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Introduction

The question of the exchange rate is one of the substantive and central topics in international economics, given its profound impact on the balance of economic and monetary relations between countries, and on the performance of economic and commercial institutions, particularly those operating in an international environment and dealing in foreign currencies. Changes in exchange rates can lead to substantial gains or losses, not only at the level of individuals and investors, but at the level of countries as a whole, through their effect on terms of trade, the movement of capital, international competitiveness, and monetary and fiscal policies. With the accelerating growth in the volume of commercial exchanges and the rise of financial globalization, exchange rates have come to play a pivotal role in determining the paths of growth and economic stability. Their continuous and sudden fluctuations may pose real challenges to the stability of national economies, especially in countries with emerging financial markets or those heavily dependent on foreign trade.

On the other hand, the question of exchange is no longer confined to the macroeconomic dimension; it has also become a strategic issue at the level of institutions, which are now required to have a deeper understanding of the potential effects of exchange-rate movements on production costs, profit margins, their financial obligations, and even on the valuation of their assets and financial position. Here the importance of recognizing what is known as exchange risk becomes apparent—risk that may arise from dealing in foreign currencies and the resulting negative (or positive) effects in the event of price fluctuations—which makes the management of these risks an inevitable necessity for the modern institution. Accordingly, this academic manuscript aims to provide the university student with a comprehensive theoretical and applied understanding of the subject of the exchange rate and its risks, by addressing the following chapters:

Chapter One: The Theoretical Framework of the Exchange Rate: through defining the basic concepts, understanding how the exchange market operates and how the rate is determined, and the factors affecting it.

Chapter Two: The Theoretical Framework of the Exchange Market: through knowledge of the basic concepts, the most important participants in it, and the operations that take place within it.

Chapter Three: Exchange Rate Regimes: presenting and analyzing the various regimes adopted by countries over time (fixed, flexible, and hybrid exchange), and understanding the contexts that justify the choice of each regime.

Chapter Four: Theories Explaining the Exchange Rate: studying the economic theories that have attempted to explain exchange-rate fluctuations, and analyzing their accuracy and determinants.

Chapter Five: Exchange Rate Risk and Its Hedging Techniques: identifying the types of risk that institutions face in their dealings with foreign currencies, and the principal financial instruments used to hedge these risks and limit their effects.

Finally, a sound command of these concepts is not merely an academic requirement; it represents an essential knowledge base for understanding international financial dynamics and making effective decisions at the level of economic policy or the financial management of institutions.

Chapter One: The Theoretical Framework of the Exchange Rate

Within the framework of international economics, every country relies on its national currency as a basic unit for measuring and valuing the goods and services traded within its borders. The currency represents a principal tool for determining market value, whereby the amount of money paid in return for obtaining a given good or service is expressed through what is known as the exchange rate. The economist "James Ingram" described the exchange rate as "a one-word dictionary that allows prices to be translated from the language of the foreign currency into the language of the domestic currency." Accordingly, we will address in this context the theoretical framework of the exchange rate, in addition to the environment through which currencies are exchanged, namely the exchange market.

1. Definition of the Exchange Rate:

It is the price at which the domestic currency is exchanged for the foreign currency, that is, the price at which the domestic currency is converted into the foreign currency (Falih Hassan Khalaf, 2003); it is the price of one currency in terms of another, or the rate of exchange of two currencies, where one of the two currencies is considered a commodity while the other is considered its price (Majdi Mahmoud Shihab, Suzy Adli Nashed, 2006). Hence the process of exchanging currencies takes place like any other commodity, on the basis of the supply of and demand for currencies. As is clear, the demand for and supply of currencies are, to some extent, derived operations, meaning that the demand, for example, for foreign currencies is a function of the demand for foreign goods, and the same applies to supply; but this does not lead us to deny the possibility of the demand for and supply of foreign currencies as two currencies independent of the conduct of commercial transactions (Al-Tahir Latrache, 2005). All price quotations consist of two currencies: the base (reference) currency and the quote (counter) currency. Together they form what is known as a currency pair.

One unit of the base currency equals (x) units of the quote currency.

Example:

USD/JPY= 120.50 means 1 USD = 120.50 JPY

USD: the US dollar; JPY: the Japanese yen.

The US dollar is the base (reference) currency, and the Japanese yen is the quote or counter currency.

The exchange rate may be regarded as the mirror that reflects a country's commercial position with the outside world, since the exchange rate constitutes a

pivotal tool for linking the domestic economy to the global economy in terms of its effect on the movement of trade and financial flows between countries. For example, when demand for the foreign currency exceeds its available supply, the exchange rate of the foreign currency rises in the national market, which leads to higher import prices and a decline in the purchasing power of the domestic currency; and also through its ability to affect production costs and domestic prices, since a change in the exchange rate leads to changes in the relative prices of domestic goods and services compared with their foreign counterparts. From here the importance of the exchange rate as a principal means of linking the national economy to the global economy becomes clear, through three main levels (Jamil Mohammed Khaled, 2014):

- Linkage through foreign trade.
- Linkage through the movement of capital.
- Linkage through the effect of global changes on the domestic economy.

