Chapter 7

International Arbitrage and Interest Rate Parity

Lecture Outline

International Arbitrage
- Locational Arbitrage
- Triangular Arbitrage
- Covered Interest Arbitrage
- Comparison of Arbitrage Effects

Interest Rate Parity
- Derivation of Interest Rate Parity
- Determining the Forward Premium
- Graphic Analysis of Interest Rate Parity
- How to Test Whether Interest Rate Parity Exists
- Interpretation of Interest Rate Parity
- Does Interest Rate Parity Hold?
- Forward Premiums Across Maturity Markets
- Considerations When Assessing Interest Rate Parity
- Changes in Forward Premiums
Chapter Theme

This chapter illustrates how three types of arbitrage (locational, triangular, and covered interest) are executed. Emphasize that the key to arbitrage from an MNC’s perspective is not the potential profits, but the relationships that should exist due to arbitrage. The linkage between covered interest arbitrage and interest rate parity is critical.

Topics to Stimulate Class Discussion

1. Why are quoted spot rates very similar across all banks?

2. Why don’t arbitrage opportunities exist for long periods of time?

3. Present a scenario and ask whether any type of international arbitrage is possible. If so, how would it be executed and how would market forces be affected?

4. Provide current interest rates of two countries and ask students to determine the forward rate that would be expected according to interest rate parity.

POINT/COUNTER-POINT:
Does Arbitrage Destabilize Foreign Exchange Markets?

POINT: Yes. Large financial institutions have the technology to recognize when one participant in the foreign exchange market is trying to sell a currency for a higher price than another participant. They also recognize when the forward rate does not properly reflect the interest rate differential. They use arbitrage to capitalize on these situations, which results in large foreign exchange transactions. In some cases, their arbitrage involves taking large positions in a currency, and then reversing their positions a few minutes later. This jumping in and out of currencies can cause abrupt price adjustments of currencies and may create more volatility in the foreign exchange market. Regulations should be created that would force financial institutions to maintain their currency positions for at least one month. This would result in a more stable foreign exchange market.

COUNTER-POINT: No. When financial institutions engage in arbitrage, they create pressure on the price of a currency that will remove any pricing discrepancy. If arbitrage did not occur, pricing discrepancies would become more pronounced. Consequently, firms and individuals who use the foreign exchange market would have to spend more time searching for the best exchange rate when trading a currency. The market would become fragmented, and prices could differ substantially among banks in a region, or among regions. If the discrepancies became large enough, firms and individuals might even attempt to conduct arbitrage themselves. The arbitrage conducted by banks allows for a more integrated foreign exchange market, which ensures that foreign exchange prices quoted by any institution are in line with the market.

WHO IS CORRECT? Use the Internet to learn more about this issue. Which argument do you support? Offer your own opinion on this issue.
ANSWER: The counter-point is correct. The type of arbitrage mentioned in this chapter is necessary to have consistent foreign exchange quotations among the financial institutions that serve as dealers in the foreign exchange market. Arbitrage does not destabilize the foreign exchange market.

Answers to End of Chapter Questions

1. **Covered Interest Arbitrage in Both Directions.** The following information is available:

   - You have $500,000 to invest
   - The current spot rate of the Moroccan dirham is $.110.
   - The 60-day forward rate of the Moroccan dirham is $.108.
   - The 60-day interest rate in the U.S. is 1 percent.
   - The 60-day interest rate in Morocco is 2 percent.

   a. What is the yield to a U.S. investor who conducts covered interest arbitrage? Did covered interest arbitrage work for the investor in this case?
   b. Would covered interest arbitrage be possible for a Moroccan investor in this case?

   **ANSWER:**

   a. Covered interest arbitrage would involve the following steps:

   1. Convert dollars to Moroccan dirham: $500,000/$.11 = MD4,545,454.55
   2. Deposit the dirham in a Moroccan bank for 60 days. You will have MD4,545,454.55 × (1.02) = MD4,636,363.64 in 60 days.
   3. In 60 days, convert the dirham back to dollars at the forward rate and receive MD4,636,363.64 × $.108 = $500,727.27

   The yield to the U.S. investor is $500,727.27/$500,000 – 1 = .15%. Covered interest arbitrage did not work for the investor in this case. The lower Moroccan forward rate more than offsets the higher interest rate in Morocco.

   b. Yes, covered interest arbitrage would be possible for a Moroccan investor. The investor would convert dirham to dollars, invest the dollars at a 1 percent interest rate in the U.S., and sell the dollars forward 60 days. Even though the Moroccan investor would earn an interest rate that is 1 percent lower in the U.S., the forward rate discount of the dirham more than offsets that differential.

