

# LM 8 - Currency Exchange Rates

## CFA Level 1 - Economics

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# Learning Outcomes

The candidate should be able to:

- ➊ define an exchange rate and distinguish between nominal and real exchange rates and spot and forward exchange rates;
- ➋ calculate and interpret the percentage change in a currency relative to another currency;
- ➌ describe functions of and participants in the foreign exchange market;
- ➍ calculate and interpret currency cross-rates;
- ➎ calculate an outright forward quotation from forward quotations expressed on a points basis or in percentage terms;
- ➏ explain the arbitrage relationship between spot rates, forward rates, and interest rates;

# Learning Outcomes

The candidate should be able to:

- 7 calculate and interpret a forward discount or premium;
- 8 calculate and interpret the forward rate consistent with the spot rate and the interest rate in each currency;
- 9 describe exchange rate regimes;
- 10 explain the effects of exchange rates on countries' international trade and capital flows.

# Introduction

- The foreign exchange (FX) market is the market in which currencies are traded against each other.
- FX market is by far the world's largest market. Daily turnover was around USD 7.5 trillion in 2022.
- It's a global market that operates 24 hours a day, five days a week with participants from around the world.

# Exchange Rate

- Individual currencies are often referred to by standardized three-letter codes (e.g. USD, EUR, JPY, CNY, GBP, CHF).
- The exchange rate is the number of units of one currency (called the price currency) that one unit of another currency (called the base currency) will buy.
- Usually, exchange rates use the convention of “A/B,” referring to the number of units of currency A that one unit of currency B will buy.
- For example, a USD/EUR exchange rate of 1.1700 means that 1 euro will buy 1.1700 US dollars.

# Nominal vs. Real Exchange Rate

- The exchange rates described above are referred to as nominal spot exchange rates (NER or  $S$ ).
- Real exchange rate (RER) is an index constructed to assess changes in the relative purchasing power of one currency compared with another.
- It is constructed by adjusting the nominal exchange rate using the price levels in each country of the currency pair:

$$RER_{d/f} = S_{d/f} \times \frac{P_f}{P_d}$$

- The RER is an increasing function of the nominal exchange rate and the foreign price level (base currency) and a decreasing function of the domestic price level (price currency).

## Real Exchange Rate: Example

An analyst is studying the effects of exchange rates on purchasing power. She comes across the following data:

- Nominal exchange rate  $USD/EUR = 1.15$ .
- Eurozone Consumer Price Index ( $P_{EUR}$ ) = 110.
- US Consumer Price Index ( $P_{USD}$ ) = 100.
- The RER for an American consumer wanting to buy goods made in the Eurozone is:

$$\begin{aligned} RER_{USD/EUR} &= S_{USD/EUR} \times \frac{P_{EUR}}{P_{USD}} \\ &= 1.15 \times \frac{110}{100} = 1.2650 \end{aligned}$$

# Change in Real Exchange Rate

- The formula for the change in the real exchange rate, accounting for changes in price levels and nominal exchange rates, is:

$$\frac{\Delta \text{RER}_{d/f}}{\text{RER}_{d/f}} = \left( 1 + \frac{\Delta S_{d/f}}{S_{d/f}} \right) \times \frac{\left( 1 + \frac{\Delta P_f}{P_f} \right)}{\left( 1 + \frac{\Delta P_d}{P_d} \right)} - 1$$



## Change in Real Exchange Rate: Example

- We would like to examine the effect of movements in the domestic and foreign price levels, and the nominal spot exchange rate, on the real purchasing power of an individual in the United Kingdom wanting to purchase Eurozone goods.
- Assume that the nominal spot exchange rate GBP/EUR increases by 10 percent, the Eurozone price level by 5 percent, and the UK price level by 2 percent.
- The change in the real exchange rate is then:

$$\frac{\Delta RER_{d/f}}{RER_{d/f}} = (1 + 10\%) \times \frac{(1 + 5\%)}{(1 + 2\%)} - 1 = 13.24\%$$

- The pound has depreciated in real terms against the euro due to a combination of nominal depreciation and higher inflation in Eurozone.

# Purchasing Power Parity

- Purchasing Power Parity (PPP) is a theory that states that nominal exchange rates should adjust in the long run so that identical goods should have the same price in different markets ( $RERs = 1$ ).
- PPP assumptions usually don't hold  $\Rightarrow$  NERs exhibit persistent deviations from PPP.

