep the exchange rate fixed), the central bank would need to intervene by selling foreign currency in exchange for domestic currency. This would lead to a reduction of foreign reserves and hence a balance of payments deficit. In

the absence of transactions on the financial account, to have a trade deficit and a fixed exchange rate implies a balance of payments deficit as well.

More generally, a balance of payments deficit (surplus) arises whenever there is excess demand for (supply of) foreign currency on the private Forex at the official fixed exchange rate. To satisfy the excess demand (excess supply), the central bank will automatically intervene on the Forex and sell (buy) foreign reserves. Thus by tracking sales or purchases of foreign reserves in the official reserve account, we can determine if the country has a balance of payments deficit or surplus.

Note that in a floating exchange rate system, a central bank can intervene in the private Forex to push the exchange rate up or down. Thus official reserve transactions can show rising or falling foreign reserves and hence suggest a balance of payments deficit or surplus in a floating exchange system. However, it is not strictly proper to describe a country with floating exchange rates as having a balance of payment deficit or surplus. The reason is that interventions are not *necessary* in a floating exchange rate. In a floating system, an imbalance between supply and demand in the private Forex is relieved by a change in the exchange rate. Thus there need never be an imbalance in the balance of payments in a floating system.

KEY TAKEAWAYS

- When the central bank buys domestic currency and sells the foreign reserve currency in the private Forex, the transaction indicates a balance of payments deficit.
- When the central bank sells domestic currency and buys foreign currency in the Forex, the transaction indicates a balance of payments surplus.
- A balance of payments deficit (surplus) arises whenever there is excess demand for (supply of) foreign currency on the private Forex at the official fixed exchange rate.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. The account on the balance of payments (BoP) used to record all central bank transactions.
 - b. The balance on the BoP when the central bank sells foreign reserves.

- c. Of *BoP deficit*, *BoP surplus*, or *BoP balance*, this is what a central bank will run if there is excess demand for its own currency in the private Forex market while maintaining a fixed exchange rate.
- d. Of *BoP deficit*, *BoP surplus*, or *BoP balance*, this is what a central bank will run if there is excess demand for the reserve currency in the private Forex market while maintaining a fixed exchange rate.
- e. Of *BoP deficit*, *BoP surplus*, or *BoP balance*, this is what China's central bank will run if there is excess demand for Chinese yuan in the private Forex market if China fixes its currency to the U.S. dollar.
- f. Of *BoP deficit*, *BoP surplus*, or *BoP balance*, this is what China's central bank will run if there is excess demand for U.S. dollars in the private Forex market if China fixes its currency to the U.S. dollar.

11.6 Black Markets

LEARNING OBJECTIVE

1. Learn the five different reasons why trade between countries may occur.

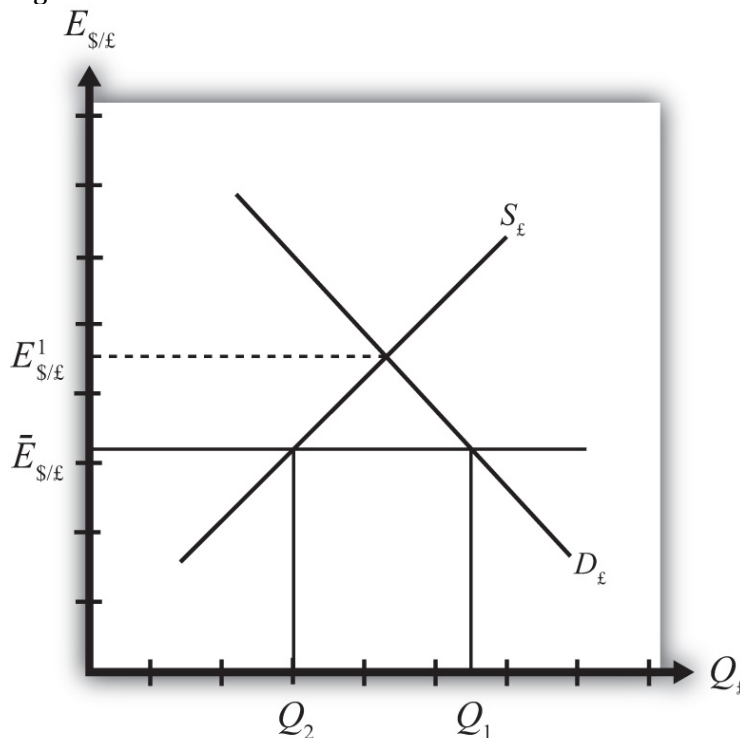
Till now we have said that a central bank must intervene in the foreign exchange (Forex) market whenever there is excess demand or supply of foreign currency. However, we might consider what would happen if the central bank did not intervene. Surely the government could simply mandate that all Forex transactions take place at the official fixed rate and implement severe penalties if anyone is caught trading at a different rate. A black market arises, however, when exchanges for foreign currency take place at an unofficial (or illegal) exchange rate.

Let's consider why a black market may arise. Suppose the United States fixes its exchange rate to the British pound at the rate $\bar{E}_{\$/\pounds}$. This is indicated in Figure 11.3 "Conditions for a Black Market" as a horizontal line drawn at $\bar{E}_{\$/\pounds}$.

Suppose further that demand for pounds (Q_1) on the private Forex exceeds supply (Q_2) at the official fixed exchange rate, but the central bank does not intervene to correct the imbalance. In this case, suppliers of pounds will come to the market with Q_2 quantity of pounds, but many people who would like to buy pounds will not find a willing supplier. Those individuals and businesses demanding the excess ($Q_1 - Q_2$) will leave the market

empty-handed. Now if this were a one-time occurrence, the unsatisfied demand might be fulfilled in later days when excess supply of pounds comes to the market. However, a more likely scenario is that this

Figure 11.3 Conditions for a Black Market



unsatisfied demand persists for a long period. With each passing day of unsatisfied demand, total unsatisfied demand grows insidiously.

Together with the excess demand is a willingness to pay more than the official rate to obtain currency. Since the market equilibrium rate is at $E_{s/x}^1$, excess demanders would be willing to pay more dollars to obtain a pound than is required in the official market. The willingness to pay more creates a profit-making possibility. Suppose an individual or business obtains pounds, perhaps by selling goods in Britain and being paid in foreign currency. This person could convert the pounds for dollars at the official rate or, if he or she wants to make more money, could trade the currency “unofficially” at a higher exchange rate. The only problem is finding someone willing to buy the pounds at the unofficial rate. This turns out rarely to be a problem. Wherever black markets develop, unofficial traders find each other on street corners, at hotels, and even within banks.

Thus a central bank doesn’t absolutely need to intervene in the Forex market in a fixed exchange rate system. However, if it does not, a black market will very likely arise and the central bank will lose control of the exchange rate. One main purpose of fixed exchange rates, namely the certainty of knowing what the currency will exchange for, is also lost since traders will have to decide whether to trade officially or unofficially. Furthermore, the black market exchange rate typically rises and falls with changes in supply and demand, thus one is never sure what that rate will be.

In light of the potential for black markets to arise, if a government wishes to maintain a *credible* fixed exchange rate, regular intervention to eliminate excess demand or supply of foreign currency is indeed required.

KEY TAKEAWAYS

- A black market arises when exchanges for foreign currency take place at an unofficial (or illegal) exchange rate.
- If a central bank does not intervene regularly in the Forex market, a black market will very likely arise and the central bank will lose control of the exchange rate.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. The term used to describe currency transactions that occur at unofficial exchange rates in a fixed exchange rate system.
- b. Of *buy, sell, or do nothing*, a central bank will likely do this with its reserve currency if excess demand for its own currency leads to illegal trades at a higher value.
- c. Of *credible or not credible*, this describes a fixed exchange rate system that coexists with a black market.

Chapter 12: Policy Effects with Fixed Exchange Rates

Government policies work differently under a system of fixed exchange rates rather than floating rates. Monetary policy can lose its effectiveness whereas fiscal policy can become supereffective. In addition, fixed exchange rates offer another policy option, namely, exchange rate policy. Even though a fixed exchange rate should mean the country keeps the rate fixed, sometimes countries periodically change their fixed rate.

This chapter considers these policies under the assumptions of the AA-DD model. It concludes with a case study about the decline of the Bretton Woods fixed exchange rate system that was in place after World War II.

12.1 Overview of Policy with Fixed Exchange Rates

LEARNING OBJECTIVE

1. Preview the comparative statics results from the AA-DD model with fixed exchange rates.

This chapter uses the AA-DD model to describe the effects of fiscal, monetary, and exchange rate policy under a system of fixed exchange rates. Fiscal and monetary policies are the primary tools governments use to guide the macroeconomy. With fixed exchange rates, a third policy option becomes available—that is, exchange rate policy. Thus we also examine the effects of changes in the fixed exchange rate. These exchange rate changes are called devaluations (sometimes competitive devaluations) and revaluations. In introductory macroeconomics courses, students learn how government policy levers can be used to influence the level of the gross national product (GNP), inflation rate, unemployment rate, and interest rates. In this chapter, that analysis is expanded to an open economy (i.e., one open to trade) and to the effects on exchange rates and current account balances.

Results

Using the AA-DD model, several important relationships between key economic variables are shown:

- A monetary policy (change in MS) has no effect on GNP or the exchange rate in a fixed exchange system. As such, the trade balance, unemployment, and interest rates all remain the same as well. Monetary policy becomes ineffective as a policy tool in a fixed exchange rate system.
- Expansionary fiscal policy ($\uparrow G$, $\uparrow TR$, or $\downarrow T$) causes an increase in GNP while maintaining the fixed exchange rate and constant interest rates. The trade balance and unemployment are both reduced.
- Contractionary fiscal policy ($\downarrow G$, $\downarrow TR$, or $\uparrow T$) reduces GNP while maintaining the fixed exchange rate and constant interest rates. The trade balance and unemployment both rise.
- A competitive devaluation lowers the currency value and causes an increase in GNP. Unemployment falls, interest rates remain the same, and the trade balance rises.
- A currency revaluation raises the currency value and causes a decrease in GNP. Unemployment rises, interest rates remain the same, and the trade balance falls.
- Monetary expansion by the reserve currency country forces the domestic country to run a balance of payments surplus to maintain its fixed exchange rate. The resulting money supply increase causes domestic interest rates to fall to maintain equality with the falling foreign interest rates. Domestic GNP remains fixed, as do unemployment and the trade balance.

- A currency crisis arises when a country runs persistent balance of payments deficits while attempting to maintain its fixed exchange rate and is about to deplete its foreign exchange reserves. A crisis can force a country to devalue its currency or move to a floating exchange rate. To postpone the crisis, countries can sometimes borrow money from organizations like the International Monetary Fund (IMF).
- Anticipation of a balance of payments crisis can induce investors to sell domestic assets in favor of foreign assets. This is called capital flight. Capital flight will worsen a balance of payments problem and can induce a crisis to occur.

Connections

The AA-DD model was developed to describe the interrelationships of macroeconomic variables within an open economy. Since some of these macroeconomic variables are controlled by the government, we can use the model to understand the likely effects of government policy changes. The main levers the government controls are monetary policy (changes in the money supply), fiscal policy (changes in the government budget), and exchange rate policy (setting the fixed exchange rate value). In this chapter, the AA-DD model is applied to understand government policy effects in the context of a fixed exchange rate system. In [Chapter 10 "Policy Effects with Floating Exchange Rates"](#), we considered these same government policies in the context of a floating exchange rate system. In [Chapter 13 "Fixed versus Floating Exchange Rates"](#), we'll compare fixed and floating exchange rate systems and discuss the pros and cons of each system.

It is important to recognize that these results are what “would” happen under the full set of assumptions that describe the AA-DD model. These effects may or may not happen in reality. Nevertheless, the model surely captures some of the simple cause-and-effect relationships and therefore helps us to understand the broader implications of policy changes. Thus even if in reality many more elements (not described in the model) may act to influence the key endogenous variables, the AA-DD model at least gives a more complete picture of some of the expected tendencies.

KEY TAKEAWAYS

- The main objective of the AA-DD model is to assess the effects of monetary, fiscal, and exchange rate policy changes.

- It is important to recognize that these results are what “would” happen under the full set of assumptions that describes the AA-DD model; they may or may not accurately describe actual outcomes in actual economies.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. Of *appreciation, depreciation, or no change*, the effect of expansionary monetary policy on the domestic currency value under fixed exchange rates in the AA-DD model.
 - b. Of *increase, decrease, or no change*, the effect of contractionary monetary policy on GNP under fixed exchange rates in the AA-DD model.
 - c. Of *increase, decrease, or no change*, the effect of expansionary monetary policy on the current account deficit under fixed exchange rates in the AA-DD model.
 - d. Of *increase, decrease, or no change*, the effect of contractionary monetary policy on the current account surplus under fixed exchange rates in the AA-DD model.
 - e. Of *appreciation, depreciation, or no change*, the effect of expansionary fiscal policy on the domestic currency value under fixed exchange rates in the AA-DD model.
 - f. Of *increase, decrease, or no change*, the effect of contractionary fiscal policy on GNP under fixed exchange rates in the AA-DD model.
 - g. Of *increase, decrease, or no change*, the effect of expansionary fiscal policy on the current account deficit under fixed exchange rates in the AA-DD model.
 - h. Of *increase, decrease, or no change*, the effect of a devaluation on GNP under fixed exchange rates in the AA-DD model.
 - i. Of *increase, decrease, or no change*, the effect of a revaluation on the current account deficit under fixed exchange rates in the AA-DD model.
 - j. The term used to describe a rapid purchase of foreign investments often spurred by the expectation of an imminent currency devaluation.

k. The term used to describe the situation when a central bank runs persistent balance of payments deficits and is about to run out of foreign exchange reserves.

