Chapter 8

Relationships Among Inflation, Interest Rates, and Exchange Rates

Lecture Outline

Purchasing Power Parity (PPP)
- Interpretations of PPP
- Rationale Behind PPP Theory
- Derivation of PPP
- Using PPP to Estimate Exchange Rate Effects
- Graphic Analysis of PPP
- Testing the PPP Theory
- Why PPP Does Not Occur
- PPP in the Long Run

International Fisher Effect (IFE)
- Implications of the IFE for Foreign Investors
- Derivation of the IFE
- Graphic Analysis of the IFE
- Tests of the IFE
- Why the IFE Does Not Occur

Comparison of IRP, PPP, and IFE Theories
**Chapter Theme**

This chapter discusses the relationship between inflation and exchange rates according to the purchasing power parity (PPP) theory. Since this is one of the most popular subjects in international finance, it is covered thoroughly. While PPP is a relevant theory, it should be emphasized that PPP will not always hold in reality. However, it provides a foundation in understanding how inflation can affect exchange rates. The international Fisher effect (IFE) is also discussed in this chapter. This theory is also very important. Yet, it should again be emphasized that this theory does not always hold. If the PPP and IFE theories held consistently, decision making by MNCs would be much easier. Because these theories do not hold consistently, an MNC’s decision making is very challenging.

**Topics to Stimulate Class Discussion**

1. Provide reasoning for why highly inflated countries tend to have weak home currencies.

2. Identify the inflation rate of your home country and some well-known foreign country. Then identify the percentage change of your home currency with respect to that foreign country. Did the currency change in the direction and by the magnitude that you would have expected according to PPP? If not, offer possible reasons for this discrepancy.

3. Identify the quoted one-year interest rates in your home country and in a well-known foreign country as of one year ago. Also determine how your home currency changed relative to this foreign currency over the last year. Did the currency change according to the IFE theory? If not, does this information disprove IFE? Elaborate.

4. Provide a simple explanation of the difference between interest rate parity (from the previous chapter), PPP (from this chapter), and IFE (from this chapter).

**POINT/COUNTER-POINT:**

**Does PPP Eliminate Concerns about Long-Term Exchange Rate Risk?**

**POINT:** Yes. Studies have shown that exchange rate movements are related to inflation differentials in the long run. Based on PPP, the currency of a high-inflation country will depreciate against the dollar. A subsidiary in that country should generate inflated revenue from the inflation, which will help offset the adverse exchange effects when its earnings are remitted to the parent. If a firm is focused on long-term performance, the deviations from PPP will offset over time. In some years, the exchange rate effects may exceed the inflation effects, and in other years the inflation effects will exceed the exchange rate effects.

**COUNTER-POINT:** No. Even if the relationship between inflation and exchange rate effects is consistent, this does not guarantee that the effects on the firm will be offsetting. A subsidiary in a high-inflation country will not necessarily be able to adjust its price level to keep up with the increased costs of doing business there. The effects vary with each MNC’s situation. Even if the subsidiary can raise its prices to match the rising costs, there are short-term deviations from PPP. The investors who invest in an MNC’s stock may be concerned about short-term deviations from PPP, because they will not necessarily hold the stock for the long term. Thus, investors may prefer that firms manage in a manner that reduces the volatility in their performance in short-run and long-run periods.
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: It is possible that inflation and exchange rate effects will offset over the long run. However, many investors will not be satisfied because they may invest in the firm for just a few years or even a shorter term. Thus, they will prefer that MNCs assess their exposure to exchange rate risk and attempt to limit the risk.

Answers to End of Chapter Questions

1. PPP. Explain the theory of purchasing power parity (PPP). Based on this theory, what is a general forecast of the values of currencies in countries with high inflation?

   ANSWER: PPP suggests that the purchasing power of a consumer will be similar when purchasing goods in a foreign country or in the home country. If inflation in a foreign country differs from inflation in the home country, the exchange rate will adjust to maintain equal purchasing power.

   Currencies in countries with high inflation will be weak according to PPP, causing the purchasing power of goods in the home country versus these countries to be similar.

2. Rationale of PPP. Explain the rationale of the PPP theory.

   ANSWER: When inflation is high in a particular country, foreign demand for goods in that country will decrease. In addition, that country’s demand for foreign goods should increase. Thus, the home currency of that country will weaken; this tendency should continue until the currency has weakened to the extent that a foreign country’s goods are no more attractive than the home country’s goods. Inflation differentials are offset by exchange rate changes.

3. Testing PPP. Explain how you could determine whether PPP exists. Describe a limitation in testing whether PPP holds.

   ANSWER: One method is to choose two countries and compare the inflation differential to the exchange rate change for several different periods. Then, determine whether the exchange rate changes were similar to what would have been expected under PPP theory.

   A second method is to choose a variety of countries and compare the inflation differential of each foreign country relative to the home country for a given period. Then, determine whether the exchange rate changes of each foreign currency were what would have been expected based on the inflation differentials under PPP theory.

   A limitation in testing PPP is that the results will vary with the base period chosen. The base period should reflect an equilibrium position, but it is difficult to determine when such a period exists.
4. Testing PPP. Inflation differentials between the U.S. and other industrialized countries have typically been a few percentage points in any given year. Yet, in many years annual exchange rates between the corresponding currencies have changed by 10 percent or more. What does this information suggest about PPP?

ANSWER: The information suggests that there are other factors besides inflation differentials that influence exchange rate movements. Thus, the exchange rate movements will not necessarily conform to inflation differentials, and therefore PPP will not necessarily hold.

