

CHAPTER 5

Interest Rate Parity

Interest rate parity is one of the most important theories in international finance because it is probably the best way to explain how exchange rate values are determined and why they fluctuate as they do. Most of the international currency exchanges occur for investment purposes, and therefore understanding the prime motivations for international investment is critical.

The chapter applies the rate of return formula developed in Chapter 4 and shows how changes in the determinants of the rate of return on assets affect investor behavior on the foreign exchange market, which in turn affects the value of the exchange rate. The model is described in two different ways: first, using simple supply and demand curves; and second, using a rate of return diagram that will be used later with the development of a more elaborate macro model of the economy.

1. OVERVIEW OF INTEREST RATE PARITY

LEARNING OBJECTIVES

1. Define the interest rate parity condition.
2. Learn the asset approach to exchange rate determination.

Interest rate parity (IRP) is a theory used to explain the value and movements of exchange rates. It is also known as the asset approach to exchange rate determination. The **interest rate parity theory** assumes that the actions of international investors—motivated by cross-country differences in rates of return on comparable assets—induce changes in the spot exchange rate. In another vein, IRP suggests that transactions on a country's financial account affect the value of the exchange rate on the foreign exchange (Forex) market. This contrasts with the purchasing power parity theory, which assumes that the actions of importers and exporters, whose transactions are recorded on the current account, induce changes in the exchange rate.

1.1 Interest Rate Parity Condition

Interest rate parity refers to a condition of equality between the rates of return on comparable assets between two countries. The term is somewhat of a misnomer on the basis of how it is being described here, as it should really be called rate of return parity. The term developed in an era when the world was in a system of fixed exchange rates. Under those circumstances, and as will be demonstrated in a later chapter, rate of return parity did mean the equalization of interest rates. However, when exchange rates can fluctuate, interest rate parity becomes rate of return parity, but the name was never changed.

In terms of the rates of return formulas developed in Chapter 4, interest rate parity holds when the rate of return on dollar deposits is just equal to the expected rate of return on British deposits—that is, when

$$RoR_{\$} = RoR_{\pounds}.$$

Plugging in the above formula yields

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

interest rate parity (IRP)

A condition in which the rates of return on comparable assets in two countries are equal.

interest rate parity theory

A theory of exchange rate determination based on investor motivations in which equilibrium is described by the interest rate parity condition.

This condition is often simplified in many textbooks by dropping the final term in which the British interest rate is multiplied by the exchange rate change. The logic is that the final term is usually very small especially when interest rates are low. The *approximate version* of the IRP condition then is

$$i_{\$} - i_{\pounds} = \frac{E_{\$/\pounds}^c - E_{\$/\pounds}}{E_{\$/\pounds}}.$$

One should be careful, however. The approximate version would not be a good approximation when interest rates in a country are high. For example, back in 1997, short-term interest rates were 60 percent per year in Russia and 75 percent per year in Turkey. With these interest rates, the approximate formula would not give an accurate representation of rates of return.

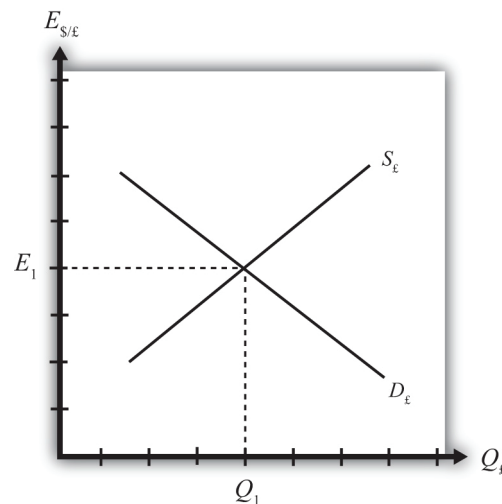
1.2 Interest Rate Parity Theory

Investor behavior in asset markets that results in interest parity can also explain why the exchange rate may rise and fall in response to market changes. In other words, interest parity can be used to develop a model of exchange rate determination. This is known as the asset approach, or the interest rate parity model.

The first step is to reinterpret the rate of return calculations described previously in more general (aggregate) terms. Thus instead of using the interest rate on a one-year certificate of deposit (CD), we will interpret the interest rates in the two countries as the average interest rates that currently prevail. Similarly, we will imagine that the expected exchange rate is the average expectation across many different individual investors. The rates of return then are the average expected rates of return on a wide variety of assets between two countries.