12.2 Monetary Policy with Fixed Exchange Rates

LEARNING OBJECTIVE

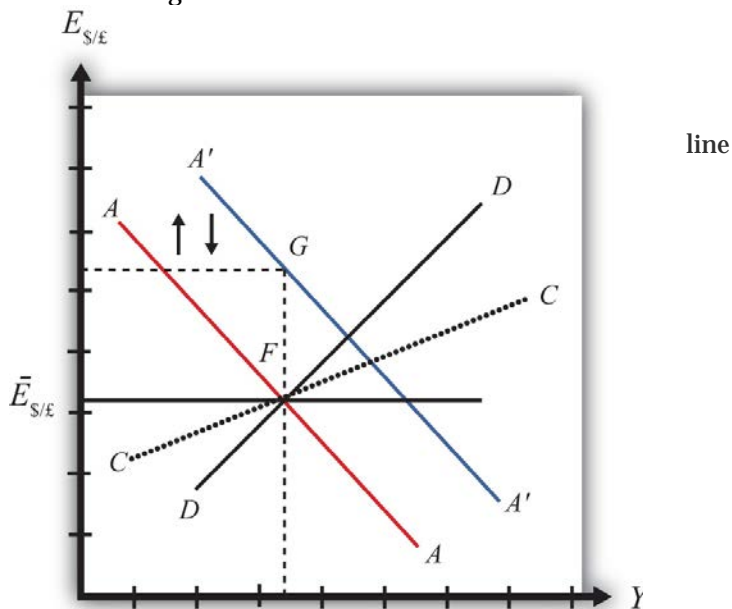
1. Learn how changes in monetary policy affect GNP, the value of the exchange rate, and the current account balance in a fixed exchange rate system in the context of the AA-DD model.
2. Understand the adjustment process in the money market, the Forex market, and the G&S market.

In this section, we use the AA-DD model to assess the effects of monetary policy in a fixed exchange rate system. Recall from [Chapter 7 "Interest Rate Determination"](#) that the money supply is effectively controlled by a country's central bank. In the case of the United States, this is the Federal Reserve Board, or the Fed. When the money supply increases due to action taken by the central bank, we refer to it as expansionary monetary policy. If the central bank acts to reduce the money supply, it is referred to as contractionary monetary policy. Methods that can be used to change the money supply are discussed in [Chapter 7 "Interest Rate Determination"](#), [Section 7.5 "Controlling the Money Supply"](#).

Expansionary Monetary Policy

Suppose the United States fixes its exchange rate to the British pound at the rate $\bar{E}_{\$/\pounds}$. This is indicated in [Figure 12.1 "Expansionary Monetary Policy with a Fixed Exchange Rate"](#) as a horizontal line drawn at $\bar{E}_{\$/\pounds}$. Suppose also that the economy is originally at a superequilibrium shown as point F with original gross national product (GNP) level Y . Next, suppose the U.S. central bank (the Fed) decides to expand the money supply by conducting an open market operation, *ceteris paribus*.

Figure 12.1 Expansionary Monetary Policy with a Fixed Exchange Rate



Ceteris paribus means that all other exogenous variables are assumed to remain at their original values. A purchase of Treasury bonds by the Fed will lead to an increase in the dollar money supply. As shown

in Chapter 9 "The AA-DD Model", Section 9.5 "Shifting the AA Curve", money supply changes cause a shift in the AA curve. More specifically, an increase in the money supply will cause AA to shift upward (i.e., $\uparrow MS$ is an AA up-shifter). This is depicted in the diagram as a shift from the red AA to the blue A'A' line.

The money supply increase puts upward pressure on the exchange rate in the following way. First, a money supply increase causes a reduction in U.S. interest rates. This in turn reduces the rate of return on U.S. assets below the rate of return on similar assets in Britain. Thus international investors will begin to demand more pounds in exchange for dollars on the private Forex to take advantage of the relatively higher RoR of British assets. In a floating exchange system, excess demand for pounds would cause the pound to appreciate and the dollar to depreciate. In other words, the exchange rate $E_{\$/\pounds}$ would rise. In the diagram, this would correspond to a movement to the new A'A' curve at point G.

However, because the country maintains a fixed exchange rate, excess demand for pounds on the private Forex will automatically be relieved by Fed intervention. The Fed will supply the excess pounds demanded by selling reserves of pounds in exchange for dollars at the fixed exchange rate. As we showed in Chapter 10 "Policy Effects with Floating Exchange Rates", Section 10.5 "Foreign Exchange Interventions with Floating Exchange Rates", Fed sales of foreign currency result in a reduction in the U.S. money supply. This is because when the Fed buys dollars in the private Forex, it is taking those dollars out of circulation and thus out of the money supply. Since a reduction of the money supply causes AA to shift back down, the final effect will be that the AA curve returns to its original position. This is shown as the up and down movement of the AA curve in the diagram. The final equilibrium is the same as the original at point F. The AA curve must return to the same original position because the exchange rate must remain fixed at $\bar{E}_{\$/\pounds}$. This implies that the money supply reduction due to Forex intervention will exactly offset the money supply expansion induced by the original open market operation. Thus the money supply will temporarily rise but then will fall back to its original level. Maintaining the money supply at the same level also assures that interest rate parity is maintained. Recall that in a fixed exchange rate system, interest rate parity requires equalization of interest rates between countries (i.e., $i_s = i_f$). If the money supply did not return to the same level, interest rates would not be equalized.

Thus after final adjustment occurs, there are no effects from expansionary monetary policy in a fixed exchange rate system. The exchange rate will not change and there will be no effect on equilibrium GNP.

Also, since the economy returns to the original equilibrium, there is also no effect on the current account balance.

Contractionary Monetary Policy

Contractionary monetary policy corresponds to a decrease in the money supply or a Fed sale of Treasury bonds on the open bond market. In the AA-DD model, a decrease in the money supply shifts the AA curve downward. The effects will be the opposite of those described above for expansionary monetary policy. A complete description is left for the reader as an exercise.

The quick effects, however, are as follows. U.S. contractionary monetary policy with a fixed exchange rate will have no effects within the economy. $E_{s/\$}$, Y_s and the current account balance will all be maintained or return to their initial levels.

Discussion

This result indicates that monetary policy is ineffective in influencing the economy in a fixed exchange rate system. In contrast, in a floating exchange rate system, monetary policy can either raise or lower GNP, at least in the short run. Thus monetary policy has some effectiveness in a floating system, and central bank authorities can adjust policy to affect macroeconomic conditions within their economy. For example, if the economy is growing only sluggishly, or perhaps is contracting, the central bank can raise the money supply to help spur an expansion of GNP, *if* the economy has a floating exchange rate. However, with a fixed exchange rate, the central bank no longer has this ability. This explains why countries lose monetary autonomy (or independence) with a fixed exchange rate. The central bank can no longer have any influence over the interest rate, exchange rate, or the level of GNP.

One other important comparison worth making is between expansionary monetary policy in a fixed exchange rate system with sterilized foreign exchange (Forex) interventions in a floating system. In the first case, expansionary monetary policy is offset later with a contraction of the money supply caused by automatic Forex intervention. In the second case, Forex intervention leading to an expansion of the money supply is countered with contractionary open market operations. In the first case, the interest rate is maintained to satisfy interest rate parity. In the second case, the interest rate remains fixed by design. Clearly, these two situations represent exactly the same set of actions, though in a different order. Thus it makes sense that the two policies would have the same implications—that is, “no impact” on any of the economic variables.

KEY TAKEAWAYS

- There are *no effects* from expansionary or contractionary monetary policy in a fixed exchange rate system. The exchange rate will not change, there will be no effect on equilibrium GNP, and there will be no effect on the current account balance.
- Monetary policy in a fixed exchange rate system is equivalent in its effects to sterilized Forex interventions in a floating exchange rate system.

EXERCISE

1. Suppose that Latvia can be described with the AA-DD model and that Latvia fixes its currency, the lats (Ls), to the euro. Consider the changes in the exogenous variable in the left column. Indicate the short-run effects on the equilibrium levels of Latvian GNP, the Latvian interest rate (i_{Ls}), the Latvian trade balance, and the exchange rate ($E_{Ls/€}$). Use the following notation:

+ the variable increases

– the variable decreases

0 the variable does not change

A the variable change is ambiguous (i.e., it may rise, it may fall)

	GNP	i_{Ls}	Trade Balance	$E_{Ls/€}$
An increase in the Latvian money supply				
A decrease in the Latvian money supply				

12.3 Fiscal Policy with Fixed Exchange Rates

LEARNING OBJECTIVES

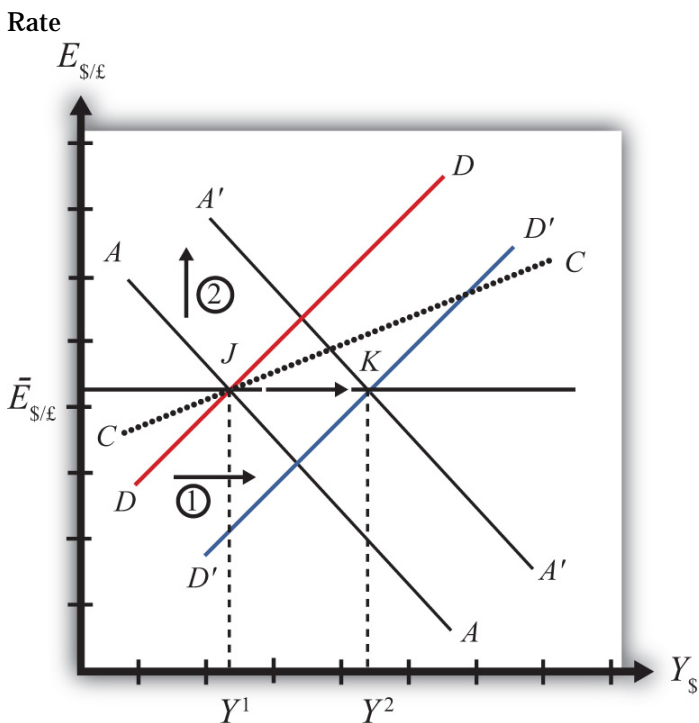
1. Learn how changes in fiscal policy affect GNP, the value of the exchange rate, and the current account balance in a fixed exchange rate system in the context of the AA-DD model.
2. Understand the adjustment process in the money market, the Forex market, and the G&S market.

In this section, we use the AA-DD model to assess the effects of fiscal policy in a fixed exchange rate system. Recall from [Chapter 8 "National Output Determination"](#) that fiscal policy refers to any change in expenditures or revenues within any branch of the government. This means any change in government spending (e.g., transfer payments or taxes) by federal, state, or local governments represents a fiscal policy change. Since changes in expenditures or revenues will often affect a government budget balance, we can also say that a change in the government surplus or deficit represents a change in fiscal policy. When government spending or transfer payments increase, or tax revenues decrease, we refer to it as expansionary fiscal policy. These actions would also be associated with an increase in the government budget deficit, or a decrease in its budget surplus. If the government acts to reduce government spending or transfer payments, or increase tax revenues, it is referred to as contractionary fiscal policy. These actions would also be associated with a decrease in the government budget deficit, or an increase in its budget surplus.

Expansionary Fiscal Policy

Suppose the United States fixes its exchange rate to the British pound at the rate $\bar{E}_{\$/\pounds}$. This is indicated in [Figure 12.2 "Expansionary Fiscal Policy with a Fixed Exchange Rate"](#) as a horizontal line drawn at $\bar{E}_{\$/\pounds}$. Suppose also that the economy is originally at a superequilibrium shown as point J with GNP at level Y^i . Next, suppose the government decides to increase government spending (or increase transfer payments or decrease taxes). As shown in [Chapter 9 "The AA-DD Model"](#), [Section 9.3 "Shifting the DD Curve"](#), fiscal policy changes cause a shift in the DD curve. More specifically, an increase in government spending (or an increase in transfer payments or a decrease in taxes) will cause DD to shift rightward (i.e., $\uparrow G$, $\uparrow TR$, and $\downarrow T$ all are DD right-shifters). This is depicted in the diagram as a shift from the red DD to the blue $D'D'$ line (step 1).

Figure 12.2 Expansionary Fiscal Policy with a Fixed Exchange



If the expansionary fiscal policy occurs because of an increase in government spending, then government demand for goods and services (G&S) will increase. If the expansionary fiscal policy occurs due to an increase in transfer payments or a decrease in taxes, then disposable income will increase, leading to an increase in consumption demand. In either case, aggregate demand increases. Before any adjustment occurs, the increase in aggregate demand causes aggregate demand to exceed aggregate supply, which will lead to an expansion of

GNP. Thus the economy will begin to move rightward from point *J*.

As GNP rises, so does real money demand, causing an increase in U.S. interest rates. With higher interest rates, the rate of return on U.S. assets rises above that in the United Kingdom and international investors increase demand for dollars (in exchange for pounds) on the private Forex. In a floating exchange rate system this would lead to a U.S. dollar appreciation (and pound depreciation)—that is, a decrease in the exchange rate $E_{\$/\pounds}$.

However, because the country maintains a fixed exchange rate, excess demand for dollars on the private Forex will automatically be relieved by the U.S. Federal Reserve (or the Fed) intervention. The Fed will supply the excess dollars demanded by buying pounds in exchange for dollars at the fixed exchange rate.

As we showed in [Chapter 10 "Policy Effects with Floating Exchange Rates"](#), [Section 10.5 "Foreign Exchange Interventions with Floating Exchange Rates"](#), the foreign currency purchases by the Fed result in an increase in the U.S. money supply. This is because when the Fed sells dollars in the private Forex, these dollars are entering into circulation and thus become a part of the money supply. The increase in the

money supply causes the AA curve to shift up (step 2). The final equilibrium will be reached when the new A'A' curve intersects the D'D' curve at the fixed exchange rate ($\bar{E}_{\$/\text{€}}$) shown at point *K*.

Note that in the transition, the Fed intervention in the Forex occurred because investors responded to rising U.S. interest rates by increasing demand for dollars on the Forex. The Fed's response causes an increase in the money supply, which in turn will lower interest rates back to their original level. This result is necessary to maintain the fixed exchange rate interest rate parity (IRP) condition of $i_s = i_f$.