5. Limitations of PPP. Explain why PPP does not hold.

ANSWER: PPP does not consistently hold because there are other factors besides inflation that influence exchange rates. Thus, exchange rates will not move in perfect tandem with inflation differentials. In addition, there may not be substitutes for traded goods. Therefore, even when a country’s inflation increases, the foreign demand for its products will not necessarily decrease (in the manner suggested by PPP) if substitutes are not available.

6. Implications of IFE. Explain the international Fisher effect (IFE). What is the rationale for the existence of the IFE? What are the implications of the IFE for firms with excess cash that consistently invest in foreign Treasury bills? Explain why the IFE may not hold.

ANSWER: The IFE suggests that a currency’s value will adjust in accordance with the differential in interest rates between two countries.

The rationale is that if a particular currency exhibits a high nominal interest rate, this may reflect a high anticipated inflation. Thus, the inflation will place downward pressure on the currency’s value if it occurs.

The implications are that a firm that consistently purchases foreign Treasury bills will on average earn a similar return as on domestic Treasury bills.

The IFE may not hold because exchange rate movements react to other factors in addition to interest rate differentials. Therefore, an exchange rate will not necessarily adjust in accordance with the nominal interest rate differentials, so that IFE may not hold.

7. Implications of IFE. Assume U.S. interest rates are generally above foreign interest rates. What does this suggest about the future strength or weakness of the dollar based on the IFE? Should U.S. investors invest in foreign securities if they believe in the IFE? Should foreign investors invest in U.S. securities if they believe in the IFE?

ANSWER: The IFE would suggest that the U.S. dollar will depreciate over time if U.S. interest rates are currently higher than foreign interest rates. Consequently, foreign investors who purchased U.S. securities would on average receive a similar yield as what they receive in their own country, and U.S. investors that purchased foreign securities would on average receive a yield similar to U.S. rates.

8. Comparing Parity Theories. Compare and contrast interest rate parity (discussed in the previous chapter), purchasing power parity (PPP), and the international Fisher effect (IFE).
ANSWER: Interest rate parity can be evaluated using data at any one point in time to determine the relationship between the interest rate differential of two countries and the forward premium (or discount). PPP suggests a relationship between the inflation differential of two countries and the percentage change in the spot exchange rate over time. IFE suggests a relationship between the interest rate differential of two countries and the percentage change in the spot exchange rate over time. IFE is based on nominal interest rate differentials, which are influenced by expected inflation. Thus, the IFE is closely related to PPP.

9. **Real Interest Rate.** One assumption made in developing the IFE is that all investors in all countries have the same real interest rate. What does this mean?

ANSWER: The real return is the nominal return minus the inflation rate. If all investors require the same real return, then the differentials in nominal interest rates should be solely due to differentials in anticipated inflation among countries.

10. **Interpreting Inflationary Expectations.** If investors in the United States and Canada require the same real interest rate, and the nominal rate of interest is 2 percent higher in Canada, what does this imply about expectations of U.S. inflation and Canadian inflation? What do these inflationary expectations suggest about future exchange rates?

ANSWER: Expected inflation in Canada is 2 percent above expected inflation in the U.S. If these inflationary expectations come true, PPP would suggest that the value of the Canadian dollar should depreciate by 2 percent against the U.S. dollar.

11. **PPP Applied to the Euro.** Assume that several European countries that use the euro as their currency experience higher inflation than the United States, while two other European countries that use the euro as their currency experience lower inflation than the United States. According to PPP, how will the euro’s value against the dollar be affected?

ANSWER: The high European inflation overall would reduce the U.S. demand for European products, increase the European demand for U.S. products, and cause the euro to depreciate against the dollar.

According to the PPP theory, the euro’s value would adjust in response to the weighted inflation rates of the European countries that are represented by the euro relative to the inflation in the U.S. If the European inflation rises, while the U.S. inflation remains low, there would be downward pressure on the euro.

12. **Source of Weak Currencies.** Currencies of some Latin American countries, such as Brazil and Venezuela, frequently weaken against most other currencies. What concept in this chapter explains this occurrence? Why don’t all U.S.-based MNCs use forward contracts to hedge their future remittances of funds from Latin American countries to the U.S. even if they expect depreciation of the currencies against the dollar?

ANSWER: Latin American countries typically have very high inflation, as much as 200 percent or more. PPP theory would suggest that currencies of these countries will depreciate against the U.S. dollar (and other major currencies) in order to retain purchasing power across countries. The high inflation discourages demand for Latin American imports and places downward pressure in their Latin American currencies. Depreciation of the currencies offsets the increased prices on Latin American goods from the perspective of importers in other countries.
Interest rate parity forces the forward rates to contain a large discount due to the high interest rates in Latin America, which reflects a disadvantage of hedging these currencies. The decision to hedge makes more sense if the expected degree of depreciation exceeds the degree of the forward discount. Also, keep in mind that some remittances cannot be perfectly hedged anyway because the amount of future remittances is uncertain.

13. **PPP.** Japan has typically had lower inflation than the United States. How would one expect this to affect the Japanese yen’s value? Why does this expected relationship not always occur?

**ANSWER:** Japan’s low inflation should place upward pressure on the yen’s value. Yet, other factors can sometimes offset this pressure. For example, Japan heavily invests in U.S. securities, which places downward pressure on the yen’s value.

14. **IFE.** Assume that the nominal interest rate in Mexico is 48 percent and the interest rate in the United States is 8 percent for one-year securities that are free from default risk. What does the IFE suggest about the differential in expected inflation in these two countries? Using this information and the PPP theory, describe the expected nominal return to U.S. investors who invest in Mexico.

**ANSWER:** If investors from the U.S. and Mexico required the same real (inflation-adjusted) return, then any difference in nominal interest rates is due to differences in expected inflation. Thus, the inflation rate in Mexico is expected to be about 40 percent above the U.S. inflation rate.