Next, we imagine that investors trade currencies in the foreign exchange (Forex) market. Each day, some investors come to a market ready to supply a currency in exchange for another, while others come to demand currency in exchange for another.

FIGURE 5.1 The Forex for British Pounds



Consider the market for British pounds (£) in New York depicted in Figure 5.1. We measure the supply and demand of pounds along the horizontal axis and the price of pounds (i.e., the exchange rate $E_{\$/\pounds}$) on the vertical axis. Let S_{\pounds} represent the supply of pounds in exchange for dollars at all different exchange rates that might prevail. The supply is generally by British investors who demand dollars to purchase dollar denominated assets. However, supply of pounds might also come from U.S. investors who decide to convert previously acquired pound currency. Let D_{\pounds} the demand for pounds in exchange for dollars at all different exchange rates that might prevail. The demand is generally by U.S. investors who supply dollars to purchase pound-denominated assets. Of course, demand may also come from British investors who decide to convert previously purchased dollars. Recall that

$$RoR_{\pounds} = i_{\pounds} + (1 + i_{\pounds}) \frac{E_{\$/\pounds}^c - E_{\$/\pounds}}{E_{\$/\pounds}},$$

which implies that as $E_{\$/\pounds}$ rises, RoR_{\pounds} falls. This means that British investors would seek to supply more pounds at higher pound values but U.S. investors would demand fewer pounds at higher pound values. This explains why the supply curve slopes upward and the demand curve slopes downward.

The intersection of supply and demand specifies the equilibrium exchange rate (E_1) and the quantity of pounds (Q_1) traded in the market. When the Forex is at equilibrium, it must be that interest rate parity is satisfied. This is true because the violation of interest rate parity will cause investors to shift funds from one country to another, thereby causing a change in the exchange rate. This process is described in more detail in Chapter 5, Section 2.

KEY TAKEAWAYS

- Interest rate parity in a floating exchange system means the equalization of rates of return on comparable assets between two different countries.
- Interest rate parity is satisfied when the foreign exchange market is in equilibrium, or in other words, IRP holds when the supply of currency is equal to the demand in the Forex.

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 theory of exchange rate determination is also known as the asset approach.
 - b. The name of the condition in which rates of return on comparable assets in different countries are equal.
 - c. Of *greater, less, or equal*, this is how the supply of pounds compares to the demand for pounds in the foreign exchange market when interest rate parity holds.

2. COMPARATIVE STATICS IN THE IRP THEORY

LEARNING OBJECTIVE

1. Learn how changes in interest rates and expected exchange rates can influence international investment decisions and affect the exchange rate value.

Comparative statics refers to an exercise in a model that assesses how changes in an exogenous variable will affect the values of the endogenous variables. The endogenous variables are those whose values are determined in the equilibrium. In the IRP model, the endogenous variables are the exchange rate value and—of lesser importance—the quantity of currencies exchanged on the Forex market. The exogenous variables are those whose values are given beforehand and are known by the model’s decision makers. In the IRP model, the exogenous variables are those that influence the positions of the rate of return curves, including the U.S. interest rate, the British interest rate, and the expected future exchange rate. Another way to describe this is that the endogenous variable values are determined within the model, while the exogenous variable values are determined outside of the model.

Comparative statics exercises enable one to answer a question like “What would happen to the exchange rate if there were an increase in U.S. interest rates?” When assessing a question like this, economists will invariably invoke the **ceteris paribus** assumption. Ceteris paribus means that we assume all other exogenous variables are maintained at their original values when we change the variable of interest. Thus if we assess what would happen to the exchange rate (an endogenous variable) if there were an increase in the U.S. interest rate (an exogenous variable) while invoking ceteris paribus, then ceteris paribus means keeping the original values for the other exogenous variables (in this case, the British interest rate and the expected future exchange rate) fixed.

It is useful to think of a comparative statics exercise as a controlled economic experiment. In the sciences, one can test propositions by controlling the environment of a physical system in such a way that one can isolate the particular cause-and-effect relationship. Thus, to test whether a ball and a feather will fall at the same rate in a frictionless vacuum, experimenters could create a vacuum

ceteris paribus

Means that all other exogenous variables are maintained at their original values when a change in one exogenous variable takes place.