Note also that as GNP increases in the transition, causing interest rates to rise, this rise is immediately countered with automatic Fed intervention in the Forex. Thus the exchange rate will never fall below the fixed rate. There will be pressure for the exchange rate to fall, but the Fed will always be there to relieve the pressure with its intervention. Thus the adjustment path from the original equilibrium at *J* to the final equilibrium at *K* will follow the rightward arrow between the two points along the fixed exchange rate.

The final result is that *expansionary fiscal policy in a fixed exchange rate system will cause an increase in GNP (from Y^1 to Y^2) and no change in the exchange rate in the short run. Since the new equilibrium at *K* lies below the original CC curve representing a fixed current account balance, expansionary fiscal policy, consisting of an increase in *G*, will cause the current account balance to fall. This corresponds to a decrease in a trade surplus or an increase in a trade deficit.*

Contractionary Fiscal Policy

Contractionary fiscal policy corresponds to a decrease in government spending, a decrease in transfer payments, or an increase in taxes. It would also be represented by a decrease in the government budget deficit or an increase in the budget surplus. In the AA-DD model, a contractionary fiscal policy shifts the DD curve leftward. The effects will be the opposite of those described above for expansionary fiscal policy. A complete description is left for the reader as an exercise.

The quick effects, however, are as follows. *Contractionary fiscal policy in a fixed exchange rate system will cause a decrease in GNP and no change in the exchange rate in the short run. Contractionary fiscal policy, consisting of a decrease in *G*, will also cause the current account balance to rise. This corresponds to an increase in a trade surplus or a decrease in a trade deficit.*

KEY TAKEAWAYS

- Expansionary fiscal policy in a fixed exchange rate system will cause an increase in GNP, no change in the exchange rate (of course), and a decrease in the current account balance.

- Contractionary fiscal policy in a fixed exchange rate system will cause a decrease in GNP, no change in the exchange rate (of course), and an increase in the current account balance.

EXERCISES

1. Sri Lanka fixes its currency, the Sri Lankan rupee (LKR), to the U.S. dollar. Suppose Sri Lanka can be described using the AA-DD model. Consider changes in the exogenous variables in Sri Lanka in the left column. Suppose each change occurs ceteris paribus. Indicate the short-run effects on the equilibrium values of Sri Lankan GNP, the Sri Lankan interest rate (i_{LKR}), the Sri Lankan trade deficit, and the exchange rate ($E_{LKR/\$}$). Use the following notation:

+ the variable increases

- the variable decreases

0 the variable does not change

A the variable change is ambiguous (i.e., it may rise, it may fall)

	GNP	i_{LKR}	Sri Lankan Trade Deficit	$E_{LKR/\$}$
A decrease in domestic taxes				
An increase in government demand				
An increase in transfer payments				

2. Consider the following occurrences. Use the AA-DD model to determine the impact on the variables (+, -, 0, or A) from the twin-deficit identity listed along the top row. Consider only short-run effects (i.e., before inflationary effects occur) and assume ceteris paribus for all other exogenous variables.

	Impact on			
	S_p	I	$IM-EX$	$G+TR-T$
A reduction in government spending with a fixed exchange rate				
An increase in transfer payments with fixed exchange rates				
A decrease in taxes with fixed exchange rates				





12.4 Exchange Rate Policy with Fixed Exchange Rates

LEARNING OBJECTIVES

1. Learn how changes in exchange rate policy affect GNP, the value of the exchange rate, and the current account balance in a fixed exchange rate system in the context of the AA-DD model.
2. Understand the adjustment process in the money market, the Forex market, and the G&S market.

In this section, we use the AA-DD model to assess the effects of exchange rate policy in a fixed exchange rate system. In a sense we can say that the government's decision to maintain a fixed exchange rate is the country's exchange rate policy. However, over time, the government does have some discretion concerning the value of the exchange rate. In this section, we will use "exchange rate policy" to mean changes in the value of the fixed exchange rate.

If the government lowers the value of its currency with respect to the reserve currency or to gold, we call the change a devaluation. If the government raises the value of its currency with respect to the reserve currency or to gold, we call the change a revaluation. The terms *devaluation* and *revaluation* should properly be used only in reference to a government change in the fixed exchange rate since each term suggests an action being taken. In contrast, natural market changes in supply and demand will result in changes in the exchange rate in a floating system, but it is not quite right to call these changes devaluations or revaluations since no concerted action was taken by anyone. Nonetheless, some writers will sometimes use the terms this way.

In most cases, devaluations and revaluations occur because of persistent balance of payments disequilibria. We will consider these situations in [Chapter 12 "Policy Effects with Fixed Exchange Rates"](#), [Section 12.6 "Currency Crises and Capital Flight"](#) on balance of payments crises and capital flight. In this section, we will consider the basic effects of devaluations and revaluations without assuming any notable prior events caused these actions to occur.

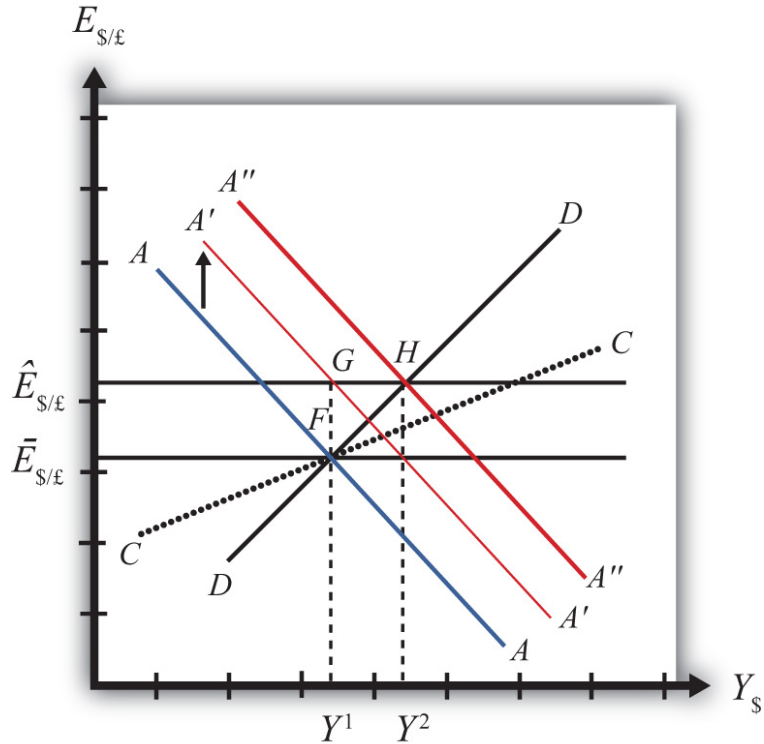
Devaluation

Suppose the United States fixes its exchange rate to the British pound at the rate $\bar{E}_{\$/\pounds}$. This is indicated in [Figure 12.3 "Effects of a Devaluation"](#) as a horizontal line drawn at $\bar{E}_{\$/\pounds}$. Suppose also that the economy is originally at a superequilibrium shown as point F with gross national product (GNP) at level Y^1 . Next, suppose the U.S. central bank (or the Fed) decides to devalue the U.S. dollar with respect to the British

pound corresponding to an increase in the fixed rate from $\bar{E}_{\$/\pounds}$ to $\hat{E}_{\$/\pounds}$. Recall that a devaluation corresponds to an increase in the $\$/\pounds$ exchange rate. Assume that there was no anticipation of the devaluation and that it comes about as a complete surprise to all market participants.

The first effect of the devaluation, of course, is the exchange rate rises. Immediately the economy moves from F to G on the diagram. It may seem that would move the economy the AA curve, but instead AA curve shifts up with the devaluation to $A'A'$. This occurs because the AA curve

Figure 12.3 Effects of a Devaluation



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is a function of the expected exchange rate. As long as investors believe that the new exchange rate will now remain fixed at its new rate ($\hat{E}_{\$/\pounds}$), the expected future exchange rate will immediately rise to this new level as well. It is this increase in $E_{\$/\pounds}$ that causes AA to shift up.

When at point G , however, the economy is not at a superequilibrium. Because of the dollar devaluation, the real exchange rate has increased, making foreign goods relatively more expensive and U.S. goods relatively cheaper. This raises aggregate demand, which at the new exchange rate ($\hat{E}_{\$/\pounds}$) is now at the level where the exchange rate line crosses the DD curve at point H .

Since the economy, for now, lies at G to the left of point H on the DD curve, aggregate demand exceeds supply. Producers will respond by increasing supply to satisfy the demand, and GNP will begin to rise. As GNP rises, real money demand will rise, causing an increase in U.S. interest rates, which will raise the rate of return on U.S. assets. Investors will respond by increasing their demand for U.S. dollars on the foreign exchange (Forex) market, and there will be pressure for a dollar appreciation.

To maintain the fixed exchange rate, however, the U.S. Fed will have to automatically intervene on the Forex and sell dollars to satisfy the excess demand in exchange for pounds. This represents a balance of payments surplus since by buying pounds on the Forex the United States is adding to its stock of foreign reserves. A balance of payments surplus in turn causes an increase in the U.S. money supply, which will shift the AA curve to the right.

As GNP rises toward Y^2 at point H , the AA curve will shift right with the Fed intervention to maintain the equilibrium exchange rate at the new fixed value, which is $\hat{E}_{\$/\pounds}$. The final superequilibrium occurs at point H where excess aggregate demand is finally satisfied.

The final result is that *a devaluation in a fixed exchange rate system will cause an increase in GNP (from Y^1 to Y^2) and an increase in the exchange rate to the new fixed value in the short run. Since the new equilibrium at H lies above the original CC curve representing a fixed current account balance, a devaluation will cause the current account balance to rise. This corresponds to an increase in a trade surplus or a decrease in a trade deficit.*

Revaluation

A revaluation corresponds to change in the fixed exchange rate such that the country's currency value is increased with respect to the reserve currency. In the AA-DD model, a U.S. dollar revaluation would be represented as a decrease in the fixed $\$/\pounds$ exchange rate. The effects will be the opposite of those described above for a devaluation. A complete description is left for the reader as an exercise.

The quick effects, however, are as follows. *A revaluation in a fixed exchange rate system will cause a decrease in GNP and a decrease in the fixed exchange rate in the short run. A revaluation will also cause the current account balance to fall. This corresponds to a decrease in a trade surplus or an increase in a trade deficit.*

KEY TAKEAWAYS

- If the government lowers (raises) the value of its currency with respect to the reserve currency, or to gold, we call the change a devaluation (revaluation).
- A devaluation in a fixed exchange rate system will cause an increase in GNP, an increase in the exchange rate to the new fixed value in the short run, and an increase in the current account balance.

- A revaluation in a fixed exchange rate system will cause a decrease in GNP, an increase in the currency value to the new fixed rate, and a decrease in the current account balance.

EXERCISES

1. Vietnam fixes its currency, the Vietnamese dong (VND), to the US dollar. Suppose Vietnam can be described using the AA-DD model. Consider changes in the exogenous variables in Vietnam in the left column. Suppose each change occurs ceteris paribus. Indicate the short-run effects on the equilibrium values of Vietnamese GNP, the Vietnamese interest rate (i_{VND}), the Vietnamese trade deficit, and the exchange rate ($E_{\text{VND}/\$}$). Use the following notation:

+ the variable increases

– the variable decreases

0 the variable does not change

A the variable change is ambiguous (i.e., it may rise, it may fall)

	GNP	i_{VND}	$E_{\text{VND}/\$}$
A devaluation of the Vietnamese dong			
A revaluation of the Vietnamese dong			

2. Consider the following occurrences. Use the AA-DD model to determine the impact on the variables (+, –, 0, or A) from the twin-deficit identity listed along the top row. Consider only short-run effects (i.e., before inflationary effects occur) and assume ceteris paribus for all other exogenous variables.

	Impact on			
	Sp	I	$IM - EX$	$G + TR - T$
A currency devaluation under fixed exchange rates				
A currency revaluation under fixed exchange rates				

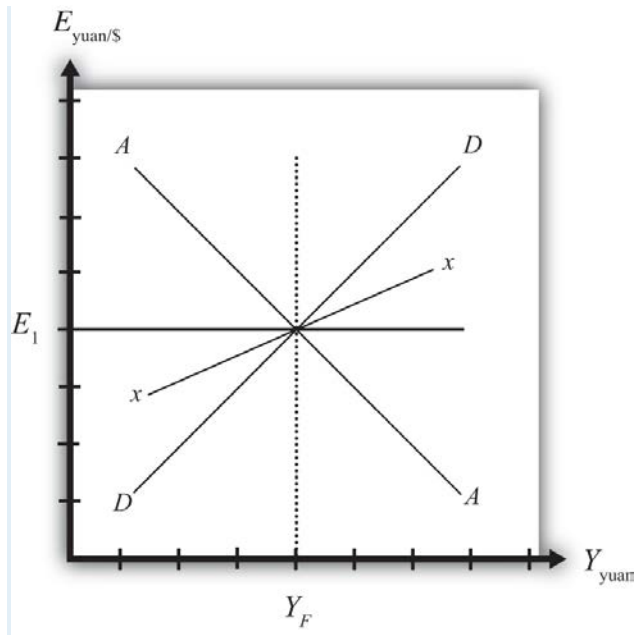
3. China maintains an exchange rate fixed to the U.S. dollar at the rate E_1 . Use the following AA-DD diagram for China to depict answers to the questions below. Suppose China's



current account is in surplus originally. Suppose Y_F indicates the full employment level of output.

- Suppose China unexpectedly *revalues* its currency under pressure from the U.S. government. Draw a line for the new exchange rate and mark the graph with an E_2 .
- Mark the graph with a T to indicate the position of the economy immediately after the revaluation when investor expectations adjust to the new exchange rate.

Figure 12.4



c. What effect does the revaluation have for the prices of Chinese goods to Americans?

d. Mark the graph with a W to indicate the position of the economy once a new short-run equilibrium is achieved. Mark the graph with Y_2 to indicate the new level of GDP.

e. Does China's stock of foreign reserves *rise* or *fall* after the

revaluation?