According to PPP, the Mexican peso should depreciate by the amount of the differential between U.S. and Mexican inflation rates. Using a 40 percent differential, the Mexican peso should depreciate by about 40 percent. Given a 48 percent nominal interest rate in Mexico and expected depreciation of the peso of 40 percent, U.S. investors will earn about 8 percent. (This answer used the inexact formula, since the concept is stressed here more than precision.)

15. **IFE.** Shouldn’t the IFE discourage investors from attempting to capitalize on higher foreign interest rates? Why do some investors continue to invest overseas, even when they have no other transactions overseas?

**ANSWER:** According to the IFE, higher foreign interest rates should not attract investors because these rates imply high expected inflation rates, which in turn imply potential depreciation of these currencies. Yet, some investors still invest in foreign countries where nominal interest rates are high. This may suggest that some investors believe that (1) the anticipated inflation rate embedded in a high nominal interest rate is overestimated, or (2) the potentially high inflation will not cause substantial depreciation of the foreign currency (which could occur if adequate substitute products were not available elsewhere), or (3) there are other factors that can offset the possible impact of inflation on the foreign currency’s value.

16. **Changes in Inflation.** Assume that the inflation rate in Brazil is expected to increase substantially. How will this affect Brazil’s nominal interest rates and the value of its currency (called the real)? If the IFE holds, how will the nominal return to U.S. investors who invest in Brazil be affected by the higher inflation in Brazil? Explain.

**ANSWER:** Brazil’s nominal interest rate would likely increase to maintain the real return required by Brazilian investors. The Brazilian real would be expected to depreciate according to the IFE. If the IFE holds, the return to U.S. investors who invest in Brazil would not be affected. Even though
they now earn a higher nominal interest rate, the expected decline in the Brazilian real offsets the additional interest to be earned.

17. **Comparing PPP and IFE.** How is it possible for PPP to hold if the IFE does not?

**ANSWER:** For the IFE to hold, the following conditions are necessary:

1. investors across countries require the same real returns,
2. the expected inflation rate embedded in the nominal interest rate occurs,
3. the exchange rate adjusts to the inflation rate differential according to PPP.

If conditions (1) or (2) do not hold, PPP may still hold, but investors may achieve consistently higher returns when investing in a foreign country’s securities. Thus, IFE would be refuted.

18. **Estimating Depreciation Due to PPP.** Assume that the spot exchange rate of the British pound is $1.73. How will this spot rate adjust according to PPP if the United Kingdom experiences an inflation rate of 7 percent while the United States experiences an inflation rate of 2 percent?

**ANSWER:** According to PPP, the exchange rate of the pound will depreciate by 4.7 percent. Therefore, the spot rate would adjust to $1.73 \times [1 + (–.0467)] = $1.649.

19. **Forecasting the Future Spot Rate Based on IFE.** Assume that the spot exchange rate of the Singapore dollar is $.70. The one-year interest rate is 11 percent in the United States and 7 percent in Singapore. What will the spot rate be in one year according to the IFE? What is the force that causes the spot rate to change according to the IFE?

**ANSWER:** $.70 \times (1 + .0374) = $.7262.

The force that causes this expected effect on the spot rate is the inflation differential. The anticipated inflation differential can be derived from interest rate differential.

20. **Deriving Forecasts of the Future Spot Rate.** As of today, assume the following information is available:

<table>
<thead>
<tr>
<th>Real rate of interest required by investors</th>
<th>U.S.</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal interest rate</td>
<td>11%</td>
<td>15%</td>
</tr>
<tr>
<td>Spot rate</td>
<td>—</td>
<td>$.20</td>
</tr>
<tr>
<td>One-year forward rate</td>
<td>—</td>
<td>$.19</td>
</tr>
</tbody>
</table>

a. Use the forward rate to forecast the percentage change in the Mexican peso over the next year.

**ANSWER:** ($ .19 – .20)/.20 = –.05, or –5%

b. Use the differential in expected inflation to forecast the percentage change in the Mexican peso over the next year.

**ANSWER:** (1.09)/(1.13) – 1 = −.0353 or −3.53%; the negative sign represents depreciation of the peso.
c. Use the spot rate to forecast the percentage change in the Mexican peso over the next year.

ANSWER: zero percent change

21. Inflation and Interest Rate Effects. The opening of Russia’s market has resulted in a highly volatile Russian currency (the ruble). Russia’s inflation has commonly exceeded 20 percent per month. Russian interest rates commonly exceed 150 percent, but this is sometimes less than the annual inflation rate in Russia.

a. Explain why the high Russian inflation has put severe pressure on the value of the Russian ruble.

ANSWER: As Russian prices were increasing, the purchasing power of Russian consumers was declining. This would encourage them to purchase goods in the U.S. and elsewhere, which results in a large supply of rubles for sale. Given the high Russian inflation, foreign demand for rubles to purchase Russian goods would be low. Thus, the ruble’s value should depreciate against the dollar, and against other currencies.

b. Does the effect of Russian inflation on the decline in the ruble’s value support the PPP theory? How might the relationship be distorted by political conditions in Russia?

ANSWER: The general relationship suggested by PPP is supported, but the ruble’s value will not normally move exactly as specified by PPP. The political conditions that could restrict trade or currency convertibility can prevent Russian consumers from shifting to foreign goods. Thus, the ruble may not decline by the full degree to offset the inflation differential between Russia and the U.S. Furthermore, the government may not allow the ruble to float freely to its proper equilibrium level.

c. Does it appear that the prices of Russian goods will be equal to the prices of U.S. goods from the perspective of Russian consumers (after considering exchange rates)? Explain.

