FRM Part 1

Book 3 - Financial Markets and Products

FOREIGN EXCHANGE MARKETS

Learning Objectives

After completing this reading you should be able to:

- ✓ Explain ad describe the mechanics of **spot quotes**, **forward quotes** and **future quotes** in the foreign exchange market and distinguish between the bid and ask exchange rates
- ✓ Calculate **bid-ask spread** and explain why bid-ask spread for spot quotes may be different from the bid-ask spread for the forward quotes
- ✓ Compare **outright** (forward) and **swap transactions**
- ✓ Define, compare and contrast **transaction risk**, **translation risk** and **economic risk**
- ✓ Describe the examples of the transaction, translation, and economic risk and explain how to **hedge these risks**
- ✓ Describe the rationale for **multi-currency hedging using options**
- ✓ Identify and explain the **factors that determine the exchange rates**
- ✓ Calculate and explain the **effect of an appreciation/depreciation** of a currency relative to a foreign currency
- ✓ Explain the **purchasing power parity theorem** and use this theorem to calculate the appreciation or depreciation of a foreign currency
- ✓ Explain how no-arbitrage assumption in the foreign exchange markets leads to the **interest rate parity theorem** and use this theorem to calculate forward foreign exchange rates
- ✓ Distinguish between **covered** and **uncovered interest rate parity** conditions

Currency Quotes

- Generally, currency quotes always appear as:

A/B

  - The base currency (in this case, A) is **always equal to one unit**, and
  - The quoted currency (in this case, B) is **what that one base unit is equivalent to in the other currency**.

Example: Interpreting the Currency Quotes

- The EUR/USD is quoted as 1.2563.
- How do we interpret this quote?

Solution

- This quote implies that we need 1.2563 USD to buy one euro.

Bid and Ask Prices

- The **bid price** is the price at which the counterparty is **willing to buy** one unit of the base currency, expressed in terms of the price currency.
- The **ask price** is the price at which a counterparty is **willing to sell** one unit of the base currency, expressed in terms of price currency.

Characteristics of Bid-Ask Quotes

i. The **ask price** should always be **higher** than the bid price.

ii. A market participant requesting the **two-sided price quote** has the option but not the obligation to transact at **either the bid or the ask** quoted by the dealer.

Example of a Spot Rate

- For instance, **spot bid** for EUR/USD could be stated as **1.1745** and **spot ask** as **1.1747**.

Forward Exchange Rates

- A forward exchange is a price at which one currency is traded against another **at some specified time in the future**.

- Forward exchange rates are quoted with the same base as the spot exchange rates but rather as points that are **multiplied by** $\frac{1}{10{,}000}$ then added to the spot exchange rate.

Example >>

Forward Exchange Rates

Example: Calculating the Forward Exchange Rates

- The following table gives the forward rates as of June 16, 2019.

Maturity	Bid	Ask
1 month	27.12	28.60
2 months	53.15	54.15
3 months	81.87	83.07

- The **spot bid and ask** rates are **1.1745** and **1.1749** respectively.
- What is the three-month forward bid and ask quotes?

Solution

- Since we are given the spot bid rate as 1.1745, then the 3-month forward bid rate is:
  - $1.1745 + \frac{1}{10{,}000} \times 81.87 = 1.1745 + 0.008187 = 1.182687$
- Analogously, the 3-month forward ask quote is
  - $1.1749 + \frac{1}{10{,}000} \times 83.07 = 1.1749 + 0.008307 = 1.183207$

The Bid-Ask Spread

- The **bid-ask spread** is the amount by which the **offer price exceeds the bid price** of a currency in a market.
- Continuing with the example from the previous slide, the bid-ask spread for the 3-month forward rate is calculated as:

$$\boldsymbol{Ask\ Price - Bid\ Price}$$
$$1.183207 - 1.182687 = 0.00052$$

Negative Forward Rates

- When the **forward** exchange rate is **less than the spot rate**, the points are negative.
  - However, it should be apparent that the magnitude of the negative ask price is less than that of the bid price.
- For example:

Maturity	Bid	Ask
1 Month	-9.39	-7.67
2 months	-18.20	-17.29
3 months	-32.10	-30.91