- Does China's current account surplus *rise* or *fall*?
- In the adjustment to a long-run equilibrium, would the Chinese price level *rise* or *fall*?

12.5 Reserve Country Monetary Policy under Fixed Exchange Rates

LEARNING OBJECTIVES

1. Learn how monetary policy in the foreign reserve country affects domestic GNP, the value of the exchange rate, and the current account balance in a fixed exchange rate system in the context of the AA-DD model.
2. Understand the adjustment process in the money market, the Forex market, and the G&S market.

Suppose the United States fixes its exchange rate to the British pound. In this circumstance, the exchange rate system is a reserve currency standard in which the British pound is the reserve currency. The U.S. government is the one that fixes its exchange rate and will hold some quantity of British pounds on reserve so it is able to intervene on the Forex to maintain the credible fixed exchange rate.

It is worth noting that since the United States fixes its exchange rate to the pound, the British pound is, of course, fixed to the U.S. dollar as well. Since the pound is the reserve currency, however, it has a special place in the monetary system. The Bank of England, Britain's central bank, will never need to intervene in the Forex market. It does not need to hold dollars. Instead, all market pressures for the exchange rate to change will be resolved by U.S. intervention, that is, by the nonreserve currency country.

Expansionary Monetary Policy by the Reserve Country

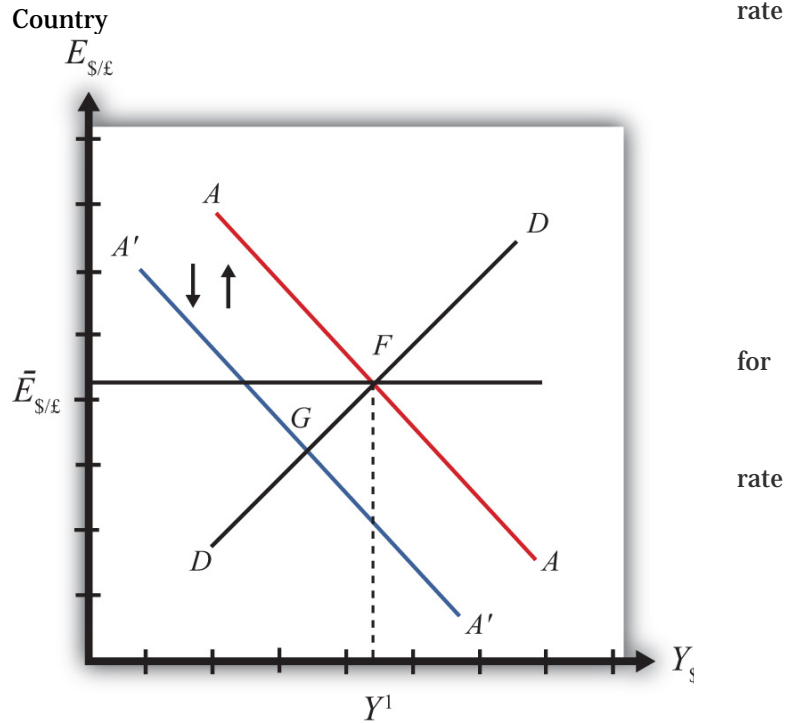
Now let's suppose that the reserve currency country, Britain, undertakes expansionary monetary policy. We will consider the impact of this change from the vantage point of the United States, the nonreserve currency country. Suppose the United States is originally in a superequilibrium at point F in the adjoining diagram with the exchange rate fixed at $\bar{E}_{\$/\pounds}$. An increase in the British money supply will cause a decrease in British interest rates, i_{\pounds} .

As shown in [Chapter 9 "The AA-DD Model"](#), [Section 9.5 "Shifting the AA Curve"](#), foreign interest rate changes cause a shift in the AA curve. More specifically, a decrease in the foreign interest rate will cause the AA curve to shift downward (i.e., $\downarrow i_{\pounds}$ is an AA down-shifter). This is depicted in [Figure 12.5](#)

["Expansionary Monetary Policy by a Reserve Country"](#) as a shift from the red AA to the blue A'A' line.

The money supply decrease puts downward pressure on the exchange rate in the following way. When British interest rates fall, it will cause $i_{\text{£}} < i_{\text{\$}}$ and interest rate parity (IRP) will be violated. Thus international investors will begin to demand more dollars in exchange pounds on the private Forex to take advantage of the relatively higher of return on U.S. assets. In a floating exchange system, excess demand for dollars would cause the dollar to appreciate and the pound to depreciate. In other words, the exchange rate ($E_{\text{\$/£}}$) would fall. In the diagram, this would correspond to a movement to the new $A'A'$ curve at point G .

Figure 12.5 Expansionary Monetary Policy by a Reserve



Because the country maintains a fixed exchange rate, however, excess demand for dollars on the private Forex will automatically be relieved by the U.S. Federal Reserve (or the Fed) intervention. The Fed will supply the excess dollars demanded by buying pounds in exchange for dollars at the fixed exchange rate. As we showed in [Chapter 10 "Policy Effects with Floating Exchange Rates"](#), [Section 10.5 "Foreign Exchange Interventions with Floating Exchange Rates"](#), the foreign currency purchases by the Fed result in an increase in the U.S. money supply. This is because when the Fed sells dollars in the private Forex, these dollars are entering into circulation and thus become a part of the money supply. Since an increase in the money supply causes AA to shift up, the AA curve will return to its original position to maintain the fixed exchange rate. This is shown as the up-and-down movement of the AA curve in the diagram. Thus the final equilibrium is the same as the original equilibrium at point F .

Remember that in a fixed exchange rate system, IRP requires equalization of interest rates between countries. When the British interest rates fell, they fell below the rates in the United States. When the U.S.

Fed intervenes on the Forex, however, the U.S. money supply rises and U.S. interest rates are pushed down. Pressure for the exchange rate to change will cease only when U.S. interest rates become equal to British interest rates and IRP ($i_t = i_s$) is again satisfied.

Thus after final adjustment occurs, expansionary monetary policy by the foreign reserve currency country in a fixed exchange rate system causes no effects on U.S. GNP or the exchange rate. Since the economy also returns to the original equilibrium, there is also no effect on the current account balance. Fed intervention in the Forex to maintain the fixed exchange rate, however, will cause U.S. interest rates to fall to maintain IRP with the lower reserve country interest rates.

Contractionary Monetary Policy by the Reserve Country

Contractionary monetary policy corresponds to a decrease in the British money supply that would lead to an increase in British interest rates. In the AA-DD model, an increase in foreign interest rates shifts the AA curve upward. The effects will be the opposite of those described above for expansionary monetary policy. A complete description is left for the reader as an exercise.

KEY TAKEAWAYS

- Expansionary monetary policy by the foreign reserve currency country in a fixed exchange rate system causes no effects on domestic GNP, the exchange rate, or the current account balance in the AA-DD model. However, it will cause domestic interest rates to fall.
- Contractionary monetary policy by the foreign reserve currency country in a fixed exchange rate system causes no effects on domestic GNP, the exchange rate, or the current account balance in the AA-DD model. However, it will cause domestic interest rates to rise.

EXERCISES

1. Honduras fixes its currency, the Honduran lempira (HNL), to the U.S. dollar. Suppose Honduras can be described using the AA-DD model. Consider changes in the exogenous variables in the left column. Suppose each change occurs *ceteris paribus*. Indicate the short-run effects on the equilibrium values of Honduran GNP, the Honduran interest rate (i_{HNL}), the Honduran trade deficit, and the exchange rate ($E_{\text{HNL}/\$}$). Use the following notation:

- + the variable increases
- the variable decreases

0 the variable does not change

A the variable change is ambiguous (i.e., it may rise, it may fall)

	GNP	i_{HNL}	$E_{HNL/\$}$
An increase in U.S. interest rates			
A decrease in U.S. interest rates			

2. Consider the following occurrences. Use the AA-DD model to determine the impact on the variables (+, -, 0, or A) from the twin-deficit identity listed along the top row. Consider only short-run effects (i.e., before inflationary effects occur) and assume ceteris paribus for all other exogenous variables.

	Impact on			
	S_p	I	$IM-EX$	$G + TR - T$
An increase in foreign interest rates under fixed exchange rates				
A decrease in foreign interest rates under fixed exchange rates				

12.6 Currency Crises and Capital Flight

LEARNING OBJECTIVE

1. Learn how currency crises develop and lead to capital flight.

To maintain a credible fixed exchange rate system, a country will need to buy and sell the reserve currency whenever there is excess demand or supply in the private foreign exchange (Forex). To make sales of foreign currency possible, a country will need to maintain a foreign exchange reserve. The reserve is a stockpile of assets denominated in the reserve currency. For example, if the United States fixes the dollar to the British pound, then it would need to have a reserve of pound assets in case it needs to intervene on the Forex with a sale of pounds.

Generally, a central bank holds these reserves in the form of Treasury bonds issued by the reserve country government. In this way, the reserve holdings earn interest for the central bank and thus the reserves will grow in value over time. Holding reserves in the form of currency would not earn interest and thus are less desirable. Nonetheless, a central bank will likely keep some of its reserves liquid in the form of currency to make anticipated daily Forex transactions. If larger sales of reserves become necessary, the U.S. central bank can always sell the foreign Treasury bonds on the bond market and convert those holdings to currency.

A fixed exchange rate is sustainable if the country's central bank can maintain that rate over time with only modest interventions in the Forex. Ideally, one would expect that during some periods of time, there would be excess demand for domestic currency on the Forex, putting pressure on the currency to appreciate. In this case, the central bank would relieve the pressure by selling domestic currency and buying the reserve on the Forex, thus running a balance of payments (BoP) surplus. During these periods, the country's reserve holdings would rise. At other periods, there may be excess demand for the reserve currency, putting pressure on the domestic currency to depreciate. Here, the central bank would relieve the pressure by selling the reserve currency in exchange for domestic currency, thus running a balance of payments deficit. During these periods, the country's reserve holdings would fall. As long as the country's reserve holdings stay sufficiently high during its ups and downs, the fixed exchange rate could be maintained indefinitely. In this way, the central bank's interventions "smooth-out" the fluctuations that would have occurred in a floating system.

Problems arise if the reserves cannot be maintained if, for example, there is a persistent excess demand for the foreign currency over time with very few episodes of excess supply. In this case, the central bank's persistent BoP deficits will move reserve holdings closer and closer to zero. A balance of payments crisis occurs when the country is about to run out of foreign exchange reserves.

Borrowing Reserves

Several things may happen leading up to a balance of payments crisis. One option open to the central bank is to borrow additional quantities of the reserve currency from the reserve country central bank, government, or an international institution like the International Monetary Fund (IMF). The IMF was originally created to help countries with balance of payments problems within the Bretton Woods fixed exchange rate system (1945–1973). When a country was near to depleting its reserves, it could borrow reserve currency from the IMF. As long as the balance of payments deficits leading to reserve depletion would soon be reversed with balance of payments surpluses, the country would be able to repay the loans to the IMF in the near future. As such, the IMF “window” was intended to provide a safety valve in case volatility in supply and demand in the Forex was greater than a country's reserve holdings could handle.

Devaluation

If a country cannot acquire additional reserves and if it does not change domestic policies in a way that causes excess demand for foreign currency to cease or reverse, then the country will run out of foreign reserves and will no longer be able to maintain a credible fixed exchange rate. The country could keep the fixed exchange rate at the same level and simply cease intervening in the Forex; however, this would not relieve the pressure for the currency to depreciate and would quickly create conditions for a thriving black market.

If the country remains committed to a fixed exchange rate system, its only choice is to devalue its currency with respect to the reserve. A lower currency value will achieve two things. First, it will reduce the prices of all domestic goods from the viewpoint of foreigners. In essence, a devaluation is like having a sale in which all the country's goods are marked down by some percentage. At the same time, the devaluation will raise the price of foreign goods to domestic residents. Thus foreign goods have all been marked up in price by some percentage. These changes should result in an increase in demand for domestic currency to take advantage of the lower domestic prices and a decrease in demand for foreign currency due to the higher foreign prices.

The second effect occurs for investors. When the currency is devalued, the rate of return on foreign assets may fall, especially if investors had anticipated a devaluation and had adjusted their expectations accordingly. (See the next section on capital flight for further discussion.) When the rate of return on foreign assets falls, the demand for foreign currency will also fall.

If the devaluation is large enough to reverse the currency demand in the Forex, generating excess demand for the domestic currency, the central bank will have to buy foreign reserves to maintain the new devalued exchange rate and can begin to accumulate a stockpile of reserves once again.

Capital Flight

Balance of payments crises are often anticipated by investors in the marketplace. When this occurs it will result in capital flight, which in turn is likely to aggravate the balance of payments crisis. Here's why.

The interest rate parity condition holds when rates of return on domestic and foreign assets are equalized. Recall from [Chapter 11 "Fixed Exchange Rates"](#), [Section 11.3 "Interest Rate Parity with Fixed Exchange Rates"](#) that in a fixed exchange rate system the IRP condition simplifies to equalization of interest rates between two countries. However, this result assumed that investors expected the currency to remain fixed indefinitely. If investors believe instead that a country is about to suffer a balance of payments crisis and run out of foreign reserves, they will also anticipate that a devaluation will occur soon.

Assume as before that the United States fixes its currency to the British pound. The interest rate parity condition can be written as

$$i_s = i_E + (1 + i_E) \frac{E_{s/E}^e - \bar{E}_{s/E}}{\bar{E}_{s/E}},$$

where the left side is the rate of return on U.S. assets, equal to the average U.S. interest rate, and the right side is the rate of return on British assets. When there is no imminent balance of payments crisis, investors should expect the future exchange rate ($E_{s/E}^e$) to equal the current fixed exchange rate ($E_{s/E}$) and the interest parity condition simplifies to $i_s = i_E$. However, if investors recognize that the central bank is selling large quantities of its foreign reserves in the Forex regularly, then they are likely also to recognize that the balance of payments deficits are unsustainable. Once the reserves run out, the central bank will be forced to devalue its currency. Thus forward-looking investors should plan for that event today. The

result is an increase in the expected exchange rate, above the current fixed rate, reflecting the expectation that the dollar will be devalued soon.