ANSWER: Russian prices might be higher than U.S. prices, even after considering exchange rates, because the ruble might not depreciate enough to fully offset the Russian inflation. The exchange rate cannot fully adjust if there are barriers on trade or currency convertibility.

d. Will the effects of the high Russian inflation and the decline in the ruble offset each other for U.S. importers? That is, how will U.S. importers of Russian goods be affected by the conditions?

ANSWER: U.S. importers will likely experience higher prices, because the Russian inflation may not be completely offset by the decline in the ruble’s value. This may cause a reduction in the U.S. demand for Russian goods.

22. IFE Application to Asian Crisis. Before the Asian crisis, many investors attempted to capitalize on the high interest rates prevailing in the Southeast Asian countries although the level of interest rates primarily reflected expectations of inflation. Explain why investors behaved in this manner. Why does the IFE suggest that the Southeast Asian countries would not have attracted foreign investment before the Asian crisis despite the high interest rates prevailing in those countries?
ANSWER: The investors’ behavior suggests that they did not expect the international Fisher effect (IFE) to hold. Since central banks of some Asian countries were maintaining their currencies within narrow bands, they were effectively preventing the exchange rate from depreciating in a manner that would offset the interest rate differential. Consequently, superior profits from investing in the foreign countries were possible.

If investors believed in the IFE, the Asian countries would not attract a high level of foreign investment because of exchange rate expectations. Specifically, the high nominal interest rate should reflect a high level of expected inflation. According to purchasing power parity (PPP), the higher interest rate should result in a weaker currency because of the implied market expectations of high inflation.

23. **IFE Applied to the Euro.** Given the recent conversion of several European currencies to the euro, explain what would cause the euro’s value to change against the dollar according to the IFE.

ANSWER: If interest rates change in these European countries whose home currency is the euro, the expected inflation rate in those countries change, so that the inflation differential between those countries and the U.S. changes. Thus, there may be an impact on the value of the euro, because a change in the inflation differential affects trade flows and therefore affects the exchange rate.

**Advanced Questions**

24. **IFE.** Beth Miller does not believe that the international Fisher effect (IFE) holds. Current one-year interest rates in Europe are 5 percent, while one-year interest rates in the U.S. are 3 percent. Beth converts $100,000 to euros and invests them in Germany. One year later, she converts the euros back to dollars. The current spot rate of the euro is $1.10.

a. According to the IFE, what should the spot rate of the euro in one year be?
b. If the spot rate of the euro in one year is $1.00, what is Beth’s percentage return from her strategy?
c. If the spot rate of the euro in one year is $1.08, what is Beth’s percentage return from her strategy?
d. What must the spot rate of the euro be in one year for Beth’s strategy to be successful?
ANSWER:

a.

\[ e_f = \frac{(1 + i_e)}{(1 + i_f)} - 1 \]

\[ = \frac{(1.03)}{(1.05)} - 1 = -1.90\% \]

If the IFE holds, the euro should depreciate by 1.90 percent in one year. This translates to a spot rate of $1.10 \times (1 - 1.90\%) = $1.079.

b.

1. Convert dollars to euros: $100,000/$1.10 = €90,909.09
2. Invest euros for one year and receive €90,909.09 \times 1.05 = €95,454.55
3. Convert euros back to dollars and receive €95,454.55 \times $1.00 = $95,454.55

The percentage return is $95,454.55/$100,000 – 1 = –4.55%.

c.

1. Convert dollars to euros: $100,000/$1.10 = €90,909.09
2. Invest euros for one year and receive €90,909.09 \times 1.05 = €95,454.55
3. Convert euros back to dollars and receive €95,454.55 \times $1.08 = $103,090.91

The percentage return is $103,090.91/$100,000 – 1 = 3.09%.

d. Beth’s strategy would be successful if the spot rate of the euro in one year is greater than $1.079.

25. Integrating IRP and IFE. Assume the following information is available for the U.S. and Europe:

<table>
<thead>
<tr>
<th>U.S.</th>
<th>Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal interest rate</td>
<td>4%</td>
</tr>
<tr>
<td>Expected inflation</td>
<td>2%</td>
</tr>
<tr>
<td>Spot rate</td>
<td>—</td>
</tr>
<tr>
<td>One-year forward rate</td>
<td>—</td>
</tr>
</tbody>
</table>

a. Does IRP hold?
b. According to PPP, what is the expected spot rate of the euro in one year?
c. According to the IFE, what is the expected spot rate of the euro in one year?
d. Reconcile your answers to parts (a) and (c).
ANSWER:

a.

\[ p = \frac{(1 + i_h)}{(1 + i_f)} - 1 \]
\[ = \frac{(1.04)}{(1.06)} - 1 \]
\[ = -1.89\% \]

Therefore, the forward rate of the euro should be $1.13 \times (1 - 0.0189) = $1.109. IRP does not hold in this case.

b.

\[ e_f = \frac{(1 + I_h)}{(1 + I_f)} - 1 \]
\[ = \frac{(1.02)}{(1.05)} - 1 \]
\[ = -2.86\% \]

According to PPP, the expected spot rate of the euro in one year is $1.13 \times (1 - 2.86\%) = $1.098.

c.

\[ e_f = \frac{(1 + i_h)}{(1 + i_f)} - 1 \]
\[ = \frac{(1.04)}{(1.06)} - 1 \]
\[ = -1.89\% \]

According to the IFE, the expected spot rate of the euro in one year is $1.13 \times (1 - 1.89\%) = $1.1086.

Parts (a) and (c) combined say that the forward rate premium or discount is exactly equal to the expected percentage appreciation or depreciation of the euro.