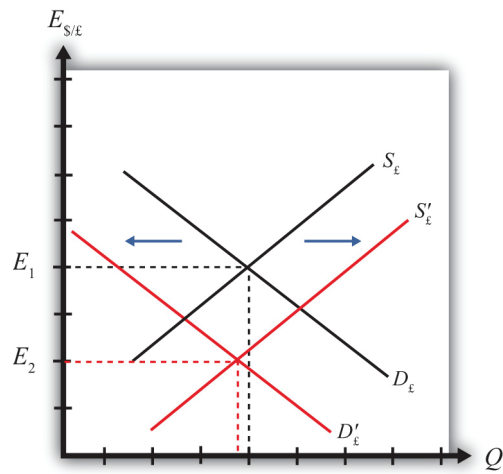
environment and measure the rate of descent of the ball versus the feather. In economic systems, such experiments are virtually impossible because one can never eliminate all the “frictions.”

However, by creating mathematical economic systems (i.e., an economic model), it becomes possible to conduct similar types of “experiments.” A comparative statics exercise allows one to isolate how a change in one exogenous variable affects the value of the equilibrium variable while controlling for changes in other variables that might also affect the outcome.

2.1 The Effect of Changes in U.S. Interest Rates on the Spot Exchange Rate

Suppose that the Forex is initially in equilibrium such that $S_{\text{£}} = D_{\text{£}}$ at the exchange rate E_1 . Now let average U.S. interest rates ($i_{\$}$) rise, ceteris paribus. The increase in interest rates raises the rate of return on U.S. assets ($RoR_{\$}$), which at the original exchange rate causes the rate of return on U.S. assets to exceed the rate of return on British assets ($RoR_{\$} > RoR_{\text{£}}$). This will raise the supply of pounds on the Forex as British investors seek the higher average return on U.S. assets. It will also lower the demand for British pounds (£) by U.S. investors who decide to invest at home rather than abroad.

FIGURE 5.2 Effects of a U.S. Interest Rate Increase



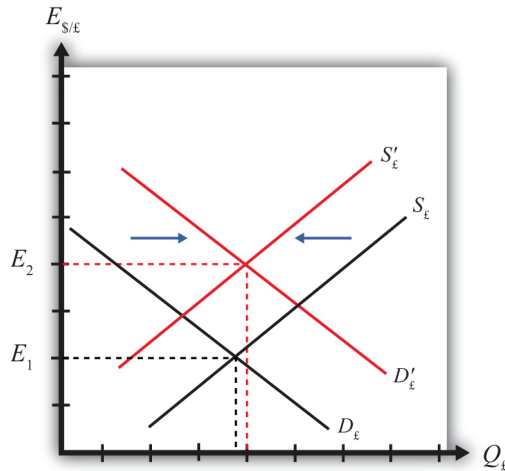
Thus in terms of the Forex market depicted in Figure 5.2, $S_{\text{£}}$ shifts right (black to red) while $D_{\text{£}}$ shifts left (black to red). The equilibrium exchange rate falls to E_2 . This means that the increase in U.S. interest rates causes a pound depreciation and a dollar appreciation. As the exchange rate falls, $RoR_{\text{£}}$ rises

since $RoR_{\text{£}} = \frac{E_{\text{£}/\$}^c}{E_{\text{£}/\$}}(1 + i_{\text{£}}) - 1$. $RoR_{\text{£}}$ continues to rise until the interest parity condition, $RoR_{\$} = RoR_{\text{£}}$, again holds.

2.2 The Effect of Changes in British Interest Rates on the Spot Exchange Rate

Suppose that the Forex is initially in equilibrium such that $S_{\text{£}} = D_{\text{£}}$ at the exchange rate E_1 shown in Figure 5.3. Now let average British interest rates ($i_{\text{£}}$) rise, ceteris paribus. The increase in interest rates raises the rate of return on British assets ($RoR_{\text{£}}$), which at the original exchange rate causes the rate of return on British assets to exceed the rate of return on U.S. assets ($RoR_{\text{£}} > RoR_{\$}$).

FIGURE 5.3 Effects of a British Interest Rate Increase



This will raise the demand for pounds on the Forex as U.S. investors seek the higher average return on British assets. It will also lower the supply of British pounds by British investors who decide to invest at home rather than abroad. Thus in terms of the graph, D_{\pounds} shifts right (black to red) while S_{\pounds} shifts left (black to red). The equilibrium exchange rate rises to E_2 . This means that the increase in British interest rates causes a pound appreciation and a dollar depreciation. As the exchange rate rises, RoR_{\pounds} falls

since $RoR_{\pounds} = \frac{E_{\$/\pounds}^e}{E_{\$/\pounds}}(1 + i_{\pounds}) - 1$. RoR_{\pounds} continues to fall until the interest parity condition, $RoR_{\pounds} = RoR_{\$}$, again holds.