This, in turn, will increase the expected rate of return of British assets, raising the right side of the above expression. Now, $RoR_e > RoR_s$, and investors will increase demand for British pounds on the Forex. In this instance, investors are “fleeing” their own domestic assets to purchase foreign assets (or capital) that now have a greater expected return. Thus the action is called capital flight.

The intuition for capital flight is simple. If an investor expects the domestic currency (and assets denominated in that currency) will soon fall in value, it is better to sell now before the value actually does fall. Also, as the domestic currency falls in value, the British pound is expected to rise in value. Thus it is wise to buy British pounds and assets while their prices are lower and profit on the increase in the pound value when the dollar devaluation occurs.

The broader effect of capital flight, which occurs in anticipation of a balance of payments crisis, is that it can actually force a crisis to occur much sooner. Suppose the United States was indeed running low on foreign reserves after running successive balance of payments deficits. Once investors surmise that a crisis may be possible soon and react with a change in their expected exchange rate, there will be a resulting increase in demand for pounds on the Forex. This will force the central bank to intervene even further in the Forex by selling foreign pound reserves to satisfy investor demand and to keep the exchange rate fixed. However, additional interventions imply an even faster depletion of foreign reserve holdings, bringing the date of crisis closer in time.

It is even possible for investor behavior to create a balance of payments crisis when one might not have occurred otherwise. Suppose the U.S. central bank (or the Fed) depletes reserves by running balance of payments deficits. However, suppose the Fed believes the reserve holdings remain adequate to defend the currency value, whereas investors believe the reserve holdings are inadequate. In this case, capital flight will likely occur that would deplete reserves much faster than before. If the capital flight is large enough, even if it is completely unwarranted based on market conditions, it could nonetheless deplete the remaining reserves and force the central bank to devalue the currency.

Return to Float

There is one other possible response for a country suffering from a balance of payments crisis. The country could always give up on the fixed exchange rate system and allow its currency to float freely. This

means the central bank no longer needs to intervene on the Forex and the exchange rate value will be determined by daily supply and demand conditions on the private Forex. Since the reason for the BoP crisis was continual pressure for the currency to depreciate, moving to a floating system would undoubtedly result in a rapidly depreciating currency.

The main advantage of returning to a floating exchange rate is that the private Forex market will quickly move the exchange rate to the level that equalizes supply and demand. In contrast, many times countries that devalue their fixed exchange rate do not devalue sufficiently and a second devaluation becomes necessary shortly thereafter. When the countries in the Bretton Woods system switched to floating rates in 1973, the original intention was to allow markets to adjust to the equilibrium exchange rates reflecting market conditions and then to refix the exchange rates at the sustainable equilibrium level. However, an agreement to reestablish fixed rates was never implemented. The U.S. dollar and many other currencies have been floating ever since.

A second advantage of switching to a floating system is that it relieves the central bank from the necessity of maintaining a stockpile of reserves. Thus the whole problem of balance of payments crises disappears completely once a country lets its currency float.

KEY TAKEAWAYS

- A fixed exchange rate is sustainable if the country's central bank can maintain that rate over time with only modest interventions in the Forex.
- A balance of payments crisis occurs when persistent balance of payments deficits bring a country close to running out of foreign exchange reserves.
- BoP crises can be resolved by (a) borrowing foreign reserves, (b) devaluation of the currency, or (c) moving to a floating exchange rate.
- In the midst of a BoP crisis, investors often purchase assets abroad in anticipation of an imminent currency devaluation or depreciation. This is known as capital flight.
- Capital flight works to exacerbate the BoP crisis because it results in a more rapid depletion of foreign exchange reserves and makes the crisis more likely to occur.

EXERCISES

1. List the three ways in which a balance of payments crisis can be resolved either temporarily or permanently. Which of these methods will be most effective, especially if the country continues to pursue the policies that led to the crisis?
2. Explain why capital flight, spurred by the expectation of a currency devaluation, can be a self-fulfilling prophecy.
3. If an expected currency devaluation inspires capital flight, explain what might happen if investors expect a currency revaluation.



12.7 Case Study: The Breakup of the Bretton Woods System, 1973

LEARNING OBJECTIVES

1. Learn how the Bretton Woods system of fixed exchange rates set up after World War II was supposed to work.
2. Learn how and why the system collapsed in 1973.
3. Recognize some of the problems inherent in one type of fixed exchange rate system.

In July 1944, delegates from forty-five of the allied powers engaged in World War II met in Bretton Woods, New Hampshire, in the United States to plan for the economic institutions believed necessary to assist in the reconstruction, development, and growth of the postwar economy. Foremost on the delegates' minds was the instability of the international economic system after World War I, including the experiences of hyperinflation as in Germany in 1922–1923 and the worldwide depression of the 1930s. One element believed necessary to avoid repeating the mistakes of the past was to implement a system of fixed exchange rates. Not only could fixed exchange rates help prevent inflation, but they could also eliminate uncertainties in international transactions and thus serve to promote the expansion of international trade and investment. It was further hoped that economic interconnectedness would make it more difficult for nationalism to reassert itself.

The *Bretton Woods system of exchange rates* was set up as a gold exchange standard, a cross between a pure gold standard and a reserve currency standard. In a gold exchange standard, one country is singled out to be the reserve currency. In the Bretton Woods case, the currency was the U.S. dollar. The U.S. dollar was fixed to a weight in gold, originally set at \$35 per ounce. The U.S. central bank agreed to exchange dollars for gold on demand, but only with foreign central banks. In a pure gold standard, the central bank would exchange gold for dollars with the general public as well.

The nonreserve countries agreed to fix their currencies to the U.S. dollar or to gold. ^[1]However, there was no obligation on the part of the nonreserve countries to exchange their currencies for gold. Only the reserve country had that obligation. Instead, the nonreserve-currency countries were obliged to maintain the fixed exchange rate to the U.S. dollar by intervening on the foreign exchange (Forex) market and buying or selling dollars as necessary. In other words, when there was excess demand on the Forex for the home currency in exchange for dollars, the nonreserve central bank would supply their currency and buy

dollars, thus running a balance of payments surplus, to maintain the fixity of their exchange rate.

Alternatively, when there was excess supply of the home currency, in exchange for dollars, the nonreserve central bank would supply dollars and buy its own currency on the Forex, resulting in a balance of payments deficit. Thus for all nonreserve countries the Bretton Woods system functioned like a reserve currency standard.

One of the problems that typically arises with a reserve currency standard is the persistence of balance of payments (BoP) deficits. BoP deficits require a country to sell its dollar reserves on the Forex market. When these deficits are recurring and large, a country will eventually run out of reserves. When that happens, it will no longer be able to defend its fixed currency value. The likely outcome would be a devaluation, an action that runs counter to the goals of the system, namely to maintain exchange rate stability and to ward off inflationary tendencies.

To provide a safety valve for countries that may face this predicament, the International Monetary Fund (IMF) was established to provide temporary loans to countries to help maintain their fixed exchange rates. Each member country was required to maintain a quota of reserves with the IMF that would then be available to lend to those countries experiencing balance of payments difficulties.

Today the IMF maintains the same quota system and member countries enjoy the same privilege to borrow even though many are no longer maintaining a fixed exchange rate. Instead, many countries borrow from the IMF when they become unable to maintain payments on international debts. Go to the [IMF Factsheet](#) for more information about the current quota system. ^[2]

The Bretton Woods exchange rate system was an imperfect system that suffered under many strains during its history. Nonetheless, it did achieve fixed exchange rates among its members for almost thirty years. For a more detailed, though brief, account of the history of the system, see [Benjamin Cohen's article](#). ^[3]

We can learn much about the intended workings of the system by studying the system's collapse. The collapse occurred mostly because the United States would not allow its internal domestic policies to be compromised for the sake of the fixed exchange rate system. Here's a brief account of what happened. For a more detailed account, see Barry Eichengreen's *Globalizing Capital* ^[4] and Alfred Eckes's *A Search for Solvency*. ^[5]

Throughout the 1960s and early 1970s, there was excessive supply of U.S. dollars on Forex markets in exchange for other currencies. This put pressure on the U.S. dollar to depreciate and nonreserve currencies to appreciate. To maintain the fixed exchange rate, nonreserve countries were required to intervene on the private Forex. For example, the British central bank was required to run a balance of payments surplus, buy the excess dollars, and sell pounds on the private Forex market.

As was shown in [Chapter 12 "Policy Effects with Fixed Exchange Rates"](#), [Section 12.6 "Currency Crises and Capital Flight"](#), persistent balance of payments surpluses do not pose a long-term problem in the same way as BoP deficits. The British central bank had an unlimited capacity to “print” as many pounds as necessary to buy the oversupplied dollars on the Forex. However, persistently large BoP surpluses will result in an ever-increasing British money supply that will lead to inflationary effects eventually. Indeed, U.S. inflation was rising, especially in the late 1960s. Federal government spending was rising quickly—first, to finance the Vietnam War, and second, to finance new social spending arising out of President Johnson’s Great Society initiatives. Rather than increasing taxes to finance the added expenses, the United States resorted to expansionary monetary policy, effectively printing money to finance growing government budget deficits. This is also called “monetizing the debt.”

The immediate financial impact of a rising U.S. money supply was lower U.S. interest rates, leading to extra demand for foreign currency by investors to take advantage of the higher relative rates of return outside the United States. The longer-term impact of a rising U.S. money supply was inflation. As U.S. prices rose, U.S. goods became relatively more expensive relative to foreign goods, also leading to extra demand for foreign currency.

A look at the statistics of the 1960s belies this story of excessive monetary expansion and fiscal imprudence. Between 1959 and 1970, U.S. money supply growth and U.S. inflation were lower than in every other G-7 country. U.S. government budget deficits were also not excessively large. Nonetheless, as Eichengreen suggests, the G-7 countries could support a much higher inflation rate than the United States since they were starting from such low levels of GDP in the wake of post–World War II reconstruction. ^[6] Thus the U.S. policy required to maintain a stable exchange rate without intervention would correspond to an inflation rate that was considerably lower vis-à-vis the other G-7 countries.

In any case, to maintain the fixed exchange rate, non-U.S. countries’ central banks needed to run balance of payments surpluses. BoP surpluses involved a nonreserve central bank purchase of dollars and sale of

their own domestic currency. Thus the German, British, French, Japanese, et al., central banks bought up dollars in great quantities and at the same time continually increased their own domestic money supplies. One effect of the continual balance of payments surpluses was a subsequent increase in inflation caused by rising money supplies in the nonreserve countries. In effect, expansionary monetary policy in the United States, and its inflationary consequences, are exported to the nonreserve countries by virtue of the fixed exchange rate system. This effect was not welcomed by the nonreserve countries like Britain, France, and Germany.

A second effect of the continual balance of payments surpluses was a rising stock of dollar reserves. Nonreserve central banks held those reserves in the form of U.S. Treasury bills; thus, increasingly, U.S. government debt was held by foreign countries.

Although such BoP surpluses could technically continue indefinitely, the inflationary consequences in Europe and Japan and the rising dollar holdings abroad put the sustainability of the system into question. Ideally in a fixed exchange system, BoP surpluses will be offset with comparable BoP deficits over time, if the exchange rate is fixed at an appropriate (i.e., sustainable) level. Continual BoP surpluses, however, indicate that the sustainable exchange rate should be at a much lower U.S. dollar value if the surpluses are to be eliminated. Recognition of this leads observers to begin to expect a dollar devaluation.

If (or when) a dollar devaluation occurred, dollar asset holdings by foreigners—including the U.S. government Treasury bills comprising the reserves held by foreign central banks—would suddenly fall in value. In other words, foreign asset holders would lose a substantial amount of money if the dollar were devalued.

For private dollar investors there was an obvious response to this potential scenario: divest of dollar assets—that is, sell dollars and convert to pounds, deutschmarks, or francs. This response in the late 1960s and early 1970s contributed to the capital flight from the U.S. dollar, put added downward pressure on the U.S. dollar value, and led to even greater BoP surpluses by nonreserve central banks.

The nonreserve central banks, on the other hand, could not simply convert dollars to pounds or francs, as this would add to the pressure for a depreciating dollar. Further, it was their dollar purchases that were preventing the dollar depreciation from happening in the first place.

During the 1960 and early 1970s the amount of U.S. dollar reserves held by nonreserve central banks grew significantly, which led to what became known as the Triffin dilemma (dollar overhang). Robert Triffin

was a Belgian economist and Yale University professor who highlighted the problems related to dollar overhang. Dollar overhang occurred when the amount of U.S. dollar assets held by nonreserve central banks exceeded the total supply of gold in the U.S. Treasury at the exchange rate of \$35 per ounce. Dollar overhang occurred in the system by 1960 and continued to worsen throughout the decade of the 1960s. By 1971 foreign holdings of U.S. dollars stood at \$50 billion while U.S. gold reserves were valued at only \$15 billion. ^[7]

Under the Bretton Woods system, foreign central banks were allowed to exchange their dollars for gold at the rate of \$35 per ounce. Once the dollar overhang problem arose, it became conceivable that the United States could run out of its reserve asset—gold. Thus the potential for this type of BoP deficit could lead to speculation that the U.S. dollar would have to be devalued at some point in the future.

Now, if one expects the dollar will fall in value at some future date, then it would make sense to convert those dollars to something that may hold its value better; gold was the alternative asset. Throughout the 1950s and 1960s, foreign central banks did convert some of their dollar holdings to gold, but not all. In 1948, the United States held over 67 percent of the world's monetary gold reserves. By 1970, however, the U.S. gold holdings had fallen to just 16 percent of the world total. ^[8] In a gold exchange standard, the linkage between gold and the reserve currency is supposed to provide the constraint that prevents the reserve currency country from excessive monetary expansion and its subsequent inflationary effects. However, in the face of BoP deficits leading to a severe depletion of gold reserves, the United States had several adjustment options open.