26. IRP. The one-year risk-free interest rate in Mexico is 10%. The one-year risk-free rate in the U.S. is 2%. Assume that interest rate parity exists. The spot rate of the Mexican peso is $.14.

a. What is the forward rate premium?
b. What is the one-year forward rate of the peso?
c. Based on the international Fisher effect, what is the expected change in the spot rate over the next year?
d. If the spot rate changes as expected according to the IFE, what will be the spot rate in one year?

e. Compare your answers to (b) and (d) and explain the relationship.

ANSWER:

a. According to interest rate parity, the forward premium is

\[
\frac{(1 + .02)}{(1 + .10)} - 1 = -.07273
\]

b. The forward rate is \( .14 \times (1 - .07273) = .1298 \).

c. According to the IFE, the expected change in the peso is:

\[
\frac{(1 + .02)}{(1 + .10)} - 1 = -.07273
\]

or \(-7.273\%\)

d. \( .14 \times (1 - .07273) = .1298 \)

e. The answers are the same. When IRP holds, the forward rate premium and the expected percentage change in the spot rate are derived in the same manner. Thus, the forward premium serves as the forecasted percentage change in the spot rate according to IFE.

27. Testing the PPP. How could you use regression analysis to determine whether the relationship specified by PPP exists on average? Specify the model, and describe how you would assess the regression results to determine if there is a significant difference from the relationship suggested by PPP.

ANSWER: A regression model could be applied to historical data to test PPP. The model is specified as:

\[
e_f = a_0 + a_1 \left[ \frac{1 + I_{U.S.}}{1 + I_f} - 1 \right] + u
\]

where \( e_f \) is the percentage change in the foreign currency’s exchange rate, \( I_{U.S.} \) and \( I_f \) are U.S. and foreign inflation rates, \( a_0 \) is a constant, \( a_1 \) is the slope coefficient, and \( u \) is an error term. If PPP holds, \( a_0 \) should equal zero, and \( a_1 \) should equal 1. A t-test on \( a_0 \) and \( a_1 \) is as follows:
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\[ t\text{-test for } a_0: t = \frac{a_0 - 0}{\text{s.e. of } a_0} \]

\[ t\text{-test for } a_1: t = \frac{a_1 - 1}{\text{s.e. of } a_1} \]

The t-statistic can be compared to the critical level (from a t-table) to determine whether the values of \( a_0 \) and \( a_1 \) differ significantly from their hypothesized values.

28. **Testing the IFE.** Describe a statistical test for the IFE.

**ANSWER:** A regression model could be applied to historical data to test IFE. The model is specified as:

\[ e_f = a_0 + a_1 \left( \frac{1 + I_{U.S.}}{1 + I_f} - 1 \right) + u \]

where \( e_f \) is the percentage change in the foreign currency’s exchange rate, \( I_{U.S.} \) and \( I_f \) are U.S. and foreign interest rates, \( a_0 \) is a constant, \( a_1 \) is the slope coefficient, and \( u \) is an error term. If IFE holds, \( a_0 \) should equal zero and \( a_1 \) should equal 1. A t-test on \( a_0 \) and \( a_1 \) is shown below:

\[ t\text{-test for } a_0 : t = \frac{a_0 - 0}{\text{s.e. of } a_0} \]

\[ t\text{-test for } a_1 : t = \frac{a_1 - 1}{\text{s.e. of } a_1} \]

The t-statistic can be compared to the critical level (from a t-table) to determine whether the values of \( a_0 \) and \( a_1 \) differ significantly from their hypothesized values.

29. **Impact of Barriers on PPP and IFE.** Would PPP be more likely to hold between the United States and Hungary if trade barriers were completely removed and if Hungary’s currency were allowed to float without any government intervention? Would the IFE be more likely to hold between the United States and Hungary if trade barriers were completely removed and if Hungary’s currency were allowed to float without any government intervention? Explain.

**ANSWER:** Changes in international trade result from inflation differences and affects the exchange rate (by affecting the demand for the currency and the supply of the currency for sale). The effect on the exchange rate is more likely to occur if (a) free trade is allowed and (b) the currency’s exchange rate is allowed to fluctuate without any government intervention.

The underlying force of IFE is the differential in expected inflation between two countries, which can affect trade and capital flows. The effects on the exchange rate are more likely to occur if (a) free trade is allowed, and (b) the currency’s exchange rate is allowed to fluctuate without government intervention.
30. **Interactive Effects of PPP.** Assume that the inflation rates of the countries that use the euro are very low, while other European countries that have their own currencies experience high inflation. Explain how and why the euro’s value could be expected to change against these currencies according to the PPP theory.

**ANSWER:** According to the PPP theory, the euro’s value would increase against the value of the other European currencies, because the trade patterns would shift in response to the inflation differential. There would be an increase in demand for the euro by these other European countries that experienced higher inflation because they will increase their importing of products from those European countries whose home currency is the euro.

31. **Applying IRP and IFE.** Assume that Mexico has a one-year interest rate that is higher than the U.S. one-year interest rate. Assume that you believe in the international Fisher effect (IFE), and interest rate parity. Assume zero transactions costs.

Ed is based in the U.S. and he attempts to speculate by purchasing Mexican pesos today, investing the pesos in a risk-free asset for a year, and then converting the pesos to dollars at the end of one year. Ed did not cover his position in the forward market.

Maria is based in Mexico and she attempts covered interest arbitrage by purchasing dollars today and simultaneously selling dollars one year forward, investing the dollars in a risk-free asset for a year, and then converting the dollars back to pesos at the end of one year.

Do you think the rate of return on Ed’s investment will be higher than, lower than, or the same as the rate of return on Maria’s investment? Explain.

**ANSWER:** Maria’s rate of return will be higher. Since interest rate parity exists, she will earn whatever the local risk-free interest rate is in Mexico. Ed’s expected rate of return is whatever the risk-free rate is in the U.S. (based on the IFE).