2. Designation of the Exchange Rate

There are several methods for determining exchange rates, the most widely used in the money market being:

1.2. The two-way (bid/ask) quotation method

In this system, two prices are quoted for the exchange rate (Ali Tawfiq Al-Sadiq, Ali Ahmed Al-Bulbul, 2002)

- **Bid price (BID): it is the number of units of the domestic currency that the bank pays to buy one unit of the foreign currency offered by the client.**
- **Ask price (Ask or Offer): it is the number of units of the domestic currency that the bank requires in order to sell one unit of the foreign currency requested by the client; here it is necessary to know the quotation method adopted, as the buy and sell sides differ for the client and for the quoting party.**

Usually, the bid price is lower than the ask price, and the difference between them is known as the profit margin or "price spread" (Spread), which represents the profit that the bank earns as a result of currency exchange operations.

Applied example:

AUD/USD 0.5500/0.5505

Australian dollar/US dollar 0.5500/0.5505

At the price of 0.5500, the bank, acting as a market maker, will buy the Australian dollar and sell the US dollar. Conversely, at the price of 0.5505, the bank will sell the Australian dollar and buy the US dollar.

The number of points (decimal places) used in pricing depends on the number of units included in the quotation:

If the number of units is less than 10, the prevailing market convention is to round the price to four decimal places.

For example: NZD/USD is quoted as follows: 0.5310.

If the number of units is greater than 10, the market convention is to round the price to two decimal places only.

For example: USD/JPY is quoted as follows: 120.30.

Nevertheless, there are some notable exceptions: the Thai baht (THB), the Indian rupee (INR), and the Philippine peso (PHP) are quoted to three decimal places, while the Indonesian rupiah (IDR) is quoted as a whole number with no decimal places (ANZ Investment Bank, Education Module: 1, 2002).

2.2 The certain and uncertain quotation method: the quotation differs from one country to another, so there are:

o The certain quotation: it represents the number of units of the foreign currency (USD) obtained for one unit of the domestic currency (EUR), and it is also called the indirect quotation or the European quotation.

1 EUR= 1.2806 USD

o The uncertain quotation: it is the number of units of the domestic currency (EUR) needed to obtain one unit of the foreign currency (USD), and it is called the direct quotation or the American quotation (Steiner & Bob, 2002).

The uncertain quotation is the reciprocal of the certain quotation, that is:

USD/EUR=1/(EUR/USD)

Example:

We have 1 euro equal to 1.2485 dollars, and thus the certain quotation is written in the following form:

EUR/USD=1.2485→USD/EUR= (1) /1.2485

USD/EUR=0.8009

Most countries quote their currencies using the uncertain quotation, except for England, which relies on the certain quotation in quoting its currency, as does Europe since the year 1999 (Shailaja, 2008).

3.2 Determining cross rates: the cross or derived rate is the exchange rate between two currencies expressed in terms of another currency taken as a reference

currency, usually the US dollar, owing to the advantages that have made it function as a pivotal currency for transactions in the foreign exchange market (Hariri Abdelghani, 2020).

Example:

Finding the cross rate between the Swiss franc and the Mexican peso CHF/MXN, where we have:

USD/CHF=1.08563 and USD/MXN=12.2674

To arrive at the cross rate we use the common currency: we sell 1 CHF in return for obtaining 1/1.08563 USD, i.e., 1 CHF = 0.92112 USD; then we sell 0.92112 USD to buy MXN, where:

1USD=0.92112 ×12.2674 MXN, that is: 1 USD= 11.29979 MXN

We conclude from this that:

CHF/MXN= (1/USD/CHF)×USD/MXN

Or: CHF/MXN=CHF/USD× USD/MXN

3. Principles of Exchange Rates in Banks

To understand the dynamics that govern bid and ask prices, we move on to clarifying the four basic principles on which the bank relies when conducting transactions in foreign currencies, namely: (Bhatt Kishor, 2021)

1.3 The commodity principle (Commodity Principle): in exchange-market dealings, foreign currencies are treated as commodities, while the domestic currency is the reference (base) currency. When the bank buys a foreign currency, it pays in the domestic currency and receives the foreign currency, that is, it "buys a commodity." And when it sells the foreign currency, it receives the domestic currency, that is, it "sells a commodity." Thus, foreign currencies are dealt with as commodities that can be bought and sold, while the domestic currency is the medium of exchange or the "settlement currency."

