International Business and Finance
Week 3 Seminar 2

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Exchange rate

- **(Nominal) Exchange rate**:
  - Relative price of currencies between different countries.
  - It tells you how much of one currency you need to buy one unit of another currency.
  - International transactions occur at the exchange rate.
  - Example:
    If the **USD/EUR = 1.20**, that means **1 Euro = 1.20 U.S. Dollars.** In other words, you need **$1.20 to buy €1**.

- **Spot Exchange Rate (S)**
  - **Current** exchange rate for immediate delivery of currencies
  - Example:
    If today's **spot rate for USD/EUR is 1.20**, then today you need **$1.20 to buy €1**.

- **Forward Exchange Rate (F)**
  - **Agreed** exchange rate for a currency transaction that will happen at a **future date**
  - Example:
    If the 6-month **forward rate for USD/EUR is 1.25**, then you agree **today** to exchange currencies **in 6 months** at that rate, regardless of what the market rate is then. Thus, you will need $125,000 to get €100,000 in 6 months.

Exchange rate

- **Exchange Rate Risk** (currency risk or foreign exchange (FX) risk)
  - Potential risk for financial loss due to **fluctuations in the exchange rate** between two currencies.
  - If you're expecting to **pay** or **receive** money in a **foreign currency**, and the exchange rate changes **unfavourably**, you might lose money compared to what you had planned.
  - It affects businesses, investors, or individuals involved in international transactions or investments.

- Example: A U.S. Investor Buying a European Asset
  - You are a U.S. investor planning to buy a **building in France** in **6 months** for **€100,000**.
  - **Spot rate (today)**: 1 EUR = 1.20 USD → You expect it to cost **$120,000**
  - But what if, in 6 months, the **EUR strengthens,** and the new rate is 1 EUR = 1.30 USD?
    - Now the building costs you **$130,000**
    - That is **$10,000 more** than expected → **exchange rate risk**.

- How to manage it:
  - **Forward Contracts**: **Agree today** to buy/sell currency at **a fixed forward rate** in the future. This "locks in" the cost and removes uncertainty.
  - **Options Contracts**: Gives you the **right (but not the obligation)** to exchange at a certain rate.

Covered Interest Rate Parity

- What is the **Covered Interest Rate Parity (CIRP)**?
  - Investors should **earn the same return** on equivalent **risk-free investments in different currencies**, **if they use forward contracts.**

$$1 + r_{\text{DC}} = \frac{F}{S}(1 + r_{\text{FC}})$$

where *S* is the spot exchange rate and *F* is the forward exchange rate defined as the price of foreign currency in terms of domestic currency.

  - LHS: Return on the domestic investment
  - RHS: Return on the foreign investment expressed in domestic currency

Exercise

Suppose that the treasurer of IBM has an extra cash reserve of $100,000,000 to invest for **six months**. The interest rate is **8 percent per annum** in the United States and **7 percent per annum** in Germany. Currently, the spot exchange rate is **1.01 euro per dollar** and the six-month forward exchange rate is **0.99 euro per dollar**. The treasurer of IBM does not wish to bear any exchange risk. Where should he/she invest to maximize the return?

The market conditions can be summarised:

- Interest Rate on $ in the US

$$r_{\$} = \frac{8}{2} = 4\%$$

- Interest Rate on € in Germany

$$r_{€} = \frac{7}{2} = 3.5\%$$

- Spot Exchange Rate

$$S = 1.01\ €/\$$$

- Forward Exchange Rate

$$F = 0.99\ €/\$$$

- If $100,000,000 is invested in the U.S., the maturity value in six months will be

$$\textbf{\$104,000,000} = \$100{,}000{,}000(1 + 0.04)$$

Exercise

- Alternatively, $100,000,000 can be converted into euros and invested at the German interest rate, hedging the exchange rate risk using the forward contract.

- Compute the dollar maturity value if the treasurer invests the $100,000,000 in Germany
  - 1. Convert $100,000,000 into euros at the current spot exchange rate:

$$\text{Converted amount in euros} = \$100{,}000{,}000 \times 1.01€/\$ = €101{,}000{,}000$$

  - 2. Invest this amount in Germany at the semi-annual interest rate:

$$\text{Maturity Value in euros} = €101{,}000{,}000 \times (1 + 0.035) = €104{,}535{,}000$$

  - 3. Convert euros into USD using the forward exchange rate:

$$\text{Dollar Maturity Value} = €104{,}535{,}000 \times \frac{1}{0.99€/\$} = \mathbf{\$105{,}590{,}909}$$

- Since the German investment ($105,590,909) is greater than the U.S. investment ($104,000,000), **the treasurer should invest the $100,000,000 in Germany** and hedge the exchange rate risk using a forward contract to maximize returns.