# FX Market Functions

- FX markets facilitate international trade (e.g. companies buying and selling products in other countries, tourists engaged in cross-border travel)
- The largest proportion of FX market trades are capital market transactions, where investors convert between currencies for the purpose of moving funds into (or out of) foreign assets (e.g. foreign direct investment, portfolio investments).

# FX Market Transactions

- Spot transactions: exchange of currencies for immediate delivery ( $T+1$  or  $T+2$ ) at the **spot exchange rate**.
- Forward contracts: agreements to buy or sell a specific amount of a foreign currency at a future date at the quoted **forward exchange rate** (e.g. 30 or 90 days in the future)
  - ▶ Example: Agree today to buy 10,000 euros on 90 days from now for USD11,200.
- Future contracts: standardized and collateralized forwards traded in exchanges.
- FX swaps: a combination of a spot and a forward FX transaction. They are used to extend (roll) an existing forward position to a new future date.
- FX options: contracts that, for an upfront premium or fee, give the purchaser the right, but not the obligation, to make an FX transaction at some future date at an exchange rate agreed upon today.

# FX Market Participants

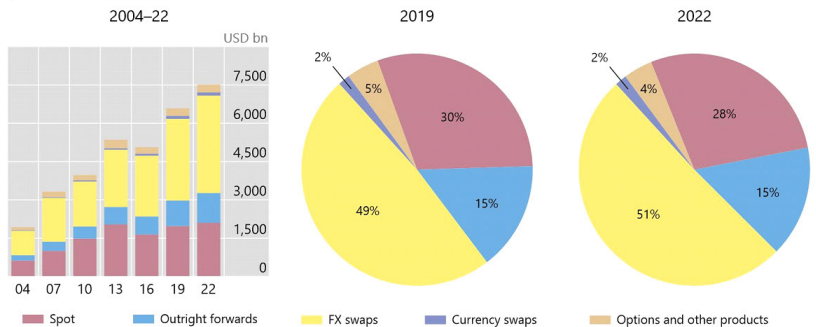
- The foreign exchange markets, encompasses a diverse range of participants from large investment funds to individuals.
- Buy Side Participants:
  - ▶ Corporate accounts.
  - ▶ Real money accounts (restricted in the use of leverage and financial derivatives).
  - ▶ Leveraged accounts (i.e. professional traders).
  - ▶ Retail accounts.
  - ▶ Governments, central banks, sovereign wealth funds.
- Sell Side Participants:
  - ▶ Large dealing banks (e.g. Deutsche Bank, Citigroup, UBS, HSBC)
  - ▶ Other regional or local banks.

# FX Market Size and Composition

## Foreign exchange market turnover by instrument<sup>1</sup>

Net-net basis, daily averages in April

Graph 1



<sup>1</sup> Adjusted for local and cross-border inter-dealer double-counting, ie "net-net" basis.

Source: BIS Triennial Central Bank Survey. For additional data by instrument, see Table 1.

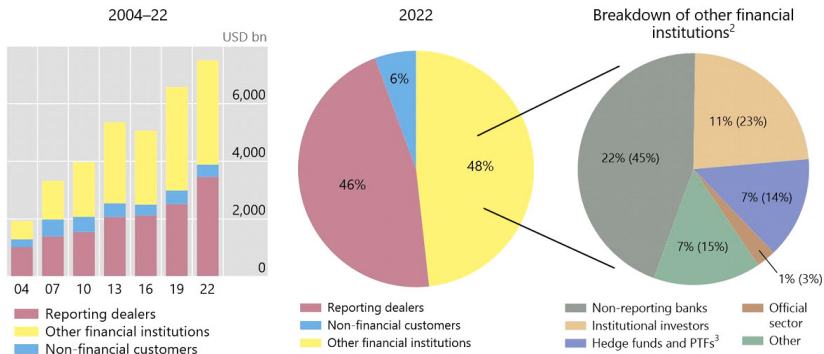
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# FX Market Size and Composition

## Foreign exchange market turnover by counterparty<sup>1</sup>

Net-net basis, daily averages in April

Graph 3



<sup>1</sup> Adjusted for local and cross-border inter-dealer double-counting, ie "net-net" basis. <sup>2</sup> For definitions of counterparties, see explanatory notes in the Annex. Shares in overall total, with shares in other financial institutions in brackets. <sup>3</sup> Proprietary trading firms.