2.3 The market maker principle (Market Maker Principles)

The bank plays the role of "market maker" when it sets the buy and sell prices of foreign currencies. In commercial dealings:

If the bank sells a foreign currency to its client, it has in fact bought it beforehand from the market; and if the bank buys a foreign currency from its client, it in fact sells it later in the market. In interbank transactions or with

external markets, the bank that requests prices is called the "price taker," while the party that provides the prices is called the "price quoter" or "market maker." For the market maker, a transaction is classified as a purchase if it results from selling a foreign currency to the other party, and vice versa.

3.3 The banking intermediation principle (Bank as an Intermediary Principle)

The bank does not maintain a permanent stock of foreign currencies; rather, it acts as an intermediary in the market on behalf of its clients. When a client requests to buy or sell a foreign currency, the bank carries out the corresponding transaction in the domestic interbank market or with foreign banks. This principle stipulates that the bank does not hold open positions in currencies (No Open Position), meaning that every sale or purchase of foreign currencies by the client is offset by an opposite operation in the market, in order to avoid risk and reduce exposure to exchange-rate changes.

4.3 The market behavior principle (Market Behavior Principle)

The currency market, like any other market, is subject to the law of supply and demand. When a party tries to sell a foreign currency for a fixed amount of domestic currency, the market seeks to obtain the largest possible quantity of the foreign currency. Conversely, when a party tries to buy the foreign currency for a given amount of domestic currency, the market tries to minimize the quantity of foreign currency delivered.

4. Forms of the Exchange Rate

There are several forms of the exchange rate that differ according to the policies adopted and the economic conditions of each country, and they may be classified as follows:

1.4 Nominal exchange rate:

It is the price at which a domestic currency is exchanged for a foreign currency or vice versa, and it is expressed in units of the domestic currency for one unit of the foreign currency. It is also known as the current exchange rate, which does not take into account the differences in purchasing power between countries. It is divided into: an official exchange rate determined by the monetary authorities; and a parallel exchange rate dealt with in the unofficial (parallel) markets (Majdi Mahmoud Shihab, Suzy Adli Nashed, 2006).

2.4 Real exchange rate:

This type of exchange rate reflects the actual value of the currency by measuring the purchasing power of the domestic currency against the foreign currency. It is computed by adjusting the nominal exchange rate according to the level of relative prices between countries. In other words, it expresses the number of domestic goods required to equal similar foreign goods, and it is given by the following formula:

$$RER = \frac{E \cdot P}{P^*}$$

where:

RER: the real exchange rate;

E: the nominal exchange rate;

P: the general level of domestic prices;

P^*The general price level in the foreign country.

The real exchange rate measures competitiveness: the higher the real exchange rate, the greater the country's competitiveness. For example, the real exchange rate of the euro against the dollar reflects the difference between purchasing power in the euro area, for instance, and purchasing power in the United States. The real exchange rate is denoted by the symbol $\mathbf{E}^{\mathbf{Réel\ x/y}}$, where the nominal exchange rate $\mathbf{E}^{\mathbf{Nominal\ x/y}}$ is expressed using the uncertain quotation (Krugman et al., 2001):

$$\mathbf{E}^{\mathbf{Réel\ x/y}} = \mathbf{E}^{\mathbf{Nominal\ x/y}} \times \frac{\mathbf{p}^*}{\mathbf{p}}$$

where:

P*: represents the price level in the foreign country.

P: represents the price level in the domestic country.

Example:

Let us assume that the basket of goods in the euro area costs 160 euros, that is: P_{EUR}=160, and the basket of goods in the United States costs 200 dollars, that is P_{USD}=200, and let us assume that the nominal exchange rate using the uncertain quotation is USD/EUR=0.8. The real exchange rate between the euro and the dollar is:

$$\mathbf{E^{Réel\ USD/EUR} = E^{Nominal\ USD/EUR} \times \frac{P_{USD}}{P_{EUR}}}$$

$E^{Réel\ USD/EUR}$= (0.8×200 USD / 160 EUR)

$E^{Réel\ USD/EUR}$= (160 Euro) / (160 USD)

$E^{Réel\ USD/EUR}$ = 1 European for 1 American

1 European basket of goods = 1 American basket of goods

In the case of the certain quotation, the real exchange rate is as follows:

$$\mathbf{E^{Réel\ x/y} = E^{Nominal\ Y/X} \times \frac{p}{p^*}}$$

Example: We take the previous example; according to the example, using the certain quotation we obtain:

$$\mathbf{E^{Réel\ USD/EUR} = E^{Nominal\ EUR/USD} \times \frac{P_{EUR}}{P_{USD}}}$$

$$E^{Nominal\ EUR/USD} = \frac{1}{E^{Nominal\ USD/EUR}}$$

$$= \frac{1}{0.8} = 1.25$$

$$E^{Réel\ USD/EUR} = 1.25 \times \frac{160}{200}$$

Or:

$$E^{Réel\frac{USD}{EUR}} = \frac{P_{EUR}}{E^{Nominal\ USD/EUR} \times P_{USD}}$$

$$= \frac{160}{0.8 \times 200}$$

$E^{Réel\frac{USD}{EUR}}$= 1

An increase in the real exchange rate of the euro against the dollar can be expressed as a real depreciation or a real decline in the value of the euro against the US dollar.

