# R14 Currency Exchange Rates





Version 1.0

# 1. Introduction & The Foreign Exchange Market

This reading covers:

- How the foreign exchange market is structured, who the major players are, and how they conduct their business.
- The nitty-gritty of how exchange rates are quoted and calculated.
- How to calculate cross-exchange rates and forward exchange rates.
- The different exchange rate regimes throughout the world.
- The effect of exchange rates on international trade and capital flows.

## 1.1 The Foreign Exchange Market

**Exchange Rate**

- It is the price or cost of one currency expressed in terms of another currency.
- Stated otherwise, it is the number of units of the price currency needed to buy/sell one unit of the base currency.
- Consider an exchange rate quote of 1.4500 USD/EUR.
- The numerator currency (USD) is called as the price currency and the denominator currency (EUR) is called as the base currency.
- It implies that one EUR is exchangeable with 1.45 USD.
- So, 1.4500 USD/EUR is interpreted as $1.45 per euro. Here, USD is the currency used to express price per one unit of euro.
- To determine appreciation or depreciation of a currency; if the quote rate increases in terms of the base currency → base currency has appreciated; and vice versa.
- If one currency in a currency exchange pair appreciates, the other currency depreciates.

**Example**

Determine whether the following currencies have appreciated or depreciated.

| Currency pair | Current exchange rate | Exchange rate three years later |
|---|---|---|
| USD/EUR | 1.4160 | 1.4051 |
| INR/USD | 60.4560 | 61.3869 |
| CHF/USD | 0.8895 | 0.8863 |

**Solution:**

In USD/EUR, the quoted exchange rate decreases → EUR depreciates (relative to USD), USD appreciates.

In INR/EUR, the quoted exchange rate increases → USD appreciates (relative to INR), INR depreciates.

In CHF/USD, the quoted exchange rate decreases → USD depreciates (relative to CHF), CHF appreciates.

**Nominal exchange rate** is the quoted currency exchange rate at any point in time.

**Real exchange rate** adjusts the nominal exchange rate for inflation in each country compared to a base period.

- Real exchange rate $_{\text{price currency/base currency}}$ = nominal exchange rate $_{\text{price currency/base currency}}$ x (Base currency CPI / Price currency CPI).
- Real exchange rate shows the relative purchasing power of currencies and has the following correlations:
    - Directly related to nominal exchange rate.
    - Directly related to price level in base currency.
    - Inversely related to price level in price currency.

Example 1 from the curriculum will help understand these concepts better.

## 2. Market Functions

- There are several motivations for foreign exchange transactions such as:
    - International trade: Companies buying and selling products/services across geographies.
    - Capital market transactions such as investors buying fixed assets in other countries, investing in stocks/bonds denominated in foreign currencies.
    - The growth of international tourism. Tourists buy the currency of the country they are visiting.
- **Hedging versus Speculating**
    - Hedging is engaging in a transaction to mitigate foreign exchange risk.
        - For example: A Chinese food products company imports canned peaches, Maple syrup, and various types of vinegar from the United States. It makes the payment in dollars. The company can engage in a forex transaction to buy a certain amount of dollars at a specified rate. This removes the risk (uncertainty) of the U.S. dollar becoming too expensive in the future. This is an example of hedging.
        - For example: Take another example of a software services exporter in Pakistan who gets paid in dollars but the revenues are reported in Pakistani rupee (PKR). To remove the uncertainty of how much the U.S. dollar translates into PKR, the company may engage in forex transaction to receive a certain amount of PKR for every dollar at a certain date.
    - Speculating: This means that unlike in the examples above, the person engaging in the transaction has no intention of taking delivery of the currency. They seek to profit from exchange rate changes. They were merely anticipating a movement in a certain direction (currency appreciating / depreciating) and trading on that view.
    - At times the difference between hedging and speculation is blurred.

- **Spot Transactions**
  - Spot transactions involve the exchange of currencies for immediate delivery. For most currencies, this corresponds to "T+2" delivery, meaning that the exchange of currencies is settled two business days after the trade is agreed to by the two sides of the deal.
  - The exchange rate used for such transactions is called the spot exchange rate.
- **Forward Contracts**
  - Forward contracts are agreements to deliver foreign exchange at a future date at an exchange rate agreed upon today. As such, they are any exchange rate transactions that occur with currency settlement longer than T+2 days.
  - In the hedging examples that we saw earlier, a forward contract may be used. For example, the Chinese company may enter into a contract on Jan 13, 2014 to pay \$500,000 on Apr 13, 2014 at the rate of 6.21 CNY ( $\frac{\text{CNY}}{\text{USD}} = 6.2100$)
  - Two factors are defined in each forward contract:
    - The date at which the currencies are to be exchanged.
    - The exchange rate applicable on the settlement date. This exchange rate is defined now and is called the forward exchange rate; it is different from the spot rate.
  - Forward contracts can be of any size the counterparties agree upon, however the liquidity in forward market decreases as the trade size and term to maturity increases.