2. **Covered Interest Arbitrage in Both Directions.** Assume that the existing U.S. one-year interest rate is 10 percent and the Canadian one-year interest rate is 11 percent. Also assume that interest rate parity exists. Should the forward rate of the Canadian dollar exhibit a discount or a premium? If U.S. investors attempt covered interest arbitrage, what will be their return? If Canadian investors attempt covered interest arbitrage, what will be their return?

   **ANSWER:** The Canadian dollar’s forward rate should exhibit a discount because its interest rate exceeds the U.S. interest rate.

   U.S. investors would earn a return of 10 percent using covered interest arbitrage, the same as what they would earn in the U.S.
Canadian investors would earn a return of 11 percent using covered interest arbitrage, the same as they would earn in Canada.

3. **Deriving the Forward Rate.** Assume that annual interest rates in the U.S. are 4 percent, while interest rates in France are 6 percent.

   a. According to IRP, what should the forward rate premium or discount of the euro be?
   b. If the euro’s spot rate is $1.10, what should the one-year forward rate of the euro be?

   **ANSWER:**

   a. \( p = \frac{(1.04)}{(1.06)} - 1 = -0.0189 = -1.89\% \)

   b. \( F = 1.10(1 - 0.0189) = 1.079 \)

4. **Inflation Effects on the Forward Rate.** Why do you think currencies of countries with high inflation rates tend to have forward discounts?

   **ANSWER:** These currencies have high interest rates, which cause forward rates to have discounts as a result of interest rate parity.

5. **Covered Interest Arbitrage.** The South African rand has a one-year forward premium of 2 percent. One-year interest rates in the U.S. are 3 percentage points higher than in South Africa. Based on this information, is covered interest arbitrage possible for a U.S. investor if interest rate parity holds?

   **ANSWER:**

   No, covered interest arbitrage is not possible for a U.S. investor. Although the investor can lock in the higher exchange rate in one year, interest rates are 3 percent lower in South Africa.

6. **Effects of September 11.** The terrorist attack on the U.S. on September 11, 2001 caused expectations of a weaker U.S. economy. Explain how such expectations could have affected U.S. interest rates, and therefore have affected the forward rate premium (or discount) on various foreign currencies.

   **ANSWER:** The expectations of a weaker U.S. economy resulted in a decline of short-term interest rates (in fact, the Fed expedited the movement by increasing liquidity in the banking system). The U.S. interest rate was reduced while foreign interest rates were not. Therefore, the forward premium on foreign currencies decreased, or the forward discount became more pronounced.

7. **Covered Interest Arbitrage in Both Directions.** Assume that the annual U.S. interest rate is currently 8 percent and Germany’s annual interest rate is currently 9 percent. The euro’s one-year forward rate currently exhibits a discount of 2 percent.

   a. Does interest rate parity exist?

   **ANSWER:** No, because the discount is larger than the interest rate differential.

   b. Can a U.S. firm benefit from investing funds in Germany using covered interest arbitrage?
Chapter 7: International Arbitrage and Interest Rate Parity

ANSWER: No, because the discount on a forward sale exceeds the interest rate advantage of investing in Germany.

c. Can a German subsidiary of a U.S. firm benefit by investing funds in the United States through covered interest arbitrage?

ANSWER: Yes, because even though it would earn 1 percent less interest over the year by investing in U.S. dollars, it would be able to sell dollars for 2 percent more than it paid for them (it would be buying euros forward at a discount of 2 percent).

8. Interest Rate Parity. Explain the concept of interest rate parity. Provide the rationale for its possible existence.

ANSWER: Interest rate parity states that the forward rate premium (or discount) of a currency should reflect the differential in interest rates between the two countries. If interest rate parity didn’t exist, covered interest arbitrage could occur (in the absence of transactions costs, and foreign risk), which should cause market forces to move back toward conditions which reflect interest rate parity. The exact formula is provided in the chapter.

9. Limitations of Covered Interest Arbitrage. Assume that the one-year U.S. interest rate is 11 percent, while the one-year interest rate in Malaysia is 40 percent. Assume that a U.S. bank is willing to purchase the currency of that country from you one year from now at a discount of 13 percent. Would covered interest arbitrage be worth considering? Is there any reason why you should not attempt covered interest arbitrage in this situation? (Ignore tax effects.)