Source: BIS Triennial Central Bank Survey. For additional data by counterparty, see Tables 2 and 3.

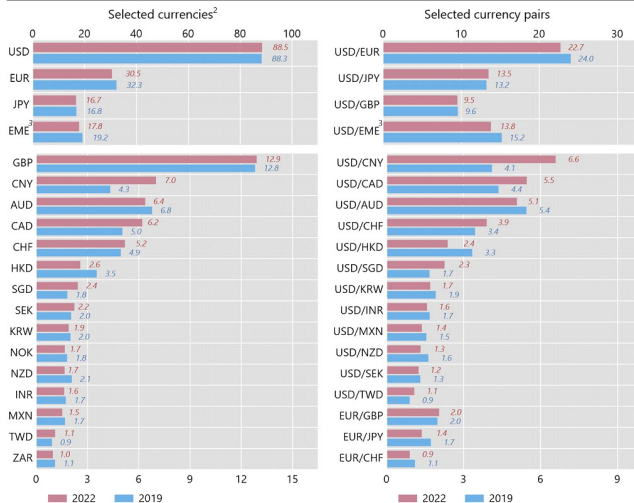
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# FX Market Size and Composition

Foreign exchange market turnover by currency and currency pairs<sup>1</sup>

Net-net basis, daily averages in April, as a percentage of total turnover

Graph 4





# Exchange Rate Quotations

- Exchange rates determine the value of one currency in terms of another.
- Exchange rates are quoted in two ways:
  - ▶ Direct quote: Domestic currency as the price currency, foreign currency as the base currency.
  - ▶ Indirect quote: Reverse arrangement, foreign currency as the price currency, domestic currency as the base currency.
  - ▶ Example: For a Paris-based trader, a direct quote would be  $\text{EUR/GBP} = 1.1211$  (1 GBP costs 1.1211 EUR). An indirect quote would be  $\text{GBP/EUR} = 0.8920$  (1 EUR costs 0.8920 GBP).
  - ▶ Direct and indirect quotes are just the inverse of each other.
- The professional FX market has developed a set of market conventions for FX quotes.

# FX Market Conventions

<b>FX Rate Quote Convention</b>	<b>Name Convention</b>	<b>Actual Ratio (Price currency/Base currency)</b>
EUR	Euro	USD/EUR
JPY	Dollar-yen	JPY/USD
GBP	Sterling	USD/GBP
CAD	Dollar-Canada	CAD/USD
AUD	Aussie	USD/AUD
NZD	Kiwi	USD/NZD
CHF	Swiss franc	CHF/USD
EURJPY	Euro-yen	JPY/EUR
EURGBP	Euro-sterling	GBP/EUR
EURCHF	Euro-Swiss	CHF/EUR
GBPJPY	Sterling-yen	JPY/GBP
EURCAD	Euro-Canada	CAD/EUR

# Exchange Rate Quotations

- Quotes as usually offered as a **two-sided price** (or two-way quote): bid and offer (or ask).
- The two-sided price quoted by the dealer is in terms of buying/selling the base currency in units of the price currency.
- Example: a two-sided price in euro–Swiss (CHF/EUR) is 1.1583–1.1585. The client will receive CHF 1.1583 for selling EUR 1 to the dealer and must pay CHF 1.1585 to the dealer to buy EUR 1.
- The bank buys the base currency (EUR, in this case) at the low price and sells the base currency at the high price  $\Rightarrow$  **the bid is always less than the offer**.
- Most major spot exchange rates are typically quoted to four decimal places (except the yen usually quoted to two decimal places).

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## Changes in Exchange Rate

- Changes in an exchange rate can be expressed as a percentage appreciation of one currency against the other.
- Example: the exchange rate for the euro (USD/EUR) increases from 1.1500 to 1.2000. This represents a percentage change of:

$$\frac{1.2000}{1.1500} - 1 = 4.35\%$$

This represents a 4.35% **appreciation** in the euro (base) against the US dollar (price).

- This appreciation can also be expressed as a depreciation of the US dollar against the euro of

$$\frac{1.1500}{1.2000} - 1 = -4.17\%$$