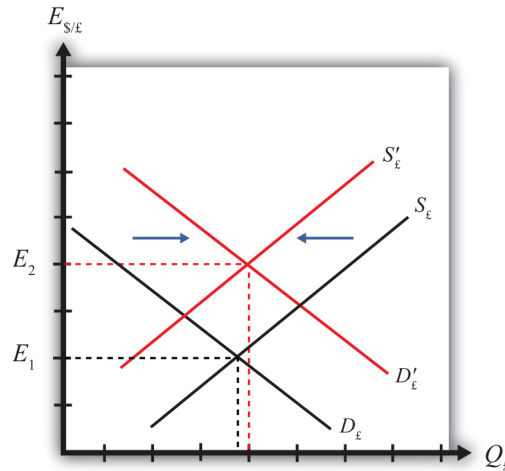
2.3 The Effect of Changes in the Expected Exchange Rate on the Spot Exchange Rate

Suppose that the Forex is initially in equilibrium such that $S_{\pounds} = D_{\pounds}$ at the exchange rate E_1 . Now suppose investors suddenly raise their expected future exchange rate ($E_{\$/\pounds}^e$), ceteris paribus. This means that if investors had expected the pound to appreciate, they now expect it to appreciate more. Likewise, if investors had expected the dollar to depreciate, they now expect it to depreciate more. Also, if they had expected the pound to depreciate, they now expect it to depreciate less. Likewise, if they had expected the dollar to appreciate, they now expect it to appreciate less.

This change might occur because new information is released. For example, the British Central Bank might release information that suggests an increased chance that the pound will rise in value in the future.

The increase in the expected exchange rate raises the rate of return on British assets (RoR_{\pounds}), which at the original exchange rate causes the rate of return on British assets to exceed the rate of return on U.S. assets ($RoR_{\pounds} > RoR_{\$}$). This will raise the demand for the pound on the Forex as U.S. investors seek the higher average return on British assets. It will also lower the supply of British pounds by British investors who decide to invest at home rather than abroad. Thus, as depicted in Figure 5.4, D_{\pounds} shifts right (black to red) while S_{\pounds} shifts left (black to red). The equilibrium exchange rate rises to E_2 . This means that the increase in the expected exchange rate ($E_{\$/\pounds}^e$) causes a pound appreciation and a dollar depreciation.

FIGURE 5.4 Effects of a Change in the Expected Exchange Rate



This is a case of self-fulfilling expectations. If investors suddenly think the pound will appreciate more in the future and if they act on that belief, then the pound will begin to rise in the present, hence fulfilling their expectations.

As the exchange rate rises, RoR_{\pounds} falls since $RoR_{\pounds} = \frac{E_{\$/\pounds}^e}{E_{\$/\pounds}}(1 + i_{\pounds}) - 1$. RoR_{\pounds} continues to fall until the interest parity condition, $RoR_{\$} = RoR_{\pounds}$, again holds.

KEY TAKEAWAYS

- An increase in U.S. interest rates causes a pound depreciation and a dollar appreciation.
- An increase in British interest rates causes a pound appreciation and a dollar depreciation.
- An increase in the expected exchange rate ($E_{\$/\pounds}^e$) causes a pound appreciation and a dollar depreciation.

EXERCISES

1. Consider the economic changes listed along the left column of the following table. Indicate the effect of each change on the variables listed in the first row. Use insights from the interest rate parity model to determine the answers. Assume floating exchange rates. You do not need to show your work. Use the following notation:

- + the variable increases
- the variable decreases
- O** the variable does not change
- A** the variable change is ambiguous (i.e., it may rise, it may fall)

	U.S. Dollar Value	$E_{\$/\pounds}$
a. A decrease in U.S. interest rates		
b. An increase in expected U.S. economic growth that raises expected asset values		
c. An expected increase in European stock values		

2. On February 5, 2004, the *Wall Street Journal* reported that Asian central banks were considering selling a significant share of their U.S. government bond holdings. It was estimated at the time that foreign central banks owned over \$800 billion in U.S. Treasury bonds, or one-fifth of all U.S. federal government debt. Taiwan was considering using some of its foreign reserves to help its businesses purchase U.S. machinery.

- a. What is the likely effect on the U.S. dollar value if Taiwan implements its plan? Explain.
- b. What effect would this transaction have on the U.S. trade deficit? Explain.
- c. How would the answer to part a. change if the Taiwanese government used sales of its foreign reserves to help its businesses purchase Taiwanese-produced machinery? Explain.