## 3. Market Participants, Size and Composition

The forex market has a diverse range of participants. One way of classifying them is to group them based on buy-side and sell-side players.

**Sell side:**

- Large FX trading banks such as Deutsche bank, Citigroup, UBS, and HSBC.
- Other banks fall into the second and third tier of the FX market.

**Buy side:**

- Clients who use banks to undertake FX transactions.
- Corporate accounts: Corporations using forex transactions for cross-border trade of goods and services.
- Real money accounts: restricted use of leverage. Investment funds managed by mutual funds, ETFs, pension funds, endowments, etc.
- Leveraged accounts: Hedge funds, high-frequency algorithmic traders.
- Retail accounts: Individuals trading for their own accounts; tourists exchanging currency during international travel.
- Governments.
- Central banks: Intervene in the forex market to control their domestic exchange rate. For instance, during 2012-13 the Reserve Bank of India bought billions of U.S. dollars

to strengthen the depreciating Indian rupee.

- Sovereign wealth funds: Countries with current account surpluses like Norway, UAE, Kuwait, and China direct international capital inflows into SWFs instead of holding them as foreign exchange reserves. SWF then invests these funds internationally in natural resources, infrastructure projects, and real estate to earn higher returns and exert more influence.

### 3.1 Market Size and Composition

Exhibit 3 in the curriculum (reproduced below) lists FX turnover by instrument.

FX Turnover by Instrument

| | |
|---|---|
| Spot | 36% |
| OTC forwards | 12 |
| Exchange-traded derivatives | 4 |
| Swaps[a] | 44 |
| OTC options[b] | 4 |
| **Total** | **100%** |
| a Includes both FX and currency swaps. | |
| b Includes what the BIS categorizes as ''other FX products.'' | |

The largest turnover is in the swaps market, followed by the spot market.
*Note: You need not memorize the numbers.*

Exhibit 4 in the curriculum (reproduced below) lists FX flows by counterparty. Average daily FX flow between financial clients is higher than that between the sell-side banks (interbank market).

FX Flows by Counterparty.

| | |
|---|---|
| Interbank | 39% |
| Financial clients | 48 |
| Non-financial clients | 13 |

## 4. Exchange Rate Quotations

Exchange rate is the price of one currency relative to another. Exchange rates are typically quoted at four decimal places. The ratio or exchange rate is quoted as price currency per unit of base currency.

Consider this quote: $\frac{\text{USD}}{\text{EUR}} = 1.4000$

It means you can buy 1.4 U.S. dollars for one euro. The currency in the denominator (one unit of the currency) is the base currency. The currency in the numerator is the price currency.

The same quote may also be written as $\frac{\text{EUR}}{\text{USD}}$ = 0.7142. If you notice, it is the reciprocal of 1.4.

**Direct quote:** A direct quote takes domestic currency as the price currency and the foreign currency as the base currency.

**Indirect quote:** An indirect quote takes domestic currency as the base currency and the foreign currency as the price currency,
Direct and indirect quotes are the reciprocal of each other.
For example, From a German investor's perspective, is $\frac{\text{USD}}{\text{EUR}}$ = 1.4000 a direct quote?
The domestic currency for a German investor is the Euro. In this case, the Euro is shown as the base currency. Therefore, from the German investor's perspective this quote is an indirect quote.

**Bid-ask**: Currencies are always quoted as bid-ask. (*This is from the perspective of a dealer, not from the client's perspective)*. Bid rate is the rate at which the dealer will buy the base currency. Ask rate is the rate at which the dealer will sell the base currency.
For example, A bid-ask quote of $\frac{\text{USD}}{\text{EUR}}$ = 1.3990 - 1.4010 means that the dealer is willing to buy 1 euro for $1.399 and sell 1 euro for $1.4010.

The bid price is always lower than the sell price as the dealer makes money on the bid-ask spread.


**Example**

Appreciation of one currency is the depreciation of the other. Say the USD/EUR rate changed from 1.4 to 1.5. What is the appreciation/depreciation of each currency?

**Solution:**

The base currency is EUR; the price currency is USD.

The exchange rate goes up from 1.4 to 1.5. It means the base currency (EUR) has appreciated/strengthened. The USD has depreciated or weakened.