This change is a decline in the purchasing power of the euro in the United States compared with the purchasing power achieved in the euro area, that is, an increase in the competitiveness of European goods relative to the competitiveness of American goods. This divergence in relative purchasing power occurs simply because the prices of American goods denominated in euros ($E\times P_{USD}$) are high compared with the prices of European goods (P_{EUR}).

Example:

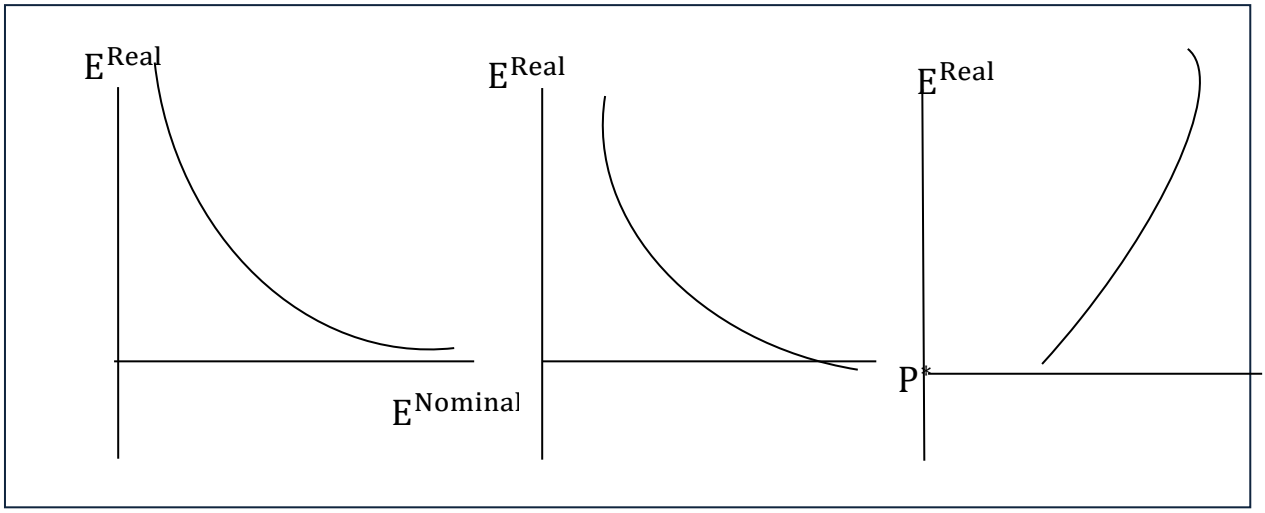
We can see that the depreciation of the nominal value of the euro by 10% moved the exchange rate from 0.8 to 0.88 euros for 1 dollar (i.e., a rise in the nominal exchange rate), which translates into an increase in the real exchange rate, equal to 1.1, meaning: 1.1 European baskets of goods = 1 American basket of goods.

This rise means a real decline or depreciation in the value of the euro by 10% compared with the dollar; likewise, a 10% rise in the prices of goods in dollars, or a 10% decline in the prices of goods in euros, leads to the same effect on the real exchange rate.

The real depreciation of the euro means a decline in the purchasing power of the euro over American goods and services compared with the purchasing power of the euro in the euro area; European goods and services have become cheaper compared with American goods and services, that is, an increase in the competitiveness of European goods relative to American goods.

From the foregoing it is clear that there is an inverse relationship between the real exchange rate and the nominal exchange rate, as well as the level of foreign prices, and a direct relationship with the level of domestic prices. This can be illustrated by the following three graphs:

Figure No. (1-1): Forms of the exchange rate and the relationship between them

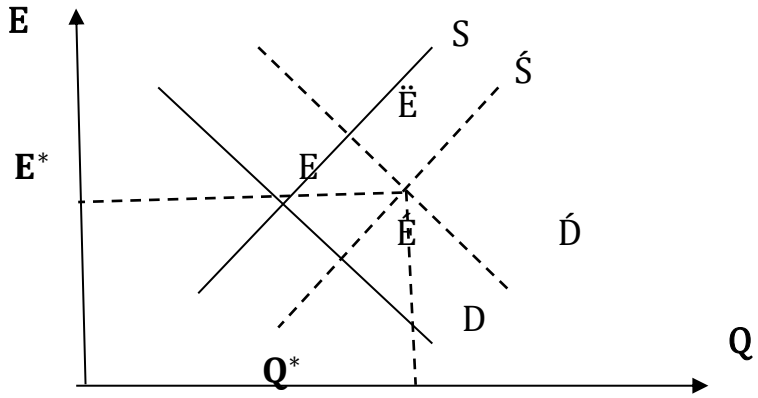


Source: Abdelkader Metwally El-Sayed (2011). International Economics: Theory and Policies. Amman, Jordan: Dar Al-Fikr Publishers and Distributors, p. 215.