ANSWER: Covered interest arbitrage would be worth considering since the return would be 21.8 percent, which is much higher than the U.S. interest rate. Assuming a $1,000,000 initial investment,

\[ \text{Yield} = \frac{\text{MXP}1,000,000 \times .100 \times .87}{\text{MXP}1,000,000} = 21.8\% \]

However, the funds would be invested in Malaysia, which could cause some concern about default risk or government restrictions on convertibility of the currency back to dollars.

10. Covered Interest Arbitrage. Assume the following information:

Spot rate of Mexican peso = $0.100
180-day forward rate of Mexican peso = $0.098
180-day Mexican interest rate = 6%
180-day U.S. interest rate = 5%

Given this information, is covered interest arbitrage worthwhile for Mexican investors who have pesos to invest? Explain your answer.

ANSWER: To answer this question, begin with an assumed amount of pesos and determine the yield to Mexican investors who attempt covered interest arbitrage. Using MX$1,000,000 as the initial investment:

\[ \text{MX$}1,000,000 \times .100 = \text{MX$}100,000 \times (1.05) = \frac{\text{MX$}105,000}{0.098} = \text{MX$}1,071,429 \]
Mexican investors would generate a yield of about 7.1% \(\frac{\text{MXP1,071,429} - \text{MXP1,000,000}}{\text{MXP1,000,000}}\), which exceeds their domestic yield. Thus, it is worthwhile for them.

11. **Covered Interest Arbitrage in Both Directions.** The one-year interest rate in New Zealand is 6 percent. The one-year U.S. interest rate is 10 percent. The spot rate of the New Zealand dollar (NZ$) is $.50. The forward rate of the New Zealand dollar is $.54. Is covered interest arbitrage feasible for U.S. investors? Is it feasible for New Zealand investors? In each case, explain why covered interest arbitrage is or is not feasible.

**ANSWER:**
To determine the yield from covered interest arbitrage by U.S. investors, start with an assumed initial investment, such as $1,000,000.

\[
\frac{1,000,000}{.50} = \text{NZ$2,000,000} \times (1.06)
\]
\[
= \text{NZ$2,120,000} \times .54 = \$1,144,800
\]
\[
\text{Yield} = \frac{\$1,144,800 - \$1,000,000}{\$1,000,000} = 14.48\%
\]

Thus, U.S. investors can benefit from covered interest arbitrage because this yield exceeds the U.S. interest rate of 10 percent.

To determine the yield from covered interest arbitrage by New Zealand investors, start with an assumed initial investment, such as NZ$1,000,000:

\[
\text{NZ$1,000,000} \times .50 = \$500,000 \times (1.10)
\]
\[
= \$550,000 \times .54 = \text{NZ$1,018,519}
\]
\[
\text{Yield} = \frac{\text{NZ$1,018,519} - \text{NZ$1,000,000}}{\text{NZ$1,000,000}} = 1.85\%
\]

Thus, New Zealand investors would not benefit from covered interest arbitrage since the yield of 1.85% is less than the 6% that they could receive from investing their funds in New Zealand.

12. **Covered Interest Arbitrage.** Assume the following information:

| Quoted Price |  
|--------------|---|
| **Spot rate of Canadian dollar** | $80 |
| **90-day forward rate of Canadian dollar** | $79 |
| **90-day Canadian interest rate** | 4% |
| **90-day U.S. interest rate** | 2.5% |

Given this information, what would be the yield (percentage return) to a U.S. investor who used covered interest arbitrage? (Assume the investor invests $1,000,000.) What market forces would occur to eliminate any further possibilities of covered interest arbitrage?

**ANSWER:**
\[
\frac{1,000,000}{.80} = \text{C$1,250,000} \times (1.04)
\]
\[
= \text{C$1,300,000} \times .79
\]
\[
= \$1,027,000
\]
Yield = ($1,027,000 – $1,000,000)/$1,000,000 = 2.7%, which exceeds the yield in the U.S. over the 90-day period.

The Canadian dollar’s spot rate should rise, and its forward rate should fall; in addition, the Canadian interest rate may fall and the U.S. interest rate may rise.

13. Changes in Forward Premiums. Assume that the forward rate premium of the euro was higher last month than it is today. What does this imply about interest rate differentials between the United States and Europe today compared to those last month?

ANSWER: The interest rate differential is smaller now than it was last month.