Questions

Q1. While you were visiting London, you purchased a Jaguar for 35,000 pounds, payable in three months. You have enough cash at your bank in New York City, which pays 0.35% **interest per month**, compounding monthly, to pay for the car. Currently, the spot exchange rate is $1.45 per pound and the three-month forward exchange rate is $1.40 per pound. In London, the money market interest rate is 2.0% **for a three-month investment**. There are two alternative ways of paying for your Jaguar.

a) Keep the funds at your bank in the U.S. and buy 35,000 pounds forward.

b) Buy a certain pound amount spot today and invest the amount in the U.K. for three months so that the maturity value becomes equal to 35,000 pounds.

c) Evaluate each payment method. Which method would you prefer? Why?

Q2. Currently, the spot exchange rate is $1.50 per pound and the three-month forward exchange rate is $1.52 per pound. The three-month interest rate is **8.0% per annum** in the U.S. and **5.8% per annum** in the U.K. Assume that you can borrow as much as $1,500,000 or £1,000,000.

a) Determine whether the interest rate parity (IRP) is currently holding.

b) If the interest rate parity is not holding, how would you carry out covered interest arbitrage? Show all the steps and determine the arbitrage profit.

c) Explain how the IRP will be restored by the market as a result of covered arbitrage activities.

Q3. Imagine you are a U.S. investor planning to purchase a luxury yacht in Italy for 100,000 Euros, payable in six months. Suppose you have $120,000 today. The current spot exchange rates are 1.20 **dollar per euro** and 0.80 **dollar per Swiss Franc** (CHF). The six-month forward exchange rates are 1.25 **dollar per euro** and 0.78 **dollar per CHF**. In Italy, the six-month money market interest rate is **1.5%**, while in Switzerland, it is **0.75%** for the same period. You consider two alternatives to execute this transaction:

a) Convert your dollars to Euros today at the spot rate and invest in Italy for six months. Compute the final amount in euros after the investment period.

b) Convert your dollars to Swiss Francs at the spot rate, invest in Switzerland for six months, and then convert to Euros at the six-month forward rate. Compute the final amount in euros after the investment period.

c) Compare the results from a) and b), and determine the optimal investment strategy.

Questions

Q1. While you were visiting London, you purchased a Jaguar for 35,000 pounds, payable in three months. You have enough cash at your bank in New York City, which pays 0.35% **interest per month**, compounding monthly, to pay for the car. Currently, the spot exchange rate is $1.45 per pound and the three-month forward exchange rate is $1.40 per pound. In London, the money market interest rate is 2.0% **for a three-month investment**. There are two alternative ways of paying for your Jaguar.

a) Keep the funds at your bank in the U.S. and buy 35,000 pounds forward.

b) Buy a certain pound amount spot today and invest the amount in the U.K. for three months so that the maturity value becomes equal to 35,000 pounds.

c) Evaluate each payment method. Which method would you prefer? Why?

Questions

a) Keep the funds at your bank in the U.S. and buy 35,000 pounds forward.

The problem situation can be summarised as follows:

- You have to pay £35,000 in three months for Jaguar.
- Bank in NY pays $r_{\$} = 0.35\%/Month$, compounding monthly
- Market in London pays $r_{£} = 2.0\%$ for three months
- Spot Exchange Rate: $S = 1.45$ \$/£
- Forward Exchange Rate: $F = 1.40$ \$/£

Questions

a) Keep the funds at your bank in the U.S. and buy 35,000 pounds forward.

- To fulfil the forward contract in three months, you need

$$\$49{,}000 = £35{,}000 \times 1.40\ \$/£$$

- The present value of $49,000 today at the U.S. interest rate:

$$\text{PV} = \frac{FV}{(1+r)^n} = \frac{\$49{,}000}{(1+0.0035)^3} = \$48{,}489$$

Thus, the cost of the Jaguar today is **$48,489** using the first method.

Questions

b) Buy a certain pound amount spot today and invest the amount in the U.K. for three months so that the maturity value becomes equal to 35,000 pounds.

- The amount of pounds required today to grow to £35,000 in three months is:

$$\text{PV}=\frac{£35{,}000}{(1+0.20)^{1}}=£34{,}314$$

- The cost in dollars to buy £34,314 at the spot rate ($1.45/£) is:

$$£34{,}314 \times 1.45\ \$/£ = \$49{,}755$$

Thus, the cost of the Jaguar today is **$49,755** using the second method.

Questions

c) Evaluate each payment method. Which method would you prefer? Why?

- a) Using the forward market, the cost today is **$48,489**.
- b) Using the spot market and investing in London, the cost today is **$49,755**.

- You should definitely choose to use the forward market (a), and save $1,266, which is the difference between $49,755 and $48,489.

Questions

Q2. Currently, the spot exchange rate is $1.50 per pound and the three-month forward exchange rate is $1.52 per pound. The three-month interest rate is **8.0% per annum** in the U.S. and **5.8% per annum** in the U.K. Assume that you can borrow as much as $1,500,000 or £1,000,000.

a) Determine whether the interest rate parity (IRP) is currently holding.

b) If the interest rate parity is not holding, how would you carry out covered interest arbitrage? Show all the steps and determine the arbitrage profit.

c) Explain how the IRP will be restored by the market as a result of covered arbitrage activities.