One option was a devaluation of the dollar. However, this option was not easy to implement. The U.S. dollar could not be devalued with respect to the pound, the franc, or the yen since the United States did not fix its currency to them. (Recall that the other countries were fixed to the dollar.) Thus the only way to realize this type of dollar devaluation was for the other countries to “revalue” their currencies with respect to the dollar. The other “devaluation” option open to the United States was devaluation with respect to gold. In other words, the United States could raise the price of gold to \$40 or \$50 per ounce or more. However, this change would not change the fundamental conditions that led to the excess supply of dollars. At most, this devaluation would only reduce the rate at which gold flowed out to foreign central banks. Also, since U.S. gold holdings had fallen to very low levels by the early 1970s and since the dollar

overhang was substantial, the devaluation would have had to be extremely large to prevent the depletion of U.S. gold reserves.

The other option open to the United States was a change in domestic monetary policy to reduce the excess supply of dollars on the Forex. Recall that money supply increases were high to help finance rising federal deficit spending. A reversal of this policy would mean a substantial reduction in the growth of the money supply. If money supply increases were not available to finance the budget deficit, the government would have to resort to a much more unpopular method of financing—that is, raising taxes or reducing spending. The unpopularity and internal difficulty of such fiscal and monetary prudence led the United States to resort to other options. One suggestion made repeatedly by the United States was that the nonreserve countries should “revalue” their currencies to the dollar. However, their response was that the fundamental problem was not their fault; therefore, they shouldn’t be the ones to implement a solution. Instead, it was the United States that needed to change.

By the spring of 1971, the imbalances in the system reached crisis proportions. In April 1971, the Bundesbank (Germany’s central bank) purchased over \$3 billion to maintain the fixed exchange rate. In early May, it bought over \$2 billion in just two days to maintain the rate. Fearing inflation after such huge purchases, Germany decided to let its currency float to a new value, 8 percent higher than its previous fixed rate. Austria, Holland, and Switzerland quickly followed suit.^[9] Despite these revaluations, they were insufficient to stem the excess supply of dollars on the Forex. By August 1971, another major realignment seemed inevitable that substantially increased the pace of dollar capital flight. On August 15, 1971, President Nixon announced a bold plan for readjustment. The plan had three main aspects:

1. A 10 percent import surcharge on all imports was implemented. This tariff would remain in effect until a new international monetary order was negotiated.
2. Suspension of dollar convertibility into gold. Foreign central banks would no longer have the option to exchange dollars for gold with the U.S. central bank.
3. Wage and price controls were implemented to stem the rising U.S. inflation

The import surcharge meant that an extra 10 percent would be assessed over the existing import tariff. This was implemented to force other countries to the bargaining table where, presumably, they would agree to a multilateral revaluation of their currencies to the dollar. The tax was especially targeted to pressure Japan, which had not revalued its currency as others had done during the previous years, to

agree to a revaluation. The 10 percent import tax effectively raised the prices of foreign goods in U.S. markets and would have a similar effect as a 10 percent currency revaluation. The expectation was that the average revaluation necessary to bring the system into balance would be somewhat less than 10 percent, thus an 8 percent revaluation, say, would be less painful to exporters than a 10 percent import tax.

The suspension of dollar-gold convertibility was really the more significant change as it effectively ended the gold exchange standard and marked the death of the Bretton Woods system. With no obligation to exchange gold for dollars, the system essentially was changed to a reserve currency system. Previous constraints on the United States, caused when it runs a BoP deficit and loses gold reserves, were thus eliminated. There was no longer a possibility that the United States could run out of gold.

The wage and price controls, implemented for a ninety-day period, put added pressure on foreign exporters. Being forced to pay a 10 percent surcharge but not being allowed to raise prices meant they would not be allowed to push the tax increase onto consumers.

These three measures together resulted in a rapid renegotiation of the Bretton Woods system, culminating in the Smithsonian Agreement in December 1971. In this agreement, the nonreserve countries accepted an average 8 percent revaluation of their currencies to the dollar in return for the elimination of the import surcharge. They also enlarged the currency bands around the par values from 1 percent to 2.25 percent. By virtue of the revaluations, the dollar naturally became “devalued.” The United States also devalued dollars with respect to gold, raising the price to \$38 per ounce. However, since the United States did not agree to reopen the gold window, the change in the price of gold was meaningless.

More important, since the United States no longer needed to be concerned about a complete loss of gold reserves, the dollar overhang problem was “solved,” and it was free to continue its monetary growth and inflationary policies. During the following year, the United States did just that; within a short time, there arose renewed pressure for the dollar to depreciate from its new par values.

In the end, the Smithsonian Agreement extended the life of Bretton Woods for just over a year. By March 1973, a repeat of the severe dollar outflows in 1971 led to a suspension of Forex trading for almost three weeks. Upon reopening, the major currencies were floating with respect to each other. The Bretton Woods system was dead.

The hope at the time was that floating rates could be allowed for a time to let exchange rates move to their market equilibrium rates. Once stability to the exchange rates was restored, a new fixed exchange rate system could be implemented. However, despite negotiations, an agreement was never reached, and a unified international system of fixed exchange rates has never since been tried.

How Bretton Woods Was Supposed to Work

In theory, a gold-exchange standard can work to provide exchange rate stability and reduce inflationary tendencies. However, it will only work if the reserve currency country maintains prudent monetary policies and if countries follow the rules of the system.

For the nonreserve countries, their task was to avoid balance of payments deficits. These deficits would arise if they pursued excessive expansionary monetary policy. The lower interest rates and eventual inflation would lead to capital flight, creating pressure for the currency to depreciate. To avoid a devaluation, and hence to follow the fixity rule, the nonreserve country would have to contract its money supply to take pressure off its currency and to reverse the BoP deficits.

The problem that usually arises here is that contractionary monetary policies will raise interest rates and eliminate an important source of government budget financing, namely debt monetization (printing money). These changes are likely to result in an increase in taxes, a decrease in government spending, a contraction of the economy, and a loss of jobs. Thus following the rules of the system will sometimes be painful.

However, this was not the source of the Bretton Woods collapse. Instead, it was excessive monetary expansion by the reserve country, the United States. In this case, when the United States expanded its money supply, to finance budget deficits, it caused lower U.S. interest rates and had inflationary consequences. This led to increased demand for foreign currency by investors and traders. However, the United States was not obligated to intervene to maintain the fixed exchange rates since the United States was not fixing to anyone. Rather, it was the obligation of the nonreserve countries to intervene, buy dollars, sell their own currencies, and consequently run BoP surpluses. These surpluses resulted in the growing stock of dollar reserves abroad.

However, if the system had worked properly, foreign central banks would have cashed in their dollar assets for gold reserves long before the dollar overhang problem arose. With diminishing gold reserves, the United States would have been forced (i.e., if it followed the rules of the system) to reverse its

expansionary monetary practices. However, as mentioned above, contractionary monetary policies will likely result in higher taxes, lower government spending, a contraction of the economy, and a loss of jobs. Most countries faced with a choice between a policy that violates international monetary system rules and policies that maintain domestic vitality, even if only temporarily, will usually choose in favor of domestic interests. Of course, this choice will likely have negative longer-term consequences. Price and exchange rate stability will be compromised through these actions, and it will eliminate the benefits that would have come from expanded trade and international investments.

The gold exchange standard might have worked effectively if the United States and the others had committed themselves more intently on following the rules of the system. In the final analysis, what matters is the importance placed on maintaining the integrity of the cooperative fixed exchange rate system relative to the importance placed on domestic economic and political concerns. In the Bretton Woods case, domestic interests clearly dominated international interests.

The Bretton Woods experience should cast a shadow of doubt on fixed exchange rate systems more generally too. Every fixed exchange rate system requires countries to give up the independence of their monetary policy regardless of domestic economic circumstances. That this is difficult, or impossible, to do is demonstrated by the collapse of the Bretton Woods system.

KEY TAKEAWAYS

- The Bretton Woods system of exchange rates was set up as a gold exchange standard. The U.S. dollar was the reserve currency, and the dollar was fixed to gold at \$35 per ounce.
- The International Monetary Fund (IMF) was established to provide temporary loans to countries to help maintain their fixed exchange rates.
- U.S. expansionary monetary policy and its inflationary consequences were exported to the nonreserve countries by virtue of the fixed exchange rate system.
- The suspension of dollar-gold convertibility in 1971 effectively ended the gold exchange standard and marked the death of the Bretton Woods system.
- The Bretton Woods system collapsed in 1973 when all the currencies were allowed to float.
- A fixed exchange rate system requires nonreserve countries to give up the independence of their monetary policy regardless of domestic economic circumstances.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. The Bretton Woods exchange system was this type of exchange rate standard.
 - b. The price of gold in terms of dollars when the Bretton Woods system began.
 - c. This international organization was created to help countries with balance of payments problems in the Bretton Woods system.
 - d. The percentage of world monetary gold held by the United States in 1948.
 - e. The percentage of world monetary gold held by the United States in 1970.
 - f. The name given to the problem of excessive U.S. dollar holdings by foreign central banks.
 - g. This country’s suspension of dollar convertibility to gold eliminated an important constraint that allowed the system to function properly.
 - h. The name of the agreement meant to salvage the Bretton Woods system in the early 1970s.
 - i. The month and year in which the Bretton Woods system finally collapsed.

[1] More accurately, countries agreed to establish a “par value” exchange rate to the dollar and to maintain the exchange to within a 1 percent band around that par value. However, this detail is not an essential part of the story that follows.

[2] International Monetary Fund, Factsheet, “IMF Quotas,” <http://www.imf.org/external/np/exr/facts/quotas.htm>

[3] Benjamin Cohen, “Bretton Woods System,” <http://www.polsci.ucsb.edu/faculty/cohen/recent/bretton.html>.

[4] Barry Eichengreen, *Globalizing Capital: A History of the International Monetary System* (Princeton, NJ: Princeton University Press, 1996).

[5] Alfred E. Eckes Jr., *A Search for Solvency* (Austin, TX: University of Texas Press, 1975).

[6] Barry Eichengreen, *Globalizing Capital: A History of the International Monetary System* (Princeton, NJ: Princeton University Press, 1996), 131.

[7] Déclaration de Valéry Giscard d’Estaing à l’Assemblée nationale (12 mai 1971), dans *La politique étrangère de la France*. 1er semestre, octobre 1971, pp. 162–67. Translated by le CVCE [Declaration by Valerie Giscargd’Estaing to the National Assembly (May 12, 1971)].

[8] Alfred E. Eckes Jr., *A Search for Solvency* (Austin, TX: University of Texas Press, 1975), 238.

[9] Alfred E. Eckes Jr., *A Search for Solvency* (Austin, TX: University of Texas Press, 1975), 261.



Chapter 13: Fixed versus Floating Exchange Rates

One of the big issues in international finance is the appropriate choice of a monetary system. Countries can choose between a floating exchange rate system and a variety of fixed exchange rate systems. Which system is better is explored in this chapter. However, rather than suggesting a definitive answer, the chapter highlights the pros and cons of each type of system, arguing in the end that both systems can and have worked in some circumstances and failed in others.

13.1 Overview of Fixed versus Floating Exchange Rates

LEARNING OBJECTIVE

1. Preview the discussion about fixed versus floating exchange rate systems.

This chapter addresses what is perhaps the most important policy issue in international finance: to have fixed or floating exchange rates. The chapter focuses on three main features that affect the choice of system: volatility and risk, inflationary consequences, and monetary autonomy.

Volatility and risk refers to the tendency for exchange rates to change and the effect these changes have on the risk faced by traders and investors. Although in floating exchange systems volatility is a natural day-to-day occurrence, even in fixed exchange systems, devaluations or revaluations make volatility an issue.

This chapter compares the two systems in light of this issue.

Inflationary consequences are shown to be a major potential problem for countries with floating exchange rates. For many countries facing this problem, fixed exchange rate systems can provide relief. The section shows that the relationship between inflation and the exchange rate system is an important element in the choice of system.

Finally, monetary autonomy, and the ability to control the economy, is lost with the choice of fixed exchange rates. We discuss why this loss of autonomy can be problematic in some circumstances but not in others.

The chapter concludes by providing some answers to the policy question, “fixed or floating?”

KEY TAKEAWAYS

- Three main features affect the choice of the exchange rate system: volatility and risk, inflationary consequences, and monetary autonomy.
- The choice between fixed and floating exchange rates is one of the most important policy decisions in international finance.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”
 - a. The choice between these two types of exchange rate systems is an important policy debate in international finance.

- b. This term describing the extent to which an exchange rate may vary over time is an important consideration in the choice of exchange rate systems.
- c. This term describing the likelihood of losing money is an important consideration in the choice of exchange rate systems.
- d. Fixed exchange rates are sometimes chosen to mitigate this kind of general price problem.
- e. This term describing the ability to influence the economy through monetary policy is an important consideration in the choice of exchange rate systems.

13.2 Exchange Rate Volatility and Risk

LEARNING OBJECTIVE

1. Learn how exchange rate volatility raises risk for international traders and investors.

Probably the most important characteristic of alternative exchange rate systems is the feature used to describe them, namely fixed or floating. Fixed exchange rates, by definition, are not supposed to change. They are meant to remain fixed, preferably permanently. Floating rates float up and down and down and up from year to year, week to week, and minute by minute. What a floating exchange rate will be a year from now, or even a week from now, is often very difficult to predict.

Volatility represents the degree to which a variable changes over time. The larger the magnitude of a variable change, or the more quickly it changes over time, the more volatile it is.

Since fixed exchange rates are not supposed to change—by definition—they have no volatility. Please note the cautious wording because fixed exchange rates are quite frequently devalued or revalued, implying that they can and do indeed change. However, we will explore this issue in more detail later. A floating exchange rate may or may not be volatile depending on how much it changes over time. However, since floating exchange rates are free to change, they are usually expected to be more volatile.