14. Covered Interest Arbitrage. Explain the concept of covered interest arbitrage and the scenario necessary for it to be plausible.

ANSWER: Covered interest arbitrage involves the short-term investment in a foreign currency that is covered by a forward contract to sell that currency when the investment matures. Covered interest arbitrage is plausible when the forward premium does not reflect the interest rate differential between two countries specified by the interest rate parity formula. If transactions costs or other considerations are involved, the excess profit from covered interest arbitrage must more than offset these other considerations for covered interest arbitrage to be plausible.

15. Interest Rate Parity. If the relationship that is specified by interest rate parity does not exist at any period but does exist on average, then covered interest arbitrage should not be considered by U.S. firms. Do you agree or disagree with this statement? Explain.

ANSWER: Disagree. If at any point in time, interest rate parity does not exist, covered interest arbitrage could earn excess returns (unless transactions costs, tax differences, etc., offset the excess returns).

16. Triangular Arbitrage. Assume the following information:

<table>
<thead>
<tr>
<th>Quoted Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of Canadian dollar in U.S. dollars</td>
</tr>
<tr>
<td>Value of New Zealand dollar in U.S. dollars</td>
</tr>
<tr>
<td>Value of Canadian dollar in New Zealand dollars</td>
</tr>
</tbody>
</table>

Given this information, is triangular arbitrage possible? If so, explain the steps that would reflect triangular arbitrage, and compute the profit from this strategy if you had $1,000,000 to use. What market forces would occur to eliminate any further possibilities of triangular arbitrage?

ANSWER: Yes. The appropriate cross exchange rate should be 1 Canadian dollar = 3 New Zealand dollars. Thus, the actual value of the Canadian dollars in terms of New Zealand dollars is more than what it should be. One could obtain Canadian dollars with U.S. dollars, sell the Canadian dollars for New Zealand dollars and then exchange New Zealand dollars for U.S. dollars. With $1,000,000, this strategy would generate $1,006,667 thereby representing a profit of $6,667.

[$1,000,000/$.90 = C$1,111,111 × 3.02 = NZ$3,355,556 × $.30 = $1,006,667]
The value of the Canadian dollar with respect to the U.S. dollar would rise. The value of the Canadian dollar with respect to the New Zealand dollar would decline. The value of the New Zealand dollar with respect to the U.S. dollar would fall.

17. **Changes in Forward Premiums.** Assume that the Japanese yen’s forward rate currently exhibits a premium of 6 percent and that interest rate parity exists. If U.S. interest rates decrease, how must this premium change to maintain interest rate parity? Why might we expect the premium to change?

**ANSWER:** The premium will decrease in order to maintain IRP, because the difference between the interest rates is reduced. We would expect the premium to change because as U.S. interest rates decrease, U.S. investors could benefit from covered interest arbitrage if the forward premium stays the same. The return earned by U.S. investors who use covered interest arbitrage would not be any higher than before, but the return would now exceed the interest rate earned in the U.S. Thus, there is downward pressure on the forward premium.

18. **Triangular Arbitrage.** Explain the concept of triangular arbitrage and the scenario necessary for it to be plausible.

**ANSWER:** Triangular arbitrage is possible when the actual cross exchange rate between two currencies differs from what it should be. The appropriate cross rate can be determined given the values of the two currencies with respect to some other currency.

19. **Interest Rate Parity.** Consider investors who invest in either U.S. or British one-year Treasury bills. Assume zero transaction costs and no taxes.

a. If interest rate parity exists, then the return for U.S. investors who use covered interest arbitrage will be the same as the return for U.S. investors who invest in U.S. Treasury bills. Is this statement true or false? If false, correct the statement.

**ANSWER:** True

b. If interest rate parity exists, then the return for British investors who use covered interest arbitrage will be the same as the return for British investors who invest in British Treasury bills. Is this statement true or false? If false, correct the statement.

**ANSWER:** True

20. **Locational Arbitrage.** Assume the following information:

<table>
<thead>
<tr>
<th></th>
<th>Beal Bank</th>
<th>Yardley Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bid price of NZD</td>
<td>$.401</td>
<td>$.398</td>
</tr>
<tr>
<td>Ask price of NZD</td>
<td>$.404</td>
<td>$.400</td>
</tr>
</tbody>
</table>

Given this information, is locational arbitrage possible? If so, explain the steps involved in locational arbitrage, and compute the profit from this arbitrage if you had $1,000,000 to use. What market forces would occur to eliminate any further possibilities of locational arbitrage?