3.4 Equilibrium exchange rate:

It refers to the price determined by the forces of supply and demand when complete equality occurs between the quantity demanded and the quantity supplied of a currency, regardless of the effect of speculation and abnormal capital movements. Thus we find that the equilibrium exchange rate is like the equilibrium price of any commodity in free markets. From this standpoint it becomes clear that the equilibrium price of the exchange rate is merely a theoretical idea, given the rapid dynamics of economic relations, which leads to the rarity of equality between the supply of and demand for foreign currency. However, some hold that the equilibrium rate can be estimated only by comparing currency prices, arriving at an imprecise estimate of the equilibrium rate, and it is determined by knowing how the free exchange rate changes with changes in the economic situation (Al-Abbas Belkacem, 2003). The equilibrium exchange rate can be expressed in this form:

Figure No. (1-2): The equilibrium exchange rate



Source: Abdelkader Metwally El-Sayed. (2011). International Economics - Theory and Policies -. First edition. Dar Al-Fikr Publishers and Distributors. Amman. Jordan. p. 145.

The occurrence of the equilibrium exchange rate also depends on a set of variables, namely: the growth rate of national income, the relative rate of change in the money supply, the rate of change in interest rates, and the direction of money demand. Keynes holds that the equilibrium exchange rate can be reached easily by means of the customs tariff, because it is used to balance domestic demand for foreign imports at the limit commensurate with foreign demand for national exports; in other words, when domestic demand for foreign currencies for the purpose of importing equals foreigners' demand for the domestic currency in the case of exporting abroad.

Chapter Two: The Theoretical Framework of the Foreign Exchange Market:

When a country conducts commercial and financial operations with the rest of the outside world, it is obliged to convert its domestic currency into its equivalent in foreign currency, and vice versa, and this is done in the foreign exchange market. Accordingly, it can be said that the exchange market is that economic space which allows currencies to be exchanged among one another, and the market is also considered a means of bringing about a balance between the supply of and demand for currencies (Tawfiq Abdel-Rahim Youssef, 2004).

The foreign exchange market is an over-the-counter market with no specific location, and its transactions are not officially standardized, unlike other types of markets such as the financial market, in which transactions and prices are concentrated. Transactions take place at exchange desks that are usually part of the trading floors of banks' markets, and in places crowded with foreign-currency dealers around telephones, computers, and telex machines (Gandolfo, 2014).

1. Characteristics of the Foreign Exchange Market:

Among the most important features that the foreign exchange market enjoys are the following (Abdelkader Metwally El-Sayed, 2011):

- It is distinguished by its breadth, depth, and high liquidity compared with various other markets;
- Continuous dealing over 24 hours: one of the features of this market is that the financial centers are open for business at all times around the world; while some centers close, others open their doors for business. For example, in Europe the market is active starting from nine or ten in the morning and stops dealing around five or six in the evening; in Paris the market operates between nine-thirty and four-thirty in the afternoon. When it closes in Europe, the United States opens its doors; and when the American West Coast market stops, dealing begins in the Middle East markets, which in turn stop when trading begins in Zurich, Paris, and London, and so the process is repeated anew.
- The availability of trading conditions at all times regardless of general economic conditions: a situation that, in the stock market for example, imposes a downturn that may last a long time during which work becomes impossible; but in the currency market the dealer can sell in a falling market and buy in a rising market, and these transactions provide him with the possibility of profit in both cases.

- The ease of trading currencies given their small number: the major currencies among them do not exceed six pairs, which makes it possible to focus on and analyze them, thereby reducing the rate of error; whereas the stocks dealt with number in the hundreds of thousands, which sometimes confuses the dealer, leading him to resort to various unsafe means to determine the direction of his work.

2. Participants in the Exchange Market:

No economic agent can intervene directly in the exchange market; rather, the participants in this market are banks and financial institutions, exchange brokers, arbitrage agents, and central banks. Intervention in the exchange market may be aimed at carrying out a speculation or arbitrage operation, or seeking to hedge against one of the exchange risks.