Volatile exchange rates make international trade and investment decisions more difficult because volatility increases exchange rate risk. Exchange rate risk refers to the potential to lose money because of a change in the exchange rate. Below are two quick examples of how traders and investors may lose money when the exchange rate changes.

Exchange Rate Risk for Traders

First consider a business that imports soccer balls into the United States. Suppose one thousand soccer balls purchased from a supplier in Pakistan costs 300,000 Pakistani rupees. At the current exchange rate of 60 Rs/\$, it will cost the importer \$5,000 dollars or \$5 per soccer ball. The importer determines that transportation, insurance, advertising, and retail costs will run about \$5 per soccer ball. If the competitive market price for this type of soccer ball is \$12, he will make a \$2 profit per ball if all balls are sold.

Suppose the shipment is scheduled to occur in three months and that payment for the shipment need not be made until that time. Let's assume the importer waits to convert currency until the payment is made and that in three months' time the Pakistani rupee has appreciated to a new value of 55 Rs/\$. The shipment cost in rupees remains the same at Rs 300,000, but the dollar value of the shipment rises to

\$5,454 or \$5.45 per soccer ball. Assuming the same \$5 of extra costs and a \$12 final sale price, the importer will now make only \$1.45 profit per soccer ball, if all balls are sold. While this is still a profit, it is about 25 percent less than expected when the decision to purchase was made three months before.

This is an example of the risk an importer faces because of a change in the currency value. Of course, it is true that the currency value could have changed in the opposite direction. Had the rupee value risen to 65 Rs/\$, the shipment value would have cost just \$4,615, or \$4.62 per ball, generating a profit of \$2.38 per soccer ball. In this case, the currency moves in the importer's favor. Thus a volatile exchange rate will sometimes lead to greater losses than expected, and at other times, to greater gains.

There are several methods to protect oneself from this type of currency risk. The importer could have exchanged currency at the time the deal was struck and held his 300,000 rupees in a Pakistani bank until payment is made. However, this involves a substantial additional opportunity cost since the funds must be available beforehand and become unusable while they are held in a Pakistani bank account. Alternatively, the importer may be able to find a bank willing to write a forward exchange contract, fixing an exchange rate today for an exchange to be made three months from now.

In any case, it should be clear that exchange rate fluctuations either increase the risk of losses relative to plans or increase the costs to protect against those risks.

Exchange Rate Risk for Investors

Volatile exchange rates also create exchange rate risk for international investors. Consider the following example. Suppose in October 2004, a U.S. resident decides to invest (i.e., save) \$10,000 for the next year. Given that the U.S. dollar had been weakening with respect to the Danish krone for several years and since the interest rate on a money market deposit was slightly higher in Denmark at 2.25 percent compared to the 1.90 percent return in the United States, the investor decides to put the \$10,000 into the Danish account. At the time of the deposit, the exchange rate sits at 5.90 kr/\$. In October 2005, the depositor cashes in and converts the money back to U.S. dollars. The exchange rate in October 2005 was 6.23 kr/\$. To determine the return on the investment we can apply the rate of return formula derived in [Chapter 4 "Foreign Exchange Markets and Rates of Return", Section 4.3 "Calculating Rate of Returns on International Investments"](#) and [Chapter 4 "Foreign Exchange Markets and Rates of Return", Section 4.4 "Interpretation of the Rate of Return Formula"](#):

$$\begin{aligned}
RoR_{kr} &= i_{kr} + (1 + i_{kr}) \frac{\frac{1}{E_{kr/\$}^{2005}} - \frac{1}{E_{kr/\$}^{2004}}}{\frac{1}{E_{kr/\$}^{2004}}} \\
&= .0225 + (1 + .0225) \frac{\frac{1}{6.23} - \frac{1}{5.90}}{\frac{1}{5.90}} \\
&= -0.0317 \times 100 = -3.17\%
\end{aligned}$$

The rate of return works out to be negative, which means that instead of making money on the foreign deposit, this investor actually loses \$317. Had he deposited the \$10,000 in a U.S. account, he would have had a guaranteed return of 1.90 percent, earning him \$190 instead.

By depositing in a foreign account, the depositor subjected himself to exchange rate risk. The dollar unexpectedly appreciated during the year, resulting in a loss. Had the dollar remain fixed in value during that same time, the foreign return would have been 2.25 percent, which is larger than that obtained in the United States.

Thus fluctuating exchange rates make it more difficult for investors to know the best place to invest. One cannot merely look at what the interest rate is across countries but must also speculate about the exchange rate change. Make the wrong guess about the exchange rate movement and one could lose a substantial amount of money.

There are some ways to hedge against exchange rate risk. For example, with short-term deposits, an investor can purchase a forward contract or enter a futures market. In these cases, the investor would arrange to sell Danish krone in the future when the deposit is expected to be converted back to dollars. Since the future exchange rate is predetermined on such a contract, the rate of return is guaranteed as well. Thus the risk of floating exchange rates can be reduced. However, for long-term investment such as foreign direct investment, these types of arrangements are more difficult and costly to implement.

Volatility and the Choice of Exchange Rate System

On the face of it, floating exchange rates would appear to be riskier than fixed rates since they are free to change regularly. For this reason, countries may choose fixed exchange rates to reduce volatility and thus to encourage international trade and investment.

The problem with this perception is that it has not worked out this way in practice. A 2004 International Monetary Fund (IMF) study ^[1] notes that on average, during the 1970s, 1980s, and 1990s, the volatility of fixed exchange rates was approximately the same as that of floating rates. There are two reasons this can occur. First, a currency fixed to another reserve currency will continue to float against other currencies. Thus when China pegged its currency to the U.S. dollar, it continued to float with the dollar vis-à-vis the euro. Second, it is common for fixed currencies to be devalued or revalued periodically, sometimes dramatically. When this happens, the effects of volatility are concentrated in a very short time frame and can have much larger economic impacts.

The second thing noted by this study is that volatility had only a small effect on bilateral international trade flows, suggesting that the choice of exchange rate system on trade flows may be insignificant. However, the study does not consider the effects of volatility on international investment decisions. Other studies do show a negative relationship between exchange rate volatility and foreign direct investment. But if these results were true and fixed exchange rates are just as volatile as floating rates, then there is no obvious exchange system “winner” in terms of the effects on volatility. Nevertheless, volatility of exchange rate systems remains something to worry about and consider in the choice of exchange rate systems.

KEY TAKEAWAYS

- Volatile exchange rates make international trade and investment decisions more difficult because volatility increases exchange rate risk.
- Volatile exchange rates can quickly and significantly change the expected rates of return on international investments.
- Volatile exchange rates can quickly and significantly change the profitability of importing and exporting.
- Despite the expectation that fixed exchange rates are less volatile, a 2004 IMF study notes that on average, during the 1970s, 1980s, and 1990s, the volatility of fixed exchange rates was approximately the same as that of floating rates.

EXERCISES

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is “a tax on imports,” then the correct question is “What is a tariff?”

- a. This term describes the unpredictable movement of an exchange rate.
- b. Of *increase, decrease, or no change*, the effect on an importer's profits if he waits to exchange currency and the foreign currency rises in value vis-à-vis the domestic currency in the meantime.
- c. Of *increase, decrease, or no change*, the effect on an importer's profits if he waits to exchange currency and the domestic currency falls in value vis-à-vis the foreign currency in the meantime.
- d. Of *increase, decrease, or no change*, the effect on an investor's rate of return on foreign assets if the foreign currency rises in value more than expected vis-à-vis the domestic currency after purchasing a foreign asset.
- e. Of *increase, decrease, or no change*, the effect on an investor's rate of return on foreign assets if the foreign currency falls in value less than expected vis-à-vis the domestic currency after purchasing a foreign asset.

Between 2007 and 2008, the U.S. dollar depreciated significantly against the euro. Answer the following questions. Do not use graphs to explain. A one- or two-sentence verbal explanation is sufficient.

- a. Explain whether European businesses that compete against U.S. imports gain or lose because of the currency change.
- b. Explain whether European businesses that export their products to the United States gain or lose because of the currency change.
- c. Explain whether European investors who purchased U.S. assets one year ago gain or lose because of the currency change.

[1] Peter Clark, Natalia Tamirisa, and Shang-Jin Wei, "Exchange Rate Volatility and Trade Flows—Some New Evidence," International Monetary Fund, May 2004[0], <http://www.imf.org/external/np/res/exrate/2004/eng/051904.pdf>.

13.3 Inflationary Consequences of Exchange Rate Systems

LEARNING OBJECTIVE

1. Learn how a fixed exchange rate system can be used to reduce inflation.

One important reason to choose a system of fixed exchange rates is to try to dampen inflationary tendencies. Many countries have (over time) experienced the following kind of situation. The government faces pressure from constituents to increase spending and raise transfer payments, which it does.

However, it does not finance these expenditure increases with higher taxes since this is very unpopular. This leads to a sizeable budget deficit that can grow over time. When the deficits grow sufficiently large, the government may become unable to borrow additional money without raising the interest rate on bonds to unacceptably high levels. An easy way out of this fiscal dilemma is to finance the public deficits with purchases of bonds by the country's central bank. In this instance, a country will be financing the budget deficit by monetizing the debt, also known as printing money. New money means an increase in the domestic money supply, which will have two effects.

The short-term effect will be to lower interest rates. With free capital mobility, a reduction in interest rates will make foreign deposits relatively more attractive to investors and there is likely to be an increase in supply of domestic currency on the foreign exchange market. If floating exchange rates are in place, the domestic currency will depreciate with respect to other currencies. The long-term effect of the money supply increase will be inflation, if the gross domestic product (GDP) growth does not rise fast enough to keep up with the increase in money. Thus we often see countries experiencing a rapidly depreciating currency together with a rapid inflation rate. A good example of this trend was seen in Turkey during the 1980s and 1990s.

One effective way to reduce or eliminate this inflationary tendency is to fix one's currency. A fixed exchange rate acts as a constraint that prevents the domestic money supply from rising too rapidly. Here's how it works.

Suppose a country fixes its currency to another country—a reserve country. Next, imagine that the same circumstances from the story above begin to occur. Rising budget deficits lead to central bank financing, which increases the money supply of the country. As the money supply rises, interest rates decrease and investors begin to move savings abroad, and so there is an increase in supply of the domestic currency on the foreign exchange market. However, now the country must prevent the depreciation of the currency

since it has a fixed exchange rate. This means that the increase in supply of domestic currency by private investors will be purchased by the central bank to balance supply and demand at the fixed exchange rate. The central bank will be running a balance of payments deficit in this case, which will result in a reduction in the domestic money supply.

This means that as the central bank prints money to finance the budget deficit, it will simultaneously need to run a balance of payments deficit, which will soak up domestic money. The net effect on the money supply should be such as to maintain the fixed exchange rate with the money supply rising proportionate to the rate of growth in the economy. If the latter is true, there will be little to no inflation occurring. Thus a fixed exchange rate system can eliminate inflationary tendencies.

Of course, for the fixed exchange rate to be effective in reducing inflation over a long period, it will be necessary that the country avoid devaluations. Devaluations occur because the central bank runs persistent balance of payments deficits and is about to run out of foreign exchange reserves. Once the devaluation occurs, the country will be able to support a much higher level of money supply that in turn will have a positive influence on the inflation rate. If devaluations occur frequently, then it is almost as if the country is on a floating exchange rate system in which case there is no effective constraint on the money supply and inflation can again get out of control.

To make the fixed exchange rate system more credible and to prevent regular devaluation, countries will sometime use a currency board arrangement. With a currency board, there is no central bank with discretion over policy. Instead, the country legislates an automatic exchange rate intervention mechanism that forces the fixed exchange rate to be maintained.

For even more credibility, countries such as Ecuador and El Salvador have dollarized their currencies. In these cases, the country simply uses the other country's currency as its legal tender and there is no longer any ability to print money or let one's money supply get out of control.

However, in other circumstances fixed exchange rates have resulted in more, rather than less, inflation. In the late 1960s and early 1970s, much of the developed world was under the Bretton Woods system of fixed exchange rates. The reserve currency was the U.S. dollar, meaning that all other countries fixed their currency value to the U.S. dollar. When rapid increases in the U.S. money supply led to a surge of inflation in the United States, the other nonreserve countries like Britain, Germany, France, and Japan were forced to run balance of payments surpluses to maintain their fixed exchange rates. These BoP surpluses raised

these countries' money supplies, which in turn led to an increase in inflation. Thus, in essence, U.S. inflation was exported to many other countries because of the fixed exchange rate system.

The lesson from these stories is that sometimes fixed exchange rates tend to lower inflation while at other times they tend to increase it. The key is to fix your currency to something that is not likely to rise in value (inflate) too quickly. In the 1980 and 1990s, when the European Exchange Rate Mechanism (ERM) was in place, countries were in practice fixed to the German deutschmark. Since the German central bank was probably the least prone to inflationary tendencies, all other European countries were able to bring their inflation rates down substantially due to the ERM system. However, had the countries fixed to the Italian lira, inflation may have been much more rapid throughout Europe over the two decades.

Many people propose a return to the gold standard precisely because it fixes a currency to something that is presumed to be steadier in value over time. Under a gold standard, inflation would be tied to the increase in monetary gold stocks. Because gold is strictly limited in physical quantity, only a limited amount can be discovered and added to gold stocks each year, Thus inflation may be adequately constrained. But because of other problems with a return to gold as the monetary support, a return to this type of system seems unlikely.

KEY TAKEAWAYS

- A fixed exchange rate can act as a constraint to prevent the domestic money supply from rising too rapidly (i.e., if the reserve currency country has noninflationary monetary policies).
- Adoption of a foreign country's currency as your own is perhaps the most credible method of fixing the exchange rate.
- Sometimes, as in the Bretton Woods system, a fixed exchange rate system leads to more inflation. This occurs if the reserve currency country engages in excessively expansionary monetary policy.
- A gold standard is sometimes advocated precisely because it fixes a currency to something (i.e., gold) that is presumed to be more steady in value over time.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is "a tax on imports," then the correct question is "What is a tariff?"