**ANSWER:** Yes! One could purchase New Zealand dollars at Yardley Bank for $.40 and sell them to Beal Bank for $.401. With $1 million available, 2.5 million New Zealand dollars could be
purchased at Yardley Bank. These New Zealand dollars could then be sold to Beal Bank for $1,002,500, thereby generating a profit of $2,500.

The large demand for New Zealand dollars at Yardley Bank will force this bank’s ask price on New Zealand dollars to increase. The large sales of New Zealand dollars to Beal Bank will force its bid price down. Once the ask price of Yardley Bank is no longer less than the bid price of Beal Bank, locational arbitrage will no longer be beneficial.

21. **Interest Rate Parity.** Why would U.S. investors consider covered interest arbitrage in France when the interest rate on euros in France is lower than the U.S. interest rate?

**ANSWER:** If the forward premium on euros more than offsets the lower interest rate, investors could use covered interest arbitrage by investing in euros and achieve higher returns than in the U.S.

22. **Locational Arbitrage.** Explain the concept of locational arbitrage and the scenario necessary for it to be plausible.

**ANSWER:** Locational arbitrage can occur when the spot rate of a given currency varies among locations. Specifically, the ask rate at one location must be lower than the bid rate at another location. The disparity in rates can occur since information is not always immediately available to all banks. If a disparity does exist, locational arbitrage is possible; as it occurs, the spot rates among locations should become realigned.

**Advanced Questions**

23. **Implications of IRP.** Assume that interest rate parity exists. You expect that the one-year nominal interest rate in the U.S. is 7%, while the one-year nominal interest rate in Australia is 11%. The spot rate of the Australian dollar is $.60. You will need 10 million Australian dollars in one year. Today, you purchase a one-year forward contract in Australian dollars. How many U.S. dollars will you need in one year to fulfill your forward contract?

**ANSWER:**

\[
\left(\frac{1.07}{1.11}\right) - 1 = -3.60\%.
\]

So the one-year forward rate is \$0.60 \times [1 + (-0.036)] = \$0.5784. You will need 10,000,000 \times 0.5784 = \$5,784,000.

24. **Deriving the Forward Rate.** Before the Asian crisis began, Asian central banks were maintaining a somewhat stable value for their respective currencies. Nevertheless, the forward rate of Southeast Asian currencies exhibited a discount. Explain.

**ANSWER:** The forward rate for the Asian currencies exhibited a discount to reflect that differential between the Asian country’s interest rate and the U.S. interest rate, in accordance with interest rate parity (IRP). If the forward rate had not exhibited a discount, a U.S. investor could have conducted covered interest arbitrage by converting dollars to the foreign currency, investing in the foreign country, and simultaneously selling the foreign currency forward.

25. **Testing IRP.** The one-year interest rate in Singapore is 11 percent. The one-year interest rate in the U.S. is 6 percent. The spot rate of the Singapore dollar (S$) is $.50 and the forward rate of the S$ is $.46. Assume zero transactions costs.
a. Does interest rate parity exist?

ANSWER: No, because the discount is larger than the interest rate differential.

b. Can a U.S. firm benefit from investing funds in Singapore using covered interest arbitrage?

ANSWER: No, because the discount on a forward sale exceeds the interest rate advantage of investing in Singapore.

26. Triangular Arbitrage. You go to a bank and are given these quotes:

You can buy a euro for 14 pesos.
The bank will pay you 13 pesos for a euro.

You can buy a U.S. dollar for .9 euros.
The bank will pay you .8 Euros for a U.S. dollar.

You can buy a U.S. dollar for 10 pesos.
The bank will pay you 9 pesos for a U.S. dollar.

You have $1,000. Can you use triangular arbitrage to generate a profit? If so, explain the order of the transactions that you would execute, and the profit that you would earn. If you can not earn a profit from triangular arbitrage, explain why.

ANSWER: Yes, you can generate a profit by converting dollars to euros, and then euros to pesos, and then pesos to dollars.

First convert the information to direct quotes:

<table>
<thead>
<tr>
<th></th>
<th>Bid</th>
<th>Ask</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euro in $</td>
<td>1.11</td>
<td>1.25</td>
</tr>
<tr>
<td>Pesos in $</td>
<td>.10</td>
<td>.11</td>
</tr>
<tr>
<td>Euro in pesos</td>
<td>13</td>
<td>14</td>
</tr>
</tbody>
</table>

Use $1,000 to purchase euros: $1,000/1.25 = 800 euros.
Convert 800 euros to buy pesos: 800 euros × 13 = 10,400 pesos.
Convert the 10,400 pesos to U.S. dollars: 10,400 × $.10 = 1,040.