- **The central bank: this bank intervenes in order to conduct open-market operations in foreign currencies on the one hand, and on the other hand to execute the government's orders—in its capacity as the state's bank—regarding transactions in the currency. This intervention by the central bank is usually carried out in order to protect the position of the domestic currency or some other currencies, because it is considered responsible for the exchange rate of the currency (Philippe D'Arvisenet, Jean Pierre Petit, 1994)**
- **Banks and financial institutions outside the market: banks and financial institutions deal with the exchange market as an intermediary for their clients, buying and selling on their behalf the various foreign currencies needed for the operations of converting their imports and exports, and dealing with the various instruments of the market.**

Banks and financial institutions also deal with the exchange market on their own account, because at the time they buy or sell foreign currencies for their clients, their positions are affected, which entails their carrying out the buy and sell operations needed to correct their positions, in a manner consistent with the policies set for them. They do so as part of the operations of managing their reserves and feeding their accounts according to the bases established by their management (Abdelkader Metwally El-Sayed, 2011).

- **Banks and financial institutions inside the market: these banks deal with the exchange market on their own account or on behalf of their clients within the market, doing so through intermediaries, whereby the bank contacts the intermediary, either offering to sell a currency or requesting to**

buy it at a given price, and this intermediary in turn contacts the other banks in the market, presenting the offer to them; if this offer is accepted, the intermediary executes the operation and notifies the two banks of it, receiving a commission in return for performing this task. These are called exchange brokers

Exchange brokers are active intermediaries who aggregate buy or sell orders for hard currencies on behalf of several banks or other dealers, ensuring communication between banks and providing information on the prevailing quotation without disclosing the names of the institutions selling or buying these currencies (Shuqairi Nuri Musa, Mohammed Abdel-Razzaq, 2012).

Brokerage houses are very important in England, and in New York and London; a large part of operations is carried out by independent brokers who work on behalf of banks. In the Paris market there are more than 20 brokers.

3. Functions of the Foreign Exchange Market:

The performance by money of its functions within the framework of economic activity is confined to the borders of its own state and is unable to be performed in other countries; but the instrument that enables the various currencies to perform their functions beyond their domestic borders is the foreign exchange market. Accordingly, this market performs the following functions (Abdel-Hussein Jalil Abdel-Hussein Al-Ghalbi, 2011):

- **Settling international payments: this is in order to facilitate international trade operations, that is, transferring international purchasing power from one country to another, on the basis that there are many currencies not qualified for the settlement of payments, and so it is necessary to buy the important currencies to accomplish those settlements.**
- **Exchange and credit: the exchange market provides credit at the international level through the banks operating within it, which extend loans to the exporter and the importer until the sale and purchase operation is completed.**
- **Speculation: speculation in the exchange market is based on making forecasts of changes in currency prices. If market dealers expect that the price of a given currency will rise in the future, they will move to buy as much of this currency as possible at the present time in order to sell it when its price rises in the future; and if they expect that the price of one of the currencies will fall in the future, they will sell all that they hold of this**

currency and move to buy another currency whose price they expect to rise in the future.

- **Hedging or cover: when exchange rates are fixed for all currencies, it makes no difference to the individual which type of currency he holds; but if prices are subject to continuous fluctuation and change, individuals and institutions will face the risk of a decrease in the value of the foreign currencies they hold or an increase in the value of what they must pay. Therefore these risks must be confronted, which is one of the functions of the forward exchange market.**
- **Arbitrage: this operation aims to achieve profits from the differences in the exchange rates of a given currency in one or more markets at a given time. Arbitrage operations arise as a result of several causes, including:**

o The supply of and demand for foreign currencies differ from one market to another, and any sudden change in either of them may make the prices of these currencies different from those in other markets, which reveals the possibility of benefiting from these differences;

o **Some markets quote their prices with a narrow spread between the bid and ask prices compared with other markets, which means the possibility of benefiting from the difference in spreads between these markets;**

o Sudden changes in prices require time to be adjusted, which reveals some differences.

The mechanism by which arbitrage operates consists of:

o Buying the currency in one market and selling it in another market;

o That this be done at the same time;

o Achieving a profit from the operation, such that the profit realized from the operation is greater than the dealing costs;

o It is considered one of the functions of the spot market;

o Arbitrage operations may be two-point, three-point, or interest arbitrage.

4. Types of Foreign Exchange Markets:

The foreign exchange markets can be divided into two types of markets, namely:

1.4 Spot exchange markets: these are the markets in which operations of buying and selling foreign currencies take place according to the current price, with the delivery and receipt of the currencies being completed two days after the trade date, except for exchange operations

between US and Canadian dollars, in which delivery takes place after one business day (Jeff-Madura, 2012).

For example, an operation carried out on Sunday has delivery on Tuesday, and an operation carried out on Wednesday has delivery on Monday (considering that Saturday and Sunday are official holidays).

It should also be noted that a business day is no longer a standing condition; agreement and execution can take place on the same day owing to technological progress in banking operations and banks' ability to carry out transfer operations electronically at the same time.