% appreciation of EUR = $\frac{1.5 - 1.4}{1.4} * 100 = 7.142\%$

To calculate the depreciation in USD, we must first convert the quote in EUR/USD terms.

Take a reciprocal of the quote to get the EUR/USD values.

Initial value: $\frac{1}{1.4}$ = 0.7143 Later value EUR/USD = $\frac{1}{1.5}$ = 0.6667

% Depreciation of dollar = $\frac{0.6667 - 0.7143}{0.7143} * 100 = -6.67\%$

Note: The percentage amount by which one currency goes up (appreciates) is not necessarily the same as the percentage amount by which the other currency goes down. In our example, while the Euro appreciated by 7.142%, the U.S. dollar did not depreciate by 7.142%, instead it only depreciated by 6.67%.

## 5. Cross-rate Calculations

Given two exchange rates and three currencies, it is possible to determine the third exchange rate. This way of determining the third exchange rate by converting one foreign exchange quote into another is called the cross rate.

Given the two exchange rates below, what is the $\frac{\text{PKR}}{\text{INR}}$ rate?

| Ratio | Spot rate |
|---|---|
| $\frac{\text{PKR}}{\text{USD}}$ | 100.0000 |
| $\frac{\text{INR}}{\text{USD}}$ | 60.0000 |

**Solution:**

$\frac{\text{PKR}}{\text{INR}} = \frac{\text{PKR}}{\cancel{\text{USD}}} * \frac{\cancel{\text{USD}}}{\text{INR}}$ In this equation, the USD cancels out giving us $\frac{\text{PKR}}{\text{INR}}$.

We are given the value of $\frac{\text{PKR}}{\text{USD}}$. To get the value of $\frac{\text{USD}}{\text{INR}}$, we take the reciprocal of $\frac{\text{INR}}{\text{USD}}$ which is given.

$$\frac{\text{PKR}}{\text{INR}} = 100 * \frac{1}{60} = 1.667$$

**Triangular arbitrage:** If the implied cross rate is not equal to the quoted cross rate, then an arbitrage opportunity exists and it is called triangular arbitrage. In such cases, one would profit by buying low and selling high. For example, in the case above, if the bank quoted a rate of 1.8 for $\frac{\text{PKR}}{\text{INR}}$, then you may buy INR (sell PKR) for 1.667 and sell INR (buy PKR) for 1.8 to profit from the mispricing.

## 6. Forward Calculations

Forward exchange rates are generally quoted in terms of points or pips. A spot rate is the rate that is in effect today. A forward rate is a fixed exchange rate that we lock in today based on which currencies will be exchanged at some future date.

The table below lists the spot rate and several forward rates for $\frac{\text{USD}}{\text{EUR}}$ currency pair. The negative sign indicates that the forward rate is less than the spot rate, i.e. the base currency EUR is weakening relative to the US dollar.

| Maturity | Spot rate or forward points |
|---|---|
| Spot | 1.2875 |

| | |
|---|---|
| One week | - 0.3 |
| One month | - 1.1 |
| Three months | - 5.5 |
| Six months | - 13.3 |
| Twelve months | - 26.5 |

To convert forward points into a forward rate, divide the points by 10,000 if the exchange rate uses a four decimal place convention and by 100 if the exchange rate uses a two decimal place convention, and then add to the spot rate.

*What is the 12-month forward rate?*

Forward rate = $1.2875 + -\frac{26.5}{10,000} = 1.28485$

At times, forward points can also be expressed as a percentage of the spot rate. For example,

$-\frac{0.00265}{1.2875} * 100 = -0.21\%$

**Relationship between Spot Rates, Forward Rates, and Interest Rates**

The forward exchange rate depends on relative interest rates. To derive the relationship between spot rates, forward rates, and interest rates, assume you have one unit of domestic currency to be invested for let us say, one year. There are two options you may consider:

The exchange rate convention used = $\frac{\text{Foreign currency}}{\text{Domestic currency}} = \frac{\text{Price currency}}{\text{Base currency}}$

Option 1**:** Invest one unit of domestic currency (base currency) at the domestic risk-free rate $i_B$ for one period.