There is profit of $40 on a $1,000 investment.

The alternative strategy that you could attempt is to first buy pesos:
Use $1,000 to purchase pesos: $1,000/.11 = 9,090.9 pesos.
Convert 9,090 pesos to euros: 9,090.9/14 = 649.35 euros.
Convert 649.35 euros to dollars: 649.35 euros × 1.11 = $720.78.

This strategy results in a loss.

27. Change in the Forward Premium. At the end of this month, you (owner of a U.S. firm) are meeting with a Japanese firm to which you will try to sell supplies. If you receive an order from that firm, you will obtain a forward contract to hedge the future receivables in yen. As of this
morning, the forward rate of the yen and spot rate are the same. You believe that interest rate parity holds.

This afternoon, news occurs that makes you believe that the U.S. interest rates will increase substantially by the end of this month, and that the Japanese interest rate will not change. However, your expectations of the spot rate of the Japanese yen are not affected at all in the future. How will your expected dollar amount of receivables from the Japanese transaction be affected (if at all) by the news that occurred this afternoon? Explain.

ANSWER: If U.S. interest rates increase, then the forward rate of the yen will exhibit a premium. Therefore, if you hedge your receivables at the end of this month, the dollar amount to be received would be higher.

28. Testing Interest Rate Parity. Describe a method for testing whether interest rate parity exists. Why are transactions costs, currency restrictions, and differential tax laws important when evaluating whether covered interest arbitrage can be beneficial?

ANSWER: At any point in time, identify the interest rates of the U.S. versus some foreign country. Then determine the forward rate premium (or discount) that should exist according to interest rate parity. Then determine whether this computed forward rate premium (or discount) is different from the actual premium (or discount).

Even if interest rate parity does not hold, covered interest arbitrage could be of no benefit if transactions costs or tax laws offset any excess gain. In addition, currency restrictions enforced by a foreign government may disrupt the act of covered interest arbitrage.

29. Interpreting a Large Forward Discount. The interest rate in Indonesia is commonly higher than the interest rate in the U.S., which reflects a higher expected rate of inflation there. Why should Nike consider hedging its future remittances from Indonesia to the U.S. parent even when the forward discount on the currency (rupiah) is so large?

ANSWER: Nike may still consider hedging under these conditions because the alternative is to be exposed to the risk that the rupiah may depreciate over the six-month period by an amount that exceeds the degree of the discount. A large forward discount implies that the nominal interest rate in Indonesia is much higher than in the U.S., which may suggest a higher rate of expected inflation. Thus, there may be severe downward pressure on the rupiah’s spot rate over time.

30. Differences among Forward Rates. Assume that the 30-day forward premium of the euro is -1 percent, while the 90-day forward premium of the euro is 2 percent. Explain the likely interest rate conditions that would cause these premiums. Does this ensure that covered interest arbitrage is worthwhile?

ANSWER: These premiums could occur when the euro’s 30-day interest rate is above the U.S. 30-day interest rate, but the euro’s 90-day interest rate is below the U.S. 90-day interest rate. Covered interest arbitrage is not necessarily worthwhile, since interest rate parity may still hold.

31. Interpreting Changes in the Forward Premium. Assume that interest rate parity holds. At the beginning of the month, the spot rate of the Canadian dollar is $.70, while the one-year forward rate is $.68. Assume that U.S. interest rates increase steadily over the month. At the end of the month, the one-year forward rate is higher than it was at the beginning of the month. Yet, the one-
year forward discount is larger (the one-year premium is more negative) at the end of the month than it was at the beginning of the month. Explain how the relationship between the U.S. interest rate and the Canadian interest rate changed from the beginning of the month until the end of the month.

ANSWER: The forward discount at the beginning of the month implies that the U.S. interest rate is lower than the Canadian interest rate. During the month, the Canadian interest rate must have increased by a greater degree than the U.S. interest rate. At the end of the month, the gap between the Canadian dollar and the U.S. dollar is greater than it was at the beginning of the month. This results in a more pronounced forward discount.

32. Economic Effects on the Forward Rate. Assume that Mexico’s economy has expanded significantly, causing a high demand for loanable funds there by local firms. How might these conditions affect the forward discount of the Mexican peso?