- a. Hyperactivity in this aggregate variable is often a reason countries turn to fixed exchange rates.
- b. If a country fixes its exchange rate, it effectively imports this policy from the reserve country.
- c. A country fixing its exchange rate can experience high inflation if this country also experiences high inflation.
- d. Of *relatively low* or *relatively high*, to limit inflation a country should choose to fix its currency to a country whose money supply growth is this.
- e. The name for the post–World War II exchange rate system that demonstrated how countries fixing their currency could experience high inflation.

13.4 Monetary Autonomy and Exchange Rate Systems

LEARNING OBJECTIVE

1. Learn how floating and fixed exchange rate systems compare with respect to monetary autonomy.

Monetary autonomy refers to the independence of a country's central bank to affect its own money supply and conditions in its domestic economy. In a floating exchange rate system, a central bank is free to control the money supply. It can raise the money supply when it wishes to lower domestic interest rates to spur investment and economic growth. By doing so it may also be able to reduce a rising unemployment rate. Alternatively, it can lower the money supply, to raise interest rates and to try to choke off excessive growth and a rising inflation rate. With monetary autonomy, monetary policy is an available tool the government can use to control the performance of the domestic economy. This offers a second lever of control, beyond fiscal policy.

In a fixed exchange rate system, monetary policy becomes ineffective because the fixity of the exchange rate acts as a constraint. As shown in [Chapter 12 "Policy Effects with Fixed Exchange Rates"](#), [Section 12.2 "Monetary Policy with Fixed Exchange Rates"](#), when the money supply is raised, it will lower domestic interest rates and make foreign assets temporarily more attractive. This will lead domestic investors to raise demand for foreign currency that would result in a depreciation of the domestic currency, if a floating exchange rate were allowed. However, with a fixed exchange rate in place, the extra demand for foreign currency will need to be supplied by the central bank, which will run a balance of payments deficit and buy up its own domestic currency. The purchases of domestic currency in the second stage will perfectly offset the increase in money in the first stage, so that no increase in money supply will take place.

Thus the requirement to keep the exchange rate fixed constrains the central bank from using monetary policy to control the economy. In other words, the central bank loses its autonomy or independence.

In substitution, however, the government does have a new policy lever available in a fixed system that is not available in a floating system, namely exchange rate policy. Using devaluations and revaluations, a country can effectively raise or lower the money supply level and affect domestic outcomes in much the same way as it might with monetary policy. However, regular exchange rate changes in a fixed system can destroy the credibility in the government to maintain a truly "fixed" exchange rate. This in turn could

damage the effect fixed exchange rates might have on trade and investment decisions and on the prospects for future inflation.

Nonetheless, some countries do apply a semifixed or semifloating exchange rate system. A crawling peg, in which exchange rates are adjusted regularly, is one example. Another is to fix the exchange rate within a band. In this case, the central bank will have the ability to control the money supply, up or down, within a small range, but will not be free to make large adjustments without breaching the band limits on the exchange rate. These types of systems provide an intermediate degree of autonomy for the central bank. If we ask which is better, monetary autonomy or a lack of autonomy, the answer is mixed. In some situations, countries need, or prefer, to have monetary autonomy. In other cases, it is downright dangerous for a central bank to have autonomy. The determining factor is whether the central bank can maintain prudent monetary policies. If the central bank can control money supply growth such that it has only moderate inflationary tendencies, then monetary autonomy can work well for a country. However, if the central bank cannot control money supply growth, and if high inflation is a regular occurrence, then monetary autonomy is not a blessing.

One of the reasons Britain has decided not to join the eurozone is because it wants to maintain its monetary autonomy. By joining the eurozone, Britain would give up its central bank's ability to control its domestic money supply since euros would circulate instead of British pounds. The amount of euros in circulation is determined by the European Central Bank (ECB). Although Britain would have some input into money supply determinations, it would clearly have much less influence than it would for its own currency. The decisions of the ECB would also reflect the more general concerns of the entire eurozone rather than simply what might be best for Britain. For example, if there are regional disparities in economic growth (e.g., Germany, France, etc., are growing rapidly, while Britain is growing much more slowly), the ECB may decide to maintain a slower money growth policy to satisfy the larger demands to slow growth and subsequent inflation in the continental countries. The best policy for Britain alone, however, might be a more rapid increase in money supply to help stimulate its growth. If Britain remains outside the eurozone, it remains free to determine the monetary policies it deems best for itself. If it joins the eurozone, it loses its monetary autonomy.

In contrast, Argentina suffered severe hyperinflations during the 1970s and 1980s. Argentina's central bank at the time was not independent of the rest of the national government. To finance large government

budget deficits, Argentina resorted to running the monetary printing presses, which led to the severe hyperinflations. In this case, monetary autonomy was a curse, not a blessing.

In an attempt to restrain the growth of the money supply, Argentina imposed a currency board in 1992. A currency board is a method of fixing one's exchange rate with a higher degree of credibility. By legislating mandatory automatic currency interventions, a currency board operates in place of a central bank and effectively eliminates the autonomy that previously existed. Although Argentina's currency board experiment collapsed in 2002, for a decade Argentina experienced the low inflation that had been so elusive during previous decades.

KEY TAKEAWAYS

- Monetary autonomy refers to the independence of a country's central bank to affect its own money supply and, through that, conditions in its domestic economy.
- In a fixed exchange rate system, a country maintains the same interest rate as the reserve country. As a result, it loses the ability to use monetary policy to control outcomes in its domestic economy.
- In a floating exchange rate system, a country can adjust its money supply and interest rates freely and thus can use monetary policy to control outcomes in its domestic economy.
- If the central bank can control money supply growth such that it has only moderate inflationary tendencies, then monetary autonomy (floating) can work well for a country. However, if the central bank cannot control money supply growth, and if high inflation is a regular occurrence, then monetary autonomy (floating) will not help the country.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is "a tax on imports," then the correct question is "What is a tariff?"
 - a. The term describing the relationship between the U.S. Federal Reserve Board and the U.S. government that has quite likely contributed to the low U.S. inflation rate in the past two decades.
 - b. In part to achieve this, the United Kingdom has refused to adopt the euro as its currency.

- c. Of *fixed* or *floating*, in this system a country can effectively set its money supply at any level desired.
- d. Of *fixed* or *floating*, in this system a country's interest rate will always be the same as the reserve country's.
- e. Of *fixed* or *floating*, in this system a country can control inflation by maintaining moderate money supply growth.

13.5 Which Is Better: Fixed or Floating Exchange Rates?

LEARNING OBJECTIVE

1. Learn the pros and cons of both floating and fixed exchange rate systems.

The exchange rate is one of the key international aggregate variables studied in an international finance course. It follows that the choice of exchange rate system is one of the key policy questions.

Countries have been experimenting with different international payment and exchange systems for a very long time. In early history, all trade was barter exchange, meaning goods were traded for other goods. Eventually, especially scarce or precious commodities, for example gold and silver, were used as a medium of exchange and a method for storing value. This practice evolved into the metal standards that prevailed in the nineteenth and early twentieth centuries. By default, since gold and silver standards imply fixed exchange rates between countries, early experience with international monetary systems was exclusively with fixed systems. Fifty years ago, international textbooks dealt almost entirely with international adjustments under a fixed exchange rate system since the world had had few experiences with floating rates.

That experience changed dramatically in 1973 with the collapse of the Bretton Woods fixed exchange rate system. At that time, most of the major developed economies allowed their currencies to float freely, with exchange values being determined in a private market based on supply and demand, rather than by government decree. Although when Bretton Woods collapsed, the participating countries intended to resurrect a new improved system of fixed exchange rates, this never materialized. Instead, countries embarked on a series of experiments with different types of fixed and floating systems.

For example, the European Economic Community (now the EU) implemented the exchange rate mechanism in 1979, which fixed each other's currencies within an agreed band. These currencies continued to float with non-EU countries. By 2000, some of these countries in the EU created a single currency, the euro, which replaced the national currencies and effectively fixed the currencies to each other immutably.

Some countries have fixed their currencies to a major trading partner, and others fix theirs to a basket of currencies comprising several major trading partners. Some have implemented a crawling peg, adjusting the exchange values regularly. Others have implemented a dirty float where the currency value is mostly determined by the market but periodically the central bank intervenes to push the currency value up or

down depending on the circumstances. Lastly, some countries, like the United States, have allowed an almost pure float with central bank interventions only on rare occasions.

Unfortunately, the results of these many experiments are mixed. Sometimes floating exchange rate systems have operated flawlessly. At other times, floating rates have changed at breakneck speed, leaving traders, investors, and governments scrambling to adjust to the volatility. Similarly, fixed rates have at times been a salvation to a country, helping to reduce persistent inflation. At other times, countries with fixed exchange rates have been forced to import excessive inflation from the reserve country.

No one system has operated flawlessly in all circumstances. Hence, the best we can do is to highlight the pros and cons of each system and recommend that countries adopt that system that best suits its circumstances.

Probably the best reason to adopt a fixed exchange rate system is to commit to a loss in monetary autonomy. This is necessary whenever a central bank has been independently unable to maintain prudent monetary policy, leading to a reasonably low inflation rate. In other words, when inflation cannot be controlled, adopting a fixed exchange rate system will tie the hands of the central bank and help force a reduction in inflation. Of course, in order for this to work, the country must credibly commit to that fixed rate and avoid pressures that lead to devaluations. Several methods to increase the credibility include the use of currency boards and complete adoption of the other country's currency (i.e., dollarization or euroization). For many countries, for at least a period, fixed exchange rates have helped enormously to reduce inflationary pressures.

Nonetheless, even when countries commit with credible systems in place, pressures on the system sometimes can lead to collapse. Argentina, for example, dismantled its currency board after ten years of operation and reverted to floating rates. In Europe, economic pressures have led to some "talk" about giving up the euro and returning to national currencies. The Bretton Woods system lasted for almost thirty years but eventually collapsed. Thus it has been difficult to maintain a credible fixed exchange rate system for a long period.

Floating exchange rate systems have had a similar colored past. Usually, floating rates are adopted when a fixed system collapses. At the time of a collapse, no one really knows what the market equilibrium exchange rate should be, and it makes some sense to let market forces (i.e., supply and demand) determine the equilibrium rate. One of the key advantages of floating rates is the autonomy over monetary

policy that it affords a country's central bank. When used wisely, monetary policy discretion can provide a useful mechanism for guiding a national economy. A central bank can inject money into the system when the economic growth slows or falls, or it can reduce money when excessively rapid growth leads to inflationary tendencies. Since monetary policy acts much more rapidly than fiscal policy, it is a much quicker policy lever to use to help control the economy.

Prudent Monetary and Fiscal Policies

Interestingly, monetary autonomy is both a negative trait for countries choosing fixed rates to rid themselves of inflation and a positive trait for countries wishing have more control over their domestic economies. It turns out that the key to success in both fixed and floating rates hinges on prudent monetary and fiscal policies. Fixed rates are chosen to force a more prudent monetary policy, while floating rates are a blessing for those countries that already have a prudent monetary policy.

A prudent monetary policy is most likely to arise when two conditions are satisfied. First, the central bank, and the decisions it makes, must be independent of the national government that makes government-spending decisions. If it is not, governments have always been inclined to print money to finance government-spending projects. This has been the primary source of high inflation in most countries. The second condition is a clear guideline for the central bank's objective. Ideally, that guideline should broadly convey a sense that monetary policy will satisfy the demands of a growing economy while maintaining sufficiently low inflation. When these conditions are satisfied, autonomy for a central bank and floating exchange rates will function well. Mandating fixed exchange rates can also work well, but only if the system can be maintained and if the country to which the other country fixes its currency has a prudent monetary policy.

Both systems can experience great difficulties if prudent fiscal policies are not maintained. This requires governments to maintain a balanced budget over time. Balance over time does not mean balance in every period but rather that periodic budget deficits should be offset with periodic budget surpluses. In this way, government debt is managed and does not become excessive. It is also critical that governments do not overextend themselves in terms of international borrowing. International debt problems have become the bane of many countries.

Unfortunately, most countries have been unable to accomplish this objective. Excessive government deficits and borrowing are the norm for both developing and developed countries. When excessive

borrowing needs are coupled with a lack of central bank independence, tendencies to hyperinflations and exchange rate volatility are common. When excessive borrowing is coupled with an independent central bank and a floating exchange rate, exchange rate volatility is also common.

Stability of the international payments system then is less related to the type of exchange rate system chosen than it is to the internal policies of the individual countries. Prudent fiscal and monetary policies are the keys.

With prudent domestic policies in place, a floating exchange rate system will operate flawlessly. Fixed exchange systems are most appropriate when a country needs to force itself to a more prudent monetary policy course.

KEY TAKEAWAYS

- Historically, no one system has operated flawlessly in all circumstances.
- Probably the best reason to adopt a fixed exchange rate system is whenever a central bank has been independently unable to maintain prudent monetary policy, leading to a reasonably low inflation rate.
- Probably the best reason to adopt a floating exchange rate system is whenever a country has more faith in the ability of its own central bank to maintain prudent monetary policy than any other country's ability.
- The key to success in both fixed and floating rates hinges on prudent monetary and fiscal policies. Fixed rates are chosen to force a more prudent monetary policy; floating rates are a blessing for those countries that already have a prudent monetary policy.

EXERCISE

1. **Jeopardy Questions.** As in the popular television game show, you are given an answer to a question and you must respond with the question. For example, if the answer is "a tax on imports," then the correct question is "What is a tariff?"
 - a. Of *fixed* or *floating*, this system is often chosen by countries that in their recent history experienced very high inflation.
 - b. Of *fixed* or *floating*, this system is typically chosen when a country has confidence in its own ability to conduct monetary policy effectively.

- c. Of *fixed* or *floating*, this system is typically chosen when a country has little confidence in its own ability to conduct monetary policy effectively.
- d. Of *fixed* or *floating*, this system is sometimes rejected because it involves the loss of national monetary autonomy.
- e. Of *fixed* or *floating*, this system is sometimes chosen because it involves the loss of national monetary autonomy.