Outrights and Swaps

- A **forward exchange** is a price at which two parties agrees to trade one currency against another at some specified time in the future.
  - This is termed as an **outright transaction** or **outright forward transaction.**
- On the other hand, a **foreign exchange swap** is a type of exchange rate transaction where a currency is bought (sold) in a **spot market** and then sold (bought) in the **forward market**.
  - From a different angle, an FX swap is a method of **funding an asset** transacted in foreign currency by **paying the interest due in terms of the domestic currency**.
- An example of FX swap is where a US-based company funds its Chinese investment by **borrowing in USD** and **buying the Chinese Yuan**, and after some time, the company **exchanges the money back to USD**.
  - By doing this, the company can fund its operation in Chinese Yuan.

Future Quotes

- Future quotes are the **exchange traded** futures legal contract that stipulates the price in one currency at which another currency can be bought or sold at a future date.
- In CME (Chicago Mercantile Exchange) setting, **USD is always the base currency** since investors treat foreign currency as assets value in USD.

Example

- Assume that the **6-month forward quote** for the USD/CAD is **1.2900**.
- The future quote is computed as the **reciprocal** of the forward quote. That is:

$$\text{6-month futures quote: } \frac{1}{1.2900} = 0.7752 \text{ USD per CAD}$$

Foreign Exchange Market (FX) Risk

Transaction Risk

- Foreign exchange rate fluctuations when **buying goods in another currency**
- Transaction risk is hedged using outright **forward transactions and swaps**

Translation Risk

- When an institution's **assets and liabilities are in a foreign currency**, which must be valued in the institution's domestic currency when the financial statements are made.
- Translation risk is hedged using the **forward contracts on the reporting date** to decrease the volatility of profits

Economic Risk

- For example, if the BRL (Brazilian real) weakens in value relative to the Canadian dollar, the Brazilian customers will see the **Canadian firm's products expensive**
- For "hedging," a firm might decide to **move production overseas** due to favorable exchange rate movements

Multicurrency Hedging Using Options

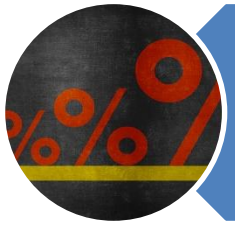
- Multinational companies are exposed to **many different currencies**.
  - Just like any other portfolio, multiple exposures to multiple currencies **reduces the FX risk due to diversification**.
- Companies often prefer options to forward contracts since the **options provide the downside protection** against unfavorable exchange rate movement while allowing a firm to benefit from desirable movements.
  - Therefore, hedging using options involves **buying options** on individual currencies to **cover each adverse exchange rate movement**.
- Alternatively, a firm might **buy an option on a portfolio of currencies** to which it is exposed in the over-the-counter market.
  - Such options are basket and Asian options.

Multicurrency Hedging Using Options

- Just like any other financial asset, currency exchange rates cannot be determined with ultimate precision because they are **influenced by supply and demand**, and other factors such as:

Balance of payments and trade flows: exports and imports

Monetary policies: determined by the central bank



Inflation: which has a negative impact on the exchange

Purchasing Power Parity Theorem (PPP)

- The laws of one price state the price of a **foreign good *x,*** denoted as P_f^x, must be the equal price of the similar good in a domestic country, P_d^x, using the spot rate $S_{\frac{f}{d}}$:

$$P_f^x = S_{\frac{f}{d}} \times P_d^x$$

- For instance, a product in Canada costs **CAD 100**.
  - The nominal exchange rate for **CAD/USD is 0.76**.
  - So, the same product will cost 0.76×100 = **USD 76 in the US**.

- PPP propagates the idea that in open economies, **differences in prices** (which are caused by inflation) **drive trade flows** and thus **demand** for and **supplies** of currencies.

Example >>

Purchasing Power Parity Theorem (PPP)

Example: Calculating the Spot Exchange Rate Using Purchasing Power Parity

- The inflation rate in the US is **3% per year** and **1% in Canada**.
  - You are also given that the **USD/CAD exchange rate is 1.0500**.
  - A **basket** of goods in the US costs **USD 100**.
- Assuming that the purchasing power parity holds, what is the **new USD/CAD after one year**.