Amount at the end of the period = $1+ i_B$

Option 2**:** Convert one unit of domestic currency into foreign currency (base currency) today using the spot rate $\frac{S_P}{B}$. Invest this amount at the foreign risk-free rate $i_P$ for one period.
Determine the forward rate F_P/B today at which the price currency will be converted back to base currency.
Amount of units of price currency at the end of the period **=** $\frac{S_P}{B}(1 + i_P)$
Amount in terms of base (domestic currency) at the end of the period = $\frac{S_P}{B}(1 + i_P) * \frac{1}{F_{\frac{P}{B}}}$

*Note: By using forward rate, any foreign exchange risk was eliminated in this transaction.*

Since the risk of these two investments is the same, they should generate equivalent returns. As an investor, you should be indifferent between the two as it is a no-arbitrage relationship.

$$1 + i_B = \frac{S_P}{B}(1 + i_P) * \frac{1}{F_{\frac{P}{B}}}$$

The above equation can be rewritten as:

$$\mathbf{F_{\frac{P}{B}} = S_{\frac{P}{B}} * \frac{1 + i_P}{1 + i_B}}$$

where,

$F_{\frac{P}{B}}$ = forward rate

$i_P$ = risk − free rate of the price currency

$i_B$ = risk − free rate of the base currency

Let us use some values now to compute the forward rate. The spot rate for INR/USD $S_{\frac{INR}{USD}}$ = 100.

The risk-free rate for INR is 10% and the risk-free rate for dollar (base currency) is 1%.

Forward rate $F_{\frac{INR}{USD}} = S_{\frac{INR}{USD}} * \frac{1 + i_{INR}}{1 + i_{USD}} = 100 * \frac{1 + 0.1}{1 + 0.01} = 108.9108$

**Some important points to be noted:**

- The currency with the higher (lower) interest rate will always trade at a discount (premium) in the forward market.
- In our example above, USD was the base currency with a risk-free rate of 1%, while INR was the price currency with a risk-free rate of 10%. The forward rate calculated was 108.91 which means that the currency with the lower interest rate (USD) appreciated, while the currency with the higher interest rate (INR) depreciated. (Trading at a discount means the currency depreciates. Trading at a premium means the currency appreciates.)
- This relationship ensures that there is no arbitrage. The only forward rate that prevents arbitrage is 108.91. Otherwise, for any rate greater/lesser than 108.91 traders can exploit the mispricing by buying low and selling high.
- If the forward contract is for x days, make an adjustment based on the x/360 convention unless told otherwise. Refer to the equation below.

$$F_{\frac{P}{B}} = S_{\frac{P}{B}} * \frac{1 + (i_P * x/360)}{1 + \left(i_B * \frac{x}{360}\right)}$$

**Example**

Given the following data, calculate the 37-day forward rate for JPY/CAD:

Canadian dollar risk-free interest rate = 3.97%

Japanese yen risk-free interest rate = 0.23%

Spot rate $S_{\frac{JPY}{CAD}}$ = 100.87

**Solution:**

Forward rate = $100.87 \left(\frac{1+ 0.0023 * \frac{37}{360}}{1+ 0.0397 * \frac{37}{360}}\right)$ = 100.87 * (1.000236/1.00408) = 100.48 JPY/CAD

## 7. Exchange Rate Regimes – Ideals and Historical Perspective

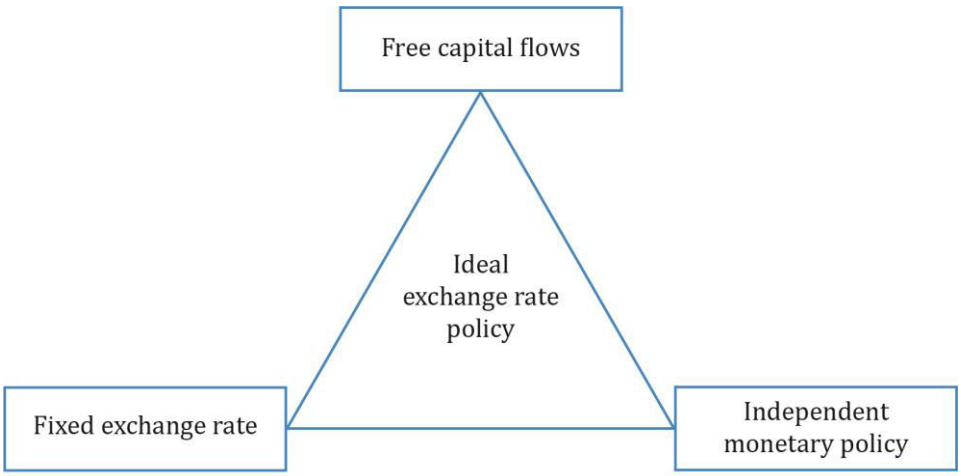
Every exchange rate is managed to some degree by central banks. The policy framework adopted by a central bank or the monetary authority to manage its currency relative to other currencies is called the exchange rate regime.

You may ask, why must the central bank intervene in the exchange rate? This is because high exchange rate volatility can affect investment decisions or affect how foreign investors perceive the investment climate (risky or stable) of a country.