32. **Arbitrage and PPP.** Assume that locational arbitrage ensures that spot exchange rates are properly aligned. Also assume that you believe in purchasing power parity. The spot rate of the British pound is $1.80. The spot rate of the Swiss franc is .3 pounds. You expect that the one-year inflation rate is 7 percent in the U.K., 5 percent in Switzerland, and 1 percent in the U.S. The one-year interest rate is 6% in the U.K., 2% in Switzerland, and 4% in the U.S. What is your expected spot rate of the Swiss franc in one year with respect to the U.S. dollar? Show your work.

**ANSWER:** SF spot rate in $ = 1.80 × .3 = $.54.

Expected % change in SF in one year = (1.01)/(1.05) – 1 = −3.8%

Expected spot rate of SF in one year = $.54 × (1 − .038) = $.5194

33. **IRP Versus IFE.** You believe that interest rate parity and the international Fisher effect hold. Assume the U.S. interest rate is presently much higher than the New Zealand interest rate. You have receivables of 1 million New Zealand dollars that you will receive in one year. You could hedge the receivables with the one-year forward contract. Or you could decide to not hedge. Is your expected U.S. dollar amount of the receivables in one year from hedging higher, lower, or the same as your expected U.S. dollar amount of the receivables without hedging? Explain.
ANSWER: The expected amount is the same, because the forward rate reflects the interest rate differential, and the expected spot rate (if you do not hedge) according to IFE reflects the interest rate differential.

34. IRP, PPP, and Speculating in Currency Derivatives. The U.S. three-month interest rate (unannualized) is 1%. The Canadian three-month interest rate (unannualized) is 4%. Interest rate parity exists. The expected inflation over this period is 5% in the U.S. and 2% in Canada. A call option with a three-month expiration date on Canadian dollars is available for a premium of $.02 and a strike price of $.64. The spot rate of the Canadian dollar is $.65. Assume that you believe in purchasing power parity.

a. Determine the dollar amount of your profit or loss from buying a call option contract specifying C$100,000.

ANSWER: The expected change in the Canadian dollar’s spot rate is:

\[
\frac{1.05}{1.02} - 1 = 2.94\%.
\]

Therefore, the expected spot rate in 3 months is \(0.65 \times 1.0294 = 0.66911\).

The net profit per unit on a call option is \(0.66911 - 0.64 - 0.02 = 0.00911\).
For the contract, the net profit is \(0.00911 \times 100,000 = 911\).

b. Determine the dollar amount of your profit or loss from buying a futures contract specifying C$100,000.

ANSWER: According to IRP, the futures rate premium should be \(\frac{1.01}{1.04} - 1 = -2.88\%\). Therefore, the futures rate should be \(0.65 \times (1 - 0.0288) = 0.6313\).

Recall that the expected spot rate in 3 months is \(0.65 \times 1.0294 = 0.66911\). The expected net profit per unit from buying a futures contract is \(0.66911 - 0.6313 = 0.03781\). For the contract, the net profit is \(0.03781 \times 100,000 = 4,341\).

35. Implications of PPP. Today’s spot rate of the Mexican peso is $.10. Assume that purchasing power parity holds. The U.S. inflation rate over this year is expected to be 7%, while the Mexican inflation over this year is expected to be 3%. Wake Forest Co. plans to import from Mexico and will need 20 million Mexican pesos in one year. Determine the expected amount of dollars to be paid by the Wake Forest Co. for the pesos in one year.

ANSWER: \(\left(\frac{1.07}{1.03}\right) - 1 = 3.8835\%\). So the expected future spot rate is \$.1038835. Carolina will need to pay \$.1038835 \times 20 million pesos = $2,077,710.

36. Investment Implications of IRP and IFE. The Argentine one-year CD (deposit) rate is 13%, while the Mexico one-year CD rate is 11% and the U.S. one-year CD rate is 6%. All CDs have zero default risk. Interest rate parity holds, and you believe that the international Fisher effect holds.

- Jamie (based in the U.S.) invests in a one-year CD in Argentina.
- Ann (based in the U.S.) invests in a one-year CD in Mexico.
• Ken (based in the U.S.) invests in a one-year CD in Argentina and sells Argentina pesos one year forward to cover his position.
• Juan (who lives in Argentina) invests in a one-year CD in the U.S.
• Maria (who lives in Mexico) invests in a one-year CD in the U.S.
• Nina (who lives in Mexico) invests in a one-year CD in Argentina.
• Carmen (who lives in Argentina) invests in a one-year CD in Mexico and sells Mexican pesos one year forward to cover her position.
• Corio (who lives in Mexico) invests in a one-year CD in Argentina and sells Argentina pesos one year forward to cover his position.

Based on this information, which person will be expected to earn the highest return on the funds invested? If you believe that multiple persons will tie for the highest expected return, name each of them. Explain.

ANSWER: Jose and Carmen will earn the highest return. When the IFE holds, the expected return from international investing is what the investor would earn domestically. When IRP holds, covered interest arbitrage will achieve the same return as what the investor could earn domestically.

37. Investment Implications of IRP and the IFE. Today, a U.S. dollar can be exchanged for 3 New Zealand dollars. The one-year CD (deposit) in New Zealand is 7% and the one-year CD rate in the U.S. is 6%. Interest rate parity exists between the U.S. and New Zealand. The international Fisher effect exists between the U.S. and New Zealand. Today a U.S. dollar can be exchanged for 2 Swiss francs. The one-year CD rate in Switzerland is 5%. The spot rate of the Swiss franc is the same as the one-year forward rate.