Questions

a) Determine whether the interest rate parity (IRP) is currently holding.

The problem situation can be summarised as follows:

- $r_{\$} = \frac{8.0\%}{4} = 2.0\%$
- $r_{£} = \frac{5.8\%}{4} = 1.45\%$
- Spot Exchange Rate: $S = 1.5$ \$/£
- Forward Exchange Rate: $F = 1.52$ \$/£

According to the covered interest rate parity (CIRP), we have:

$$1 + r_{\$} = \frac{F}{S}(1 + r_{£})$$

- LHS: $1 + r_{\$}$=1.02
- RHS: $\frac{F}{S}\left(1 + r_{£}\right) = \frac{1.52}{1.5}(1 + 0.0145) = 1.0280$

Thus, IRP is not holding exactly.

Questions

b) If the interest rate parity is not holding, how would you carry out covered interest arbitrage? Show all the steps and determine the arbitrage profit.

1. Borrow \$1,500,000; repayment will be \$1,530,000 after three months. ($r_{\$}$ = 2.0%)
2. Buy £1,000,000 using \$1,500,000. ($S = 1.5$ \$/£)
3. Invest £1,000,000 at the pound interest rate of 1.45%; maturity value will be £1,014,500. ($r_{£}$ = 1.45%)
4. Sell £1,014,500 forward for \$1,542,040. ($F = 1.52$ \$/£)

Thus, the arbitrage profit will be **\$12,040**. (= \$1,542, 040 − \$1,530, 000)

Questions

c) Explain how the IRP will be restored by the market as a result of covered arbitrage activities.

IRP:

$$1 + r_{\$} < \frac{F}{S}(1 + r_{£})$$

Following the arbitrage transactions described above,

- The dollar interest rate **will rise**.
- The pound interest rate **will fall**.
- The spot exchange rate **will rise**.
- The forward exchange rate **will fall**.
- These adjustments **will continue until IRP holds**.

Questions

Q3. Imagine you are a U.S. investor planning to purchase a luxury yacht in Italy for 100,000 Euros, payable in six months. Suppose you have $120,000 today. The current spot exchange rates are 1.20 **dollar per euro** and 0.80 **dollar per Swiss Franc** (CHF). The six-month forward exchange rates are 1.25 **dollar per euro** and 0.78 **dollar per CHF**. In Italy, the six-month money market interest rate is **1.5%**, while in Switzerland, it is **0.75%** for the same period. You consider two alternatives to execute this transaction:

a) Convert your dollars to Euros today at the spot rate and invest in Italy for six months. Compute the final amount in euros after the investment period.

b) Convert your dollars to Swiss Francs at the spot rate, invest in Switzerland for six months, and then convert to Euros at the six-month forward rate. Compute the final amount in euros after the investment period.

c) Compare the results from a) and b), and determine the optimal investment strategy.

Questions

a) Convert your dollars to Euros today at the spot rate and invest in Italy for six months. Compute the final amount in euros after the investment period.

- Compute the euro maturity value if you invest the $120,000 in Italy
  - 1. Convert $120,000 to euros today at the spot exchange rate:

$$\text{Converted amount in euros} = \$120{,}000 \times \frac{1}{1.20\ \$/€} = €100{,}000$$

  - 2. Invest this amount in Italy at an interest rate of 1.5% for six months:

$$\text{Maturity Value in euros} = €100{,}000 \times (1 + 0.015) = \mathbf{€101{,}500}$$

- Since the yacht price is in euros, no further conversion is required.

Questions

b) Convert your dollars to Swiss Francs at the spot rate, invest in Switzerland for six months, and then convert to euros at the six-month forward rate. Compute the final amount in euros after the investment period.

- Compute the euro maturity value if you invest the $120,000 in Switzerland
  - 1. Convert $120,000 to Swiss Francs (CHF) today at the spot exchange rate:

$$\text{Converted amount in CHF} = \$120{,}000 \times \frac{1}{0.80\ \$/\text{CHF}} = \text{CHF } 150{,}000$$

  - 2. Invest this amount in Switzerland at an interest rate of 0.75% for six months:

$$\text{Maturity Value in CHF} = \text{CHF } 150{,}000 \times (1 + 0.0075) = \text{CHF } 151{,}125$$

  - 3. Convert CHF into euros using the forward exchange rate of $0.78\ \$/\text{CHF}$ and $1.25\ \$/€$:

$$\text{Euro Maturity Value} = \text{CHF } 151{,}125 \times 0.78\ \$/\text{CHF} \times \frac{1}{1.25\ \$/€} = \textbf{€94,302}$$

Questions

c) Compare the results from a) and b), and determine the optimal investment strategy.

- **Strategy a)** yields **€101,500**
- **Strategy b)** yields **€94,302**

- The investor should convert dollars to euros today and invest in Italy.