Before we look at the different exchange rate regimes, let us understand what an ideal regime must have.

**Properties of an ideal exchange rate regime:**

1. The exchange rate between any two currencies would be credibly fixed.
2. All currencies would be fully convertible (i.e. currencies could be freely exchanged for any purpose and in any amount).
3. Each country would be able to undertake fully independent monetary policy in pursuit of domestic objectives, such as growth and inflation targets.




But, in reality these three properties are not consistent. If properties 1 and 2 hold good, then there would really be only one currency in the world and independent monetary policy will not be possible.

**Historical perspective on currency regimes:**

Note: This is not part of the learning objectives and there are no practice problems. However, a brief history of the currency regime is summarized below:

- Most of the 19th century, until the start of World War 1 in 1914: the U.S. dollar and the U.K. pound sterling operated on the gold standard; meaning the price of each currency was fixed in terms of gold. Any other currency that fixed its price in terms of these two currencies was also indirectly operating on the gold standard. Trade

imbalances, deflation, hyperinflation, and economies facing depression paved way for a new standard instead of gold.

- Towards the end of World War II in 1944 to the early 1970s: A Fixed parity system called "The Bretton Woods" system was introduced by John Keynes and Harry White; adopted by 44 countries replacing the gold standard. There were now fixed parities for exchange rate between currencies. There would be periodic realignments of currencies to bring them back to the fixed parity or equilibrium state. Inflation issues, countries not able to exercise monetary policy, and excessive capital mobility made countries move to the floating exchange rate system.

## 8. A Taxonomy of Current Regimes

**Exchange rate regimes for countries that do not have their own currency**

Formal dollarization**:**

- Country uses the currency of another currency.
- The country cannot conduct its own monetary policy and imports the inflation of the country whose currency it uses.
- E.g., Panama uses the US dollar.

Monetary Union**:**

- Several countries use a common currency.
- Countries do not have the ability to determine their own domestic monetary policy.
- E.g., the European Union.

**Exchange rate regimes for countries that have their own currency**

*Note: As we move down the exchange rate regimes in the list below, the currency volatility increases and the ability to implement independent monetary policy increases.*

Currency board system**:**

- An explicit commitment to exchange domestic currency for a specified foreign currency at a fixed exchange rate.
- The country cannot conduct its own monetary policy and imports the inflation of the country whose currency it uses.
- E.g., Hong Kong issues HKD only when it is backed by equivalent USD holdings.

Fixed parity:

- A country pegs its currency within margins of ± 1% vs. another currency or basket of currencies.
- It is also called as conventional fixed peg arrangement.
- Exchange rate is maintained through:
  - Direct intervention: Buying and selling foreign currency.
  - Indirect intervention: Interest rate policies or regulating foreign transactions.
- E.g., Saudi Arabia uses a fixed parity with USD.

Target zone:

- Similar to a fixed parity, but with wider bands (± 2%).
- Authorities have more flexibility in monetary policies.

Crawling peg:

- Passive crawling peg: Allows for periodical adjustments in exchange rate, typically done to adjust for higher inflation versus the currency used in the peg.
- Active crawling peg: A series of adjustments are pre-announced and implemented over time making domestic inflation predictable.
- E.g. China.

Crawling bands:

- The width of bands used in fixed peg is increased over time to make the gradual transition from fixed parity to a floating rate.

Managed float:

- Monetary authority attempts to influence the exchange rate in response to specific indicators – balance of payments, inflation rates, or employment – without any specific target exchange rate.

Independently float:

- Exchange rate is entirely market-driven.
- Interventions are used only to reduce market fluctuations.

## 9. Exchange Rates and The Trade Balance: Introduction

If a country imports more goods and services than it exports, it has a trade deficit. This deficit must be financed by borrowing from foreigners or by selling assets to foreigners. Thus, a trade deficit must be exactly matched by an offsetting capital account surplus.

On the other hand, if a country exports more goods and services than it imports, it has a trade surplus. This surplus must be invested by lending to foreigners or by buying assets from foreigners. Thus, a trade surplus must be exactly matched by an offsetting capital account deficit.

A trade deficit indicates that the country's investment spending is more than its domestic saving. Whereas, a trade surplus indicates that a country domestic saving is more than its investment spending.

The effect of changes in exchange rates on a country's trade balance can be analyzed using the following two approaches.