• Karen (based in the U.S.) invests in a one-year CD in New Zealand and sells New Zealand dollars one year forward to cover her position.
• James (based in the U.S) invests in a one-year CD in New Zealand and does not cover his position.
• Brian (based in the U.S.) invests in a one-year CD in Switzerland and sells Swiss francs one year forward to cover his position.
• Eric (who lives in Switzerland) invests in a one-year CD in Switzerland.
• Sandra (who lives in the U.S.) invests in a one-year CD in Switzerland and sells Swiss francs one year forward to cover her position.
• Tonya (who lives in New Zealand) invests in a one-year CD in the U.S. and sells U.S. dollars one year forward to cover her position.

Based on this information, which person will be expected to earn the highest return on the funds invested? If you believe that multiple persons will tie for the highest expected return, name each of them. Explain.

ANSWER: Tonya will earn 7 percent, which is higher than the returns that are expected for any other investor.
38. Real Interest Rates, Expected Inflation, IRP, and the Spot Rate. The U.S. and the country of Rueland have the same real interest rate of 3%. The expected inflation over the next year is 6 percent in the U.S. versus 21% in Rueland. Interest rate parity exists. The one-year currency futures contract on Rueland’s currency (called the ru) is priced at $.40 per ru. What is the spot rate of the ru?

ANSWER: FR premium = (1.09)/(1.24) – 1 = –.12096

SR × (1 + premium) = FR

SR = FR/ (1 + premium)

= $.40/(.87)

= $.455

Solution to Continuing Case Problem: Blades, Inc.

1. What is the relationship between the exchange rates and relative inflation levels of the two countries? How will this relationship affect Blades’ Thai revenue and costs given that the baht is freely floating? What is the net effect of this relationship on Blades?

ANSWER: The relationship between exchange rates and relative inflation rates is summarized by the purchasing power parity (PPP) theory. When one country’s inflation rate rises relative to that of another, the demand for the former country’s currency declines as its exports decline (due to its higher prices). Furthermore, consumers and firms in the country with higher inflation tend to increase their importing. Thus, the absolute form of PPP states that prices of similar products of two different countries should be equal when measured in a common currency. The relative form of PPP states that prices of similar products of different countries will not necessarily be the same when measured in a common currency because of market imperfections. However, it states that the rate of change in the prices of products should be similar. Both forms of the theory suggest that the currency of the country with the higher level of inflation should depreciate to offset the inflation differential.

Since the baht has become a freely floating currency, the currency should be expected to depreciate due to the high inflation levels prevailing in Thailand. Blades’ revenue generated in Thailand will be negatively affected by PPP. Because of Blades’ export arrangement, it is unable to increase its prices in line with Thai levels of inflation. However, since Blades’ exports are denominated in baht, a depreciation of the baht will result in a conversion of baht into fewer dollars. Blades’ cost of goods sold generated in Thailand will increase as Thai exporters adjust their prices according to Thai inflation rates. However, the high prices resulting from high levels of inflation in Thailand may be somewhat offset by a depreciation of the baht.

Since Blades generates net cash inflows from its Thai operations, it will be negatively affected by PPP.

2. What are some of the factors that prevent PPP from occurring in the short run? Would you expect PPP to hold better if countries negotiate trade arrangements under which they commit themselves to the purchase or sale of a fixed number of goods over a specified time period? Why or why not?
ANSWER: PPP may not hold because exchange rates are affected by other factors in addition to the inflation differential between two countries, such as relative interest rates, national income levels, and government controls. Furthermore, certain goods may not be affected by PPP because no suitable substitutes are available in the home country. Thus, the trade relationships between two countries for these goods may not be affected by inflation rate differentials in the manner suggested by PPP.

Arrangements whereby firms with differing inflation commit themselves to the purchase of a fixed number of goods over a specified period of time will cause PPP not to hold, at least in the short run. This is because contractual agreements are not easily terminated, causing a delayed impact of inflation rates on trade relationships and, consequently, exchange rates.

3. How do you reconcile the high level of interest rates in Thailand with the expected change of the baht-dollar exchange rate according to PPP?

ANSWER: High levels of real interest rates in a given country may increase the demand for that country’s currency as foreign investors can earn higher rates of return in the foreign country than may be available domestically. This would place upward pressure on the currency of the country with the higher level of real interest rates. However, the high level of nominal interest rates in Thailand is primarily the result of high expected levels of Thai inflation. Therefore, according to the international Fisher effect (IFE), the Thai baht should depreciate by an amount sufficient to offset the nominal interest rate differential between Thailand and the U.S.

4. Given Blades’ future plans in Thailand, should the company be concerned with PPP? Why or why not?

ANSWER: Although PPP may not hold well in the short run, it has been found to hold reasonably well in the long run. Since Blades is under a three-year export arrangement with Entertainment Products, Inc. and since it is considering the expansion into Thailand, the company should be concerned with PPP; in the long run, the relatively high level of Thai inflation may result in a depreciation of the baht sufficient to offset the inflation differential. Yet, Blades will be able to renegotiate its arrangement once the three-year period for the existing arrangement is over.

5. PPP may hold better for some countries than for others. The Thai baht has been freely floating for more than a decade. How do you think Blades can gain insight into whether PPP holds for Thailand? Offer some logic to explain why the PPP relationship may not hold here.

ANSWER: One possible way to determine whether PPP holds between two countries is to regress historical exchange rate changes on the inflation differential between two countries. The PPP relationship may not hold because other factors also influence the baht exchange rate.