ANSWER: Expansion in Mexico creates a demand for loanable funds, which places upward pressure on Mexican interest rates, which increases the forward discount on the Mexican peso (or reduces the premium).

Solution to Continuing Case Problem: Blades, Inc.

1. The first arbitrage opportunity relates to locational arbitrage. Holt has obtained spot rate quotations from two banks in Thailand, Minzu Bank and Sobat Bank, both located in Bangkok. The bid and ask prices of Thai baht for each bank are displayed in the table below:

<table>
<thead>
<tr>
<th></th>
<th>Minzu Bank</th>
<th>Sobat Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bid</td>
<td>$0.0224</td>
<td>$0.0228</td>
</tr>
<tr>
<td>Ask</td>
<td>$0.0227</td>
<td>$0.0229</td>
</tr>
</tbody>
</table>

Determine whether the foreign exchange quotations are appropriate. If they are not appropriate, determine the profit you could generate by withdrawing $100,000 from Blades’ checking account and engaging in arbitrage before the rates are adjusted.

ANSWER: Locational arbitrage is possible:

*Locational Arbitrage*

1. Buy Thai baht from Minzu Bank ($100,000/$0.0227) 4,405,286.34
2. Sell Thai baht to Sobat Bank (THB4,405,286.34 × $0.0228) 100,440.53
3. Dollar profit ($100,440.53 – $100,000) 440.53
2. Besides the bid and ask quotes for the Thai baht provided in the previous question, Minzu Bank has provided the following quotations for the U.S. dollar and the Japanese yen:

<table>
<thead>
<tr>
<th></th>
<th>Quoted Bid Price</th>
<th>Quoted Ask Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of a Japanese yen in U.S. dollars</td>
<td>$0.0085</td>
<td>$0.0086</td>
</tr>
<tr>
<td>Value of a Thai baht in Japanese yen</td>
<td>¥2.69</td>
<td>¥2.70</td>
</tr>
</tbody>
</table>

Determine whether the cross exchange rate between the Thai baht and Japanese yen is appropriate. If it is not appropriate, determine the profit you could generate for Blades Inc, by withdrawing $100,000 from Blades’ checking account and engaging in triangular arbitrage before the rates are adjusted.

ANSWER: Triangular arbitrage is possible.

**Triangular Arbitrage**

1. Exchange dollars for Thai baht ($100,000/$0.0227) 4,405,286.34
2. Convert the Thai baht into Japanese yen (THB4,405,286.34 × ¥2.69) 11,850,220.25
3. Convert the Japanese yen into dollars (¥11,850,220.26 × $0.0085) 100,726.87
4. Dollar profit ($100,726.87 – $100,000) 726.87

3. Ben Holt has obtained several forward contract quotations for the Thai baht to determine whether covered interest arbitrage may be possible. He was quoted a forward rate of $0.0225 per Thai baht for a 90-day forward contract. The current spot rate is $0.0227. Ninety-day interest rates available to Blades in the U.S. are 2 percent, while 90-day interest rates in Thailand are 3.75 percent (these rates are not annualized). Holt is aware that covered interest arbitrage, unlike locational and triangular arbitrage, requires an investment of funds. Thus, he would like to be able to estimate the dollar profit resulting from arbitrage over and above the dollar amount available on a 90-day U.S. deposit.

Determine whether the forward rate is priced appropriately. If it is not priced appropriately, determine the profit you could generate for Blades by withdrawing $100,000 from Blades’ checking account and engaging in covered interest arbitrage. Measure the profit as the excess amount above what you could generate by investing in the U.S. money market.

ANSWER: Covered interest arbitrage is possible.

**Covered Interest Arbitrage**

1. On Day 1, convert U.S. dollars to Thai baht and set up a 90-day deposit account at a Thai bank ($100,000/$0.0227) 4,405,286.34
2. In 90 days, the Thai deposit will mature to THB4,405,286.34 × 1.0375, which is the amount to be sold forward 4,570,484.58
3. In 90 days, convert the Thai baht into U.S. dollars at the agreed-upon rate (THB4,570,484.58 × $0.0225) 102,835.90
4. Dollar amount available on a 90-day U.S. deposit ($100,000 \times 1.02)  
102,000.00

5. Dollar profit over and above the dollar amount available on a 90-day U.S. deposit ($102,835.90 – $100,000)  
2,835.90

4. Why are arbitrage opportunities likely to disappear soon after they have been discovered? To illustrate your answer, assume that covered interest arbitrage involving the immediate purchase and forward sale of baht is possible. Discuss how the baht’s spot and forward rates would adjust until covered interest arbitrage is no longer possible. What is the resulting equilibrium state called?