✓ **The dynamics of arbitrage in spot markets: arbitrage refers to benefiting from the differences in the prices of securities, exchange rates, or interest rates between different financial markets simultaneously, with the aim of achieving immediate profits without risk. The operation is carried out by buying a currency or a financial asset at a low price in one market and selling it at a higher price in another market.**

Arbitrage leads to the convergence of prices between the different markets, whereby prices rise in the low-price market and fall in the high-price market, until a state of price equilibrium is reached between the two markets. Since the buy and sell operations take place at the same instant, the risk is almost nonexistent, which makes it attractive to many investors and arbitrageurs. Arbitrage opportunities arise as a result of several factors, the most important of which are (Hariri Abdelghani, 2020):

- The difference in the supply of and demand for foreign currencies between markets;
- The disparity in price spreads between active and inactive markets;
- The existence of a difference in dealing methods, whereby some local banks rely on intermediaries, while foreign banks deal directly;
- Sudden fluctuations in exchange rates;
- Delays in communications or in the transfer of information between dealers in the markets, which creates time gaps that are exploited to achieve profits.

We can distinguish the following types of arbitrage in the spot market:

- **Two-point arbitrage (between two currencies): arbitrage opportunities between two currencies arise when the exchange rate of the two currencies is not the same in two financial centers.**

Let us assume that there are two financial centers A and B, and that the two currencies are x and y, and that at present there are no transaction costs (for example, brokerage fees), no taxes, and the difference between the bid and ask prices equals zero. Let E(x/y) be the spot exchange rate between x and y, where x is the price of one unit of y. Arbitrage between these two currencies is expressed by the following equation:

$$E_A(x/y) \neq E_B(x/y)$$

From the equation we observe that the exchange rate of the two currencies has different values in each of the two financial centers at the same time, where:

$$E_A > E_B$$

*This means that currency y is cheaper in market B compared with market A (or currency x is cheaper in A). Here arbitrage takes place between the two currencies in the two markets, whereby currency y is bought from the cheaper market (i.e., B) and resold in the more expensive market (A). The difference between the buy and sell prices of the currencies represents the profit realized, which we denote by the symbol*π*:*

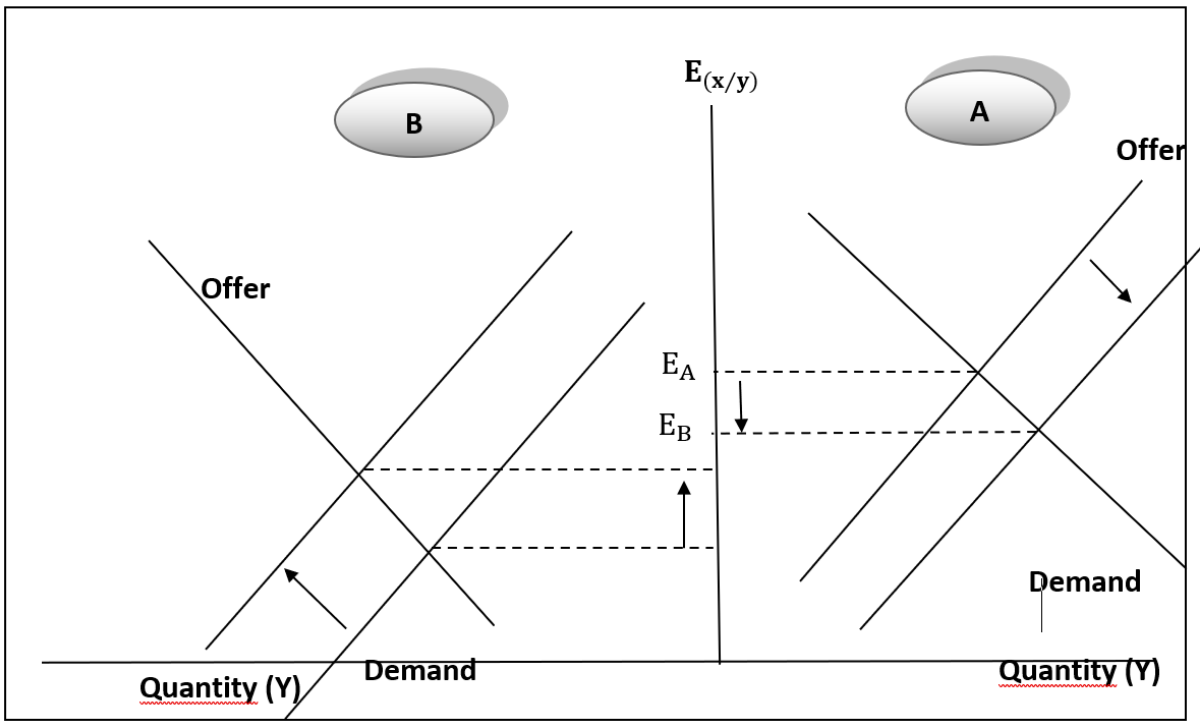
$$\boldsymbol{\pi = E_A - E_B}$$

Figure No. (1.2), Panel One, illustrates how arbitrage affects the forces of supply and demand and hence exchange rates in both centers. As demand for currency y rises in B, the exchange rate in market B will rise; meanwhile the supply of currency x will rise, which leads to a decline in the exchange rate in this market, which in turn leads to a decline in the profits realized. This process continues until profits fall to zero ($\pi = 0$*), that is:*