**Solution to Supplemental Case: Flame Fixtures, Inc.**

a. If the peso depreciates by more than the inflation differential, then the dollar cost to Flame will be even lower than expected.
b. If the peso depreciates by less than the inflation differential, then the dollar cost to Flame will be even higher than expected. Consider a scenario in which the Mexican inflation rate is 80 percent or so, causing the bill in pesos to be 80 percent higher. Yet, if the peso depreciated by a relatively small amount over this period (say 20 percent or so), the dollar cost to Flame will increase substantially. Since there are other factors in addition to inflation that also affect the peso’s exchange rate, the peso will not necessarily depreciate by an amount that fully offsets the high inflation.

c. Stable dollar payments would only occur if the peso depreciated by an amount that offset its high inflation rate. It is unlikely that there will be a perfect offset in any given period. Therefore, Flame’s dollar payments would be unstable, and so would its profits.

d. The risk would increase, because its payments for parts would now be more volatile, and so would its profits. Given that it does not have much liquidity, it will suffer a cash squeeze if the peso does not depreciate much while Mexican inflation is high. Over the long run, there may be periods in which this happens. Flame would be locked into this arrangement with Coron for ten years, and therefore cannot back out, even if the peso’s depreciation does not offset the inflation differential.

**Small Business Dilemma**

**Assessment of the IFE by the Sports Exports Company**

1. Is Jim’s interpretation of the IFE theory correct?

   **ANSWER:** Yes. The expected future spot rate derived from the IFE theory is the same as the forward rate. Thus, the results from selling pounds at the future spot rate (when not hedging) should be equal to the results from selling the pounds forward (when hedging) on average if the IFE theory holds.

2. If you were in Jim’s position, would you spend time trying to decide whether to hedge the receivables each month, or do you believe that the results would be the same (on average) whether you hedged or not?

   **ANSWER:** There is some question as to whether the IFE theory holds. Therefore, it is naive to think that the results will be the same on average whether one hedges or does not hedge. However, it is possible that one could do worse by making the hedge vs. no-hedge decision each month, but most managers would attempt to make the decision rather than ignore it.

**Part 2—Integrative Problem**

**Exchange Rate Behavior**

1. As an employee of the foreign exchange department for a large company, you have been given the following information.
Determine whether triangular arbitrage is feasible, and if so, how it should be conducted to make a profit.

ANSWER: Triangular arbitrage is not feasible because the cross exchange rate between £ and A$ is properly specified:

\[
\text{Proper Cross exchange rate} = \frac{\text{Spot rate of £}}{\text{Spot rate of A$}} = \frac{1.596}{.7} = 2.28
\]

2. Using the information in question 1, determine whether covered interest arbitrage is feasible and, if so, how it should be conducted to make a profit.

ANSWER: Covered interest arbitrage is only feasible when interest rate parity does not exist. To test whether interest rate parity exists, determine the forward premium that should exist for the pound and for the Australian dollar.

<table>
<thead>
<tr>
<th>Currency</th>
<th>Forward Premium that Should Exist</th>
<th>Actual Forward Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pound (£)</td>
<td>( p = \frac{(1+i_h)}{(1+i_f)} - 1 )</td>
<td>( p = \frac{F - S}{S} )</td>
</tr>
<tr>
<td></td>
<td>( = \frac{1.08}{1.0909} - 1 )</td>
<td>( = \frac{1.58004 - 1.596}{1.596} )</td>
</tr>
<tr>
<td></td>
<td>( = -.01 )</td>
<td>( = -.01 )</td>
</tr>
<tr>
<td>Australian Dollar (A$)</td>
<td>( p = \frac{(1+i_h)}{(1+i_f)} - 1 )</td>
<td>( p = \frac{F - S}{S} )</td>
</tr>
<tr>
<td></td>
<td>( = \frac{1.08}{1.07} - 1 )</td>
<td>( = \frac{.71 - .70}{.70} )</td>
</tr>
<tr>
<td></td>
<td>( = .0093 )</td>
<td>( = .01428 )</td>
</tr>
</tbody>
</table>

Interest rate parity exists for the British pound. However, interest rate parity does not exist for the A$. The actual forward premium is higher than it should be. U.S. investors could benefit from the
discrepancy by using covered interest arbitrage. The forward premium they would receive when selling A$ at the end of one year more than offsets the interest rate differential. While the U.S. investors receive 1 percent less interest on the Australian investment, they receive 1.428 percent more when selling A$ than what they initially pay for A$.

3. Based on the information in question 1 for the beginning of the year, use the international Fisher effect (IFE) theory to forecast the annual percentage change in the British pound’s value over the year.

ANSWER: The IFE suggests that given two currencies, the currency with a higher interest rate reflects higher expected inflation, which will place downward pressure on the value of that currency (based on purchasing power parity). The currency adjustment will offset the differential in interest rates.

\[ e_f = \left(\frac{1 + i_b}{1 + i_f}\right) - 1 \]

\[ = \frac{(1 + .08)}{(1 + .0909)} - 1 \]

\[ \approx -.01 \text{ or } -1\% \]

Thus, the pound was expected to depreciate by 1 percent over the year, based on the IFE.

4. Assume that at the beginning of the year, the pound’s value is in equilibrium. Assume that over the year the British inflation rate is 6 percent while the U.S. inflation rate is 4 percent. Assume that any change in the pound’s value due to the inflation differential has occurred by the end of the year. Using this information and the information provided in question 1, determine how the pound’s value changed over the year.

ANSWER: If PPP held, the pound would have changed by:

\[ e_p = \left(\frac{1 + I_b}{1 + I_f}\right) - 1 \]

\[ = \frac{1.04}{1.06} - 1 \]

\[ \approx .0189 \text{ or } -1.89\% \]
5. Assume that the pound’s depreciation over the year was attributed directly to central bank intervention. Explain the type of direct intervention that would place downward pressure on the value of the pound.

ANSWER: If central banks used pounds to purchase dollars in the foreign exchange market, they would place downward pressure on the pound’s value.