- The elasticities approach
- The absorption approach

## 10. Exchange Rates and Trade Balance: The Elasticities Approach

- Focuses on the impact of exchange rate changes on the total value of exports and imports.
- The impact of currency appreciation or depreciation on trade balance depends on the elasticities of demand for imports and exports.
- High elasticity → more impact of changes in currency exchange rates.
  Goods having high elasticity of demand:
  - Goods with close substitutes.
  - Luxury goods.
  - Goods that account for a high proportion of consumer spending.

  Goods having low elasticity of demand:
  - Goods that have few or no substitutes.
  - Necessities.
  - Goods that account for a small proportion of consumer spending.
- **Marshall-Lerner Condition** describes the combinations of export and demand elasticities such that depreciation (appreciation) of the domestic currency will move the trade balance toward surplus (deficit).
  i.e. If $\omega_X \varepsilon_X + \omega_M (\varepsilon_M - 1) > 0$ → currency depreciation will reduce trade deficit.
  Where ε = elasticity; ω = the proportion of imports or exports in total trade; X= exports; M=imports.

**Example**

United Kingdom exports goods valued at £600 million and imports goods valued at £900 million from the United States. The demand elasticities for exports are 0.70 and for imports are 0.60. Calculate the impact of a 10% depreciation of GBP (relative to us) on the overall trade deficit for the United Kingdom.

**Solution:**

**UK's exports:**

As GBP depreciates relative to USD by 10%, UK's exports will now be cheaper to the US citizens. They will in turn increase consumption of the now cheaper UK goods. Demand elasticity of export of 0.70 tells us that for a 10% decrease in GBP rate, exported quantity to the US will increase by 7% (10% * 0.70).

Change in exports = currency change % * initial export value * demand elasticity for export

= 10%*600*0.70 = 600 * 7% = £42 Million

UK's exports increases by £42 Million.

*Note: While considering the impact of price depreciation/appreciation on total exported value, only the source of change is the quantity demanded in foreign country. Income earned by a UK*

*citizen in GBP does not change as the goods are still priced at the same GBP level as before (despite the change in the exchange rate).*

**UK's imports:**

As GBP depreciates relative to USD by 10%, imports from US will now be costlier to the UK citizens in GBP terms. They will decrease consumption of the now costlier US goods. Demand elasticity of import of 0.60 tells us that for a 10% decrease in GBP rate (i.e. US goods have become costlier by 10% for UK citizens in GBP terms), imported quantity of US goods to the UK will decrease by 6% (10% * 0.60).

Thus, impact on imported value in UK is twofold: a) import prices of US goods increase by 10% in GBP terms b) Quantity demanded of US goods by UK citizens decreases by 6%.

Net impact in the imported value is that it increases by: = 10% - 6% = 4%.

Change in imports = currency change % * initial export value * (demand elasticity for import -1)

= 10%*900*0.40 = 900 * 4% = £36 Million

UK's imports increases by £36 Million.

*Note: While considering the impact of price depreciation/appreciation on total imported value, both the change in the import quantity demanded and change in the price level are sources of change. In our example, US goods became costlier by 10% and the quantity demanded declined by 6%. As the price level increase was larger than drop in quantity demanded, total imported value increased by 4%.*

| **From UK's perspective:** | | | |
|---|---|---|---|
| | Initial value (£) | Change (£) | Final value (£) |
| Exports | 600,000,000 | +42,000,000 | 642,000,000 |
| Imports | 900,000,000 | +36,000,000 | 936,000,000 |
| Trade balance | (300,000,000) | +6,000,000 | (294,000,000) |
| Total trade | 1,500,000,000 | 78,000,000 | 1,578,000,000 |

Marshall-Lerner condition = $\omega_X \varepsilon_X + \omega_M (\varepsilon_M - 1)$ = (600/1,500) * 0.7 + (900/1,500) * (0.6 – 1) = 0.04

Since, 0.04 > 0, a depreciation of the domestic currency will lead to increase in the trade balance towards surplus.

This value implies that a 1% depreciation in domestic currency will increase trade balance by 0.04% of the total trade.

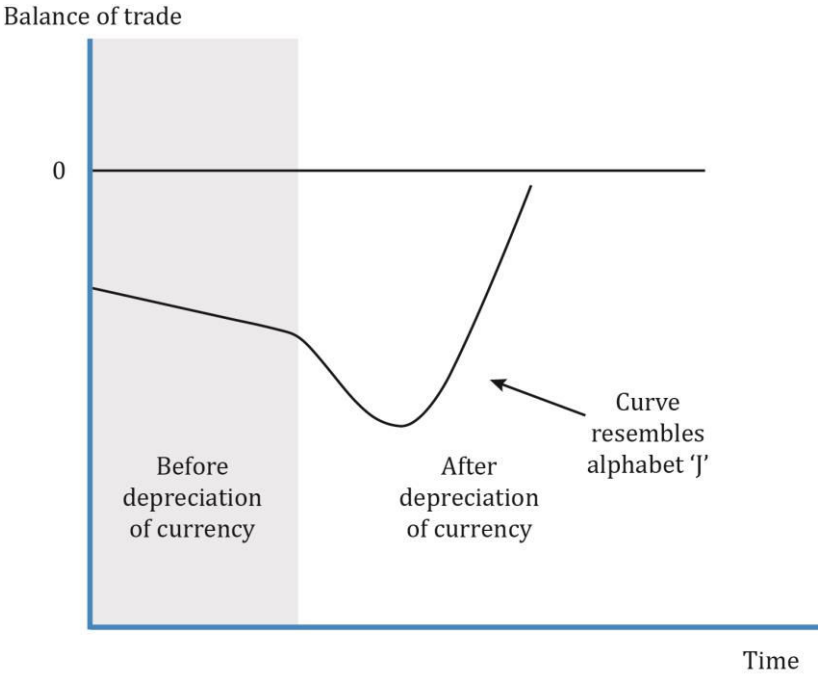
Thus in our example, a 10% depreciation in GBP will increase trade balance by 0.4% of the total trade = 0.4% * 1,500,000,000 = £6,000,000.

- **Impact on trade balances (X - M):**

| | $\omega_X \varepsilon_X + \omega_M (\varepsilon_M - 1) > 0$ Marshall-Lerner holds. | $\omega_X \varepsilon_X + \omega_M (\varepsilon_M - 1) < 0$ Marshall-Lerner doesn't hold. |
|---|---|---|
| Domestic currency appreciates | Trade balance moves towards deficit. (X-M) decreases. | Trade balance moves towards surplus. (X–M) increases. |
| Domestic currency depreciates | Trade balance moves towards surplus. (X–M) increases. | Trade balance moves towards deficit. (X–M) decreases. |

- **The J-Curve Effect:**
  - In the short run, existing contracts make exports and imports relatively inelastic.
  - Hence, currency depreciation initially increases the trade deficit.
  - However, in the long run, elasticities increase and the trade deficit starts to reduce.
  - This initial increase in deficit followed by a decrease when the Marshall-Lerner condition is met is termed as J-curve effect.




## 11. Exchange Rates and Trade Balance: The Absorption Approach

- This approach focuses on the impact of exchange rate changes on capital flows. {As a trade deficit (surplus) must be offset by surplus (deficit) in capital account}.
  Exports – imports = (private savings – physical capital investment) + (tax revenue – government spending)

$X - M = (S - I) + (T - G)$
$X - M = S + T - (I + G)$
This can be expressed as:
Balance of trade = national income – total expenditure
Total expenditure represents the absorption of goods and services in an economy.

- Thus, for a currency exchange rate change to improve (reduce) trade balance, national income must increase (decrease) relative to expenditure. In other words, domestic savings must increase (decrease) relative to domestic investments in physical capital.
- If the economy is operating at less than full capacity utilization → Domestic currency depreciation will increase consumption of domestic goods and assets and reduce consumption of foreign goods and assets (as their price increases) → national income will increase more than national expenditure → trade balance will increase.
- If the economy is operating at full capacity utilization → Domestic currency depreciation will increase consumption of domestic goods and assets and reduce consumption of foreign goods and assets (as their price increases) → as the economy is already at full utilization, domestic prices will also begin to rise returning the economy back to its original trade balance → However, domestic assets decline in value as weaker currency reduces future cash flows of businesses → decreased wealth would see the households saving more and spending less → trade balance improves as expenditure reduces.
- Elasticities approach is a microeconomic view as it focuses on the relationship between exchange rates and trade balances.
- Whereas, absorption approach can be viewed as a macroeconomic view as it also focuses on capital flows.

## Summary

**LO.a: Define an exchange rate, and distinguish between nominal and real exchange rates, and spot and forward exchange rates.**

Exchange rate is the number of units of the price currency needed to buy/sell one unit of the base currency. In case of an exchange rate quote of 1.4000 USD/EUR, we refer to the numerator currency (in this case, the US Dollar) as the price currency and the denominator currency (in this case, the Euro) as the base currency. This quote is a direct quote for a US-based investor and an indirect quote for a euro-based investor.

Nominal exchange rate is the quoted rate at any point in time.

Real exchange rate is the nominal exchange rate adjusted for inflation, in each country, compared to a base period. Real exchange rate $_{p/b}$ = nominal exchange rate $_{p/b}$ x (Base currency CPI / Price currency CPI).