$$E_A = E_B$$

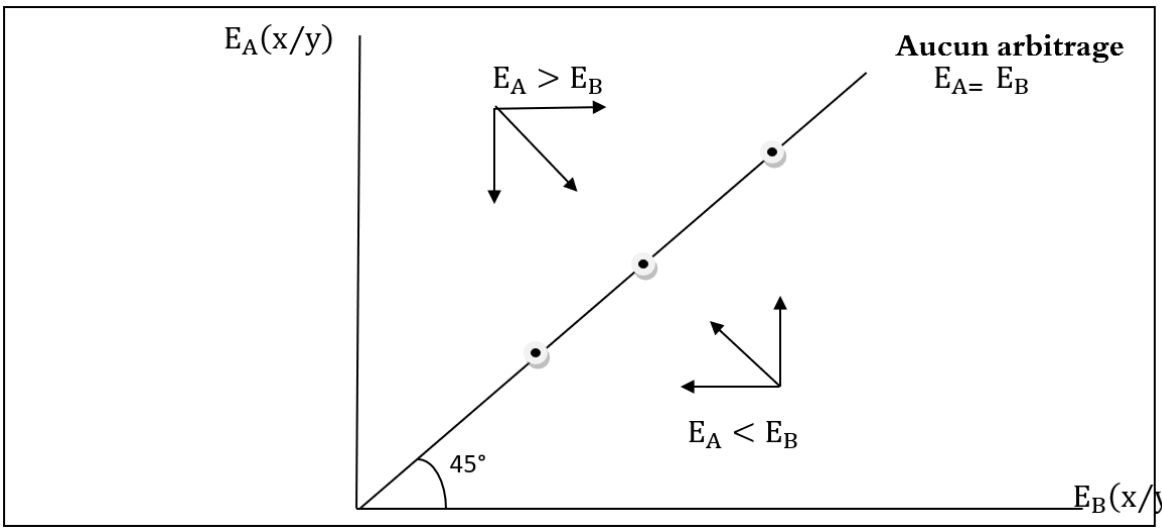
which is illustrated by Figure No. (1.2), Panel Two, which shows that the points located on the 45-degree line passing through the origin indicate the absence of arbitrage in this case.

Figure No. (2-1-1): Panel One: The effect of arbitrage between two currencies on supply and demand



Source: Moosa, I. (2004). International Finance an analytical approach. Australia: McGraw- Hill, p.315.
Example:

Figure No. (2-1-2): Panel Two: Showing the no-arbitrage points



Source: Moosa, I. (2004). International Finance an analytical approach. Australia: McGraw- Hill, p.315.
Example:

Let us assume that the prices of the pound sterling against the US dollar quoted in both the London and New York markets were as follows:

Ask price	Bid price	Market
1.2340	1.2330	New York
1.2360	1.2350	London

There is a difference between the prices in the two markets, which provides the possibility of arbitrage by selling the US dollar and buying the pound sterling in the New York market, and selling the pound sterling and buying the US dollar in the London market at the same time. Assuming that dealing costs are 0.0002 per pound sterling, a net profit of 0.0008 dollars per pound sterling bought can be achieved. As shown, we can carry out arbitrage by buying the dollar (and selling the sterling) in London and selling the dollar (buying the sterling) in New York simultaneously. In London, 1.2350 dollars can be bought for the pound sterling, and at the same time the dollar can be sold for the sterling in New York at a price of 1.2340 dollars per pound, yielding a return of 0.0010 dollars per pound bought and sold without holding any currency position.

Assuming that transaction costs were 0.0002 per pound sterling, the net profit is 0.0008 per pound sterling bought and sold.

Such a situation allowing arbitrage will not last long, because the market quickly returns to a state of equilibrium that does not allow any benefit from price differences between markets; the pound sterling falls in London or rises in New York until the two prices are equal.

- **Compound (three-point) arbitrage: it is called triangular arbitrage or three-point arbitrage. Given the existence of three currencies x, y, and z, we will have three exchange rates** $(\mathrm{E}_{x/y})$,$(\mathrm{E}_{x/z})$ and$(\mathrm{E}_{y/z})$, where it is necessary to determine the base exchange rate, which shows the units of measurement (i.e., the remaining exchange rates), where (