ANSWER: Arbitrage opportunities are likely to disappear soon after they have been discovered because of market forces. Due to the actions taken by arbitrageurs, supply and demand for the foreign currency adjust until the mispricing disappears. For example, covered interest arbitrage involving the immediate purchase and subsequent sale of Thai baht would place upward pressure on the spot rate of the Thai baht and downward pressure on the Thai baht forward rate until covered interest arbitrage is no longer possible. At that point, interest rate parity exists, and the interest rate differential between the two countries is exactly offset by the forward premium or discount.

Solution to Supplemental Case: Zuber, Inc.

a. The expected value of the yield on investing funds in this country would be 14 percent, versus only 9 percent in the U.S. However, there is much uncertainty about the foreign yield. If the currency depreciates by a large amount, it will wipe out some of the principal invested. Given that Zuber did not want to target these funds for a speculative purpose, it would not be wise to invest these funds in the country without covering.

b. Covered interest arbitrage would involve exchanging dollars for the currency today, investing the currency in the country’s Treasury securities, and negotiating a forward contract to sell the currency in one year in exchange for dollars.

Given that $10 million is available, this amount would be converted into 25 million units of the foreign currency, which would accumulate to 28.5 million units (at 14 percent) by the end of the year, and be converted into $11,115,000 at the time (based on a forward rate of $.39). This reflects a return of 11.15 percent.

c. The risks of covered interest arbitrage are as follows:

- The Treasury of the country could default on its securities issued.
- The bank may not fulfill its obligation on the forward contract (the bank was just recently privatized and does not have a track record as a privatized institution).
- The government could restrict funds from being converted into dollars. (Since the country has only allowed foreign investments recently, it does not have a track record. There is some uncertainty about its future laws on international finance.)
d. While covered interest arbitrage would be expected to achieve a yield of 11.15 percent (versus only 9 percent in the U.S.), the risks are significant, especially considering that the country is still experimenting with cross-border transactions. Since some students will probably suggest going for the higher returns, this question may allow for an interesting class discussion.

**Small Business Dilemma**

**Assessment of Prevailing Spot and Forward Rates by the Sports Exports Company**

1. Do you think Jim will be able to find a bank that provides him with a more favorable spot rate than his local bank? Explain.

   ANSWER: The quoted spot rate for British pounds will typically be similar among banks at a given point in time, because locational arbitrage might be possible if there were significant differences. It is possible that some banks that rarely provide the foreign exchange services quote a less favorable exchange rate, and locational arbitrage will not necessarily correct this if these banks have a large spread between the bid and the ask quotes. Therefore, it may be worthwhile for Jim to call other banks to obtain quotes, but Jim will likely find that he cannot obtain a much better rate than what his local bank provides.

2. Do you think that Jim’s bank is likely to provide more reasonable quotations for the spot rate of the British pound if it is the only bank in town that provides foreign exchange services? Explain.

   ANSWER: The bank is likely to provide more reasonable quotations for the spot rate of the British pound if there are many banks in town that provide foreign exchange services. In this case, there is more competition, and a local bank is more likely to lose business if its quotations are not reasonable.

3. Jim is considering using a forward contract to hedge the anticipated receivables in pounds next month. His local bank quoted him a spot rate of $1.65 and a one-month forward rate of $1.6435. Before Jim decides to sell pounds one month forward, he wants to be sure that the forward rate is reasonable, given the prevailing spot rate. A one-month Treasury security in the United States currently offers a yield (not annualized) of 1 percent, while a one-month Treasury security in the United Kingdom offers a yield of 1.4 percent. Do you believe that the one-month forward rate is reasonable given the spot rate of $1.65?

   ANSWER: Yes. According to interest rate parity, the forward rate premium should be based on the differential between interest rates:

   \[
p = \frac{(1 + .01)}{(1 + .014)} - 1
   \]

   \[
   = [.996055] - 1
   \]

   \[
   = -.0039448
   \]
The actual premium is:

\[ p = \frac{(F - S)}{S} \]

\[ = \frac{(1.6435 - 1.65)}{1.65} \]

\[ = -0.003939 \]

The actual premium is very close to what the premium should be according to interest rate parity.