Solution

- After one year, the basket of goods in the US is:
  - $P_d = 1.03 \times 100 = USD\ 103$
- The same basket of would cost the following in Canada:
  - $P_f = 1.05 \times 1.01 \times 100 = CAD\ 106.05$
- According to purchasing power parity:
  - $S_{\frac{f}{d}} = P_f^x / P_d^x = \frac{106.05}{103} = 1.0296$

Percentage Appreciation / Depreciation

- Suppose that the exchange rate of ZAR/CNY moved from 1.6459 to 1.8356. The **percentage of appreciation/depreciation of the Chinese Yuan** will be:

$$\frac{1.6459}{1.8356} - 1 = -10.33\%$$

  - It used to take **1.65 CNY to buy one ZAR**, it **now takes 1.84 CNY** to buy one ZAR.

- To calculate the **appreciation percentage of South African Rand**, we have to **invert the exchange rate:**

$$\left(\frac{1.8356}{1.6459}\right) - 1 = 11.53\%$$

- Thus, we can see that the **depreciation percentage of South African** Rand is **different** from the **Chinese Yuan's appreciation**.

Real and Nominal Interest Rates

- **Nominal interest** rates are those rates that are listed in the market and show the return that will be earned on a currency.
  - For instance, **5% per year** for a given currency of a country implies that 100 units of a currency is anticipated to **grow to 105 in one year**.

- Real interest rate are the rates that are **adjusted to accommodate the effects of inflation**. The real interest is given by:

$$r_{real} = \frac{1 + r_{nominal}}{1 + r_{inflation}} - 1$$

- The above equation is usually approximated as:

$$r_{real} \approx r_{nominal} - r_{inflation}$$

Covered Interest Parity

Take the following example:

- A trader can invest in the funds in the **risk-free foreign rate of interest** (i_f) so that the funds grows to $(1+i_f)^T$ at time T. At time *T*, the investor can enter into a **forward contract to exchange** $(1+i_f)^T$ for foreign currency at a foreign forward rate of exchange $F_{f/d}$ to get:

$$(1+i_f)^T F_{f/d}$$

- ***Or*** the trader **immediately exchange the proceeds to USD** and invest in risk-free domestic rate of interest to get:

$$S_{f/d}=(1+i_d)^T$$

- Since we are assuming there is a **no-arbitrage condition**, then these two investments should give the same result. That is:

$$(1+i_f)^T F_{f/d}=S_{f/d}(1+i_d)^T$$

- Rearranging we get:

$$F_{f/d}=S_{f/d}\left(\frac{(1+i_d)^T}{(1+i_f)^T}\right)$$

The Uncovered Interest Rate Parity

- This condition postulates that the expected yield from a **risky foreign investment** must be **equal** to that of **equivalent domestic currency investment**.
- Assume that an investor has a choice of venturing in **one-year domestic market investment** and a **risky (unhedged) foreign market investment**.
  - The foreign investment return in domestic currency will be given by:

$$\boldsymbol{\left(1 + i_f\right)\left(1 - \%\Delta S_{f/d}\right) - 1}$$

  - This also can be represented as:

$$\boldsymbol{\approx i_f - \%\Delta S_{f/d}}$$

- Also, the uncovered interest rate parity implies that the **anticipated change in the spot rate** over the investment period should show the **difference between the foreign and domestic interest rates**. This is mathematically represented as:

$$\boldsymbol{\%\Delta S^{e}_{f/d} = i_f - i_d}$$

  - Where ΔS^e is the future change in the spot rate.

Example >>

The Uncovered Interest Rate Parity

Example: Uncovered Interest Parity

- Currencies A (domestic) and B (foreign) have **risk-free rates of interest of 2% and 5% respectively**.
- Assuming that the uncovered interest rate parity holds, by what percentage would B weaken (strengthen) relative to A?

Solution

- According to uncovered interest rate parity:
  - $\%\boldsymbol{\Delta S^{e}_{f/d}} = \boldsymbol{i_f - i_d} = \mathbf{5\% - 2\%} = \mathbf{3\%}$
- So, we would expect currency B to weaken by 3% relative to the value of currency A.

➢ The assumption brought forward by the uncovered interest rate is that **when a country has higher interest rates**, **its currency will depreciate which offsets the high yields**, bringing the return of the two investments to the same level.

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