Spot exchange rate is the currency exchange rate for immediate delivery.

Forward exchange rate is a currency exchange rate for an exchange to be done in the future – a forward contract is an agreement to exchange a specific amount of one currency for a specific amount of another currency on a future date.

**LO.b: Describe functions of and participants in the foreign exchange market.**

In terms of the value of daily transactions, currency is the largest market. Within currency, FX swaps are the largest, followed by the spot market. Transactions related to speculation and hedging far exceed transactions related to international trade.

Hedgers have an existing foreign exchange risk that they want to reduce / eliminate through transactions in the FX market.

Speculators enter into transactions that increase their foreign exchange risk with the expectation of earning a profit.

Sell side: market makers; large multinational banks.

Buy side: corporations, investment fund managers, hedge fund managers, investors, governments and central banks.

**LO.c: Calculate and interpret the percentage change in a currency relative to another currency.**

When USD/EUR goes down from 1.4160 to 1.4000, the USD price of a euro goes down (1.4000/1.4160) – 1 = -1.13%. We say that the euro has depreciated relative to the USD by 1.13%.

In this case the EUR/USD exchange rate has gone up from 1/1.416 = 0.704 to 1/1.4 = 0.714. The euro price of a US Dollar has gone up (0.714 / 0.704) – 1 = 1.46%. We say that the US Dollar has appreciated relative to the euro by 1.46%.

**LO.d: Calculate and interpret currency cross rates.**

The computations for cross rates are a simple case of algebraic manipulation wherein the quotes should be set up in a way that the common currency cancels out.

**LO.e: Calculate an outright forward quotation from forward quotations expressed on a points basis or in percentage terms.**

- If spot rate is 1.4000 USD/EUR and the forward quote is spot plus 200 points, the forward becomes 1.4200.
- To convert points to decimal divide by 10,000: 200 / 10,000 = 0.02.
- The point is the last digit of the spot rate quote.
- We can express the forward rate as a percentage above or below the spot rate.

**LO.f: Explain the arbitrage relationship between spot rates, forward rates, and interest rates.**

- $F_{P/B} = S_{P/B} (1 + i_p) / (1 + i_B)$
- In this formula the interest rates have been de-annualized, if annualized rates are given, de-annualize using n/360.

**LO.g: Calculate and interpret a forward discount or premium.**

If forward rate > spot rate, the base currency is said to be trading at a forward premium.

If forward rate < spot rate, the base currency is said to be trading at a forward discount.

**LO.h: Calculate and interpret the forward rate consistent with the spot rate and the interest rate in each currency.**

The currency with the higher (lower) interest rate will always trade at a discount (premium) in the forward market.

Interest rate differential = $i_P - i_B$

Percentage change in spot rates is proportional to the interest rate differential.

**LO.i: Describe exchange rate regimes.**

Exchange rate regimes for countries that do not have their own currency:

- Formal dollarization – A country uses the currency of another currency, typically the US dollar.
- Monetary Union – Several countries use a common currency.

Exchange rate regimes for countries that have their own currency:

- Currency board system: An explicit commitment to exchange domestic currency for a specified foreign currency at a fixed exchange rate.
- Fixed parity: A country pegs its currency within margins of 1% vs. another currency.
- Target zone: Like fixed parity, but with wider bands (± 2%); gives monetary authority more flexibility.

- Crawling peg: Exchange rate is adjusted periodically, typically to adjust for higher inflation versus the currency used in the peg.
- Managed float: Monetary authority attempts to influence the exchange rate in response to specific indicators – balance of payments, inflation rates, or employment – without any specific target exchange rate.
- Independently float: Exchange rate is entirely market-driven.

**LO.j: Explain the effects of exchange rates on countries' international trade and capital flows.**

The effect of a depreciation of the domestic currency on a country's trade balance can be analyzed using either the elasticities approach or the absorption approach.

- Elasticities approach: For a depreciation of the domestic currency to reduce an existing trade deficit, the elasticities (ε) of export and import demand must meet the Marshall-Lerner Condition: $\omega_X \varepsilon_X + \omega_M (\varepsilon_M - 1) > 0$. Where ε = elasticity; ω = the proportion of total trade for imports or exports.
- Absorption approach: National income must increase relative to the national expenditure in order to decrease a trade deficit. In other words, national saving must increase relative to domestic investment in order to decrease a trade deficit.
- The J-Curve Effect: In the short run, existing contracts make exports and imports relatively inelastic. Therefore, currency depreciation initially leads to a larger trade deficit, but in the long run elasticities increase and the currency depreciation leads to trade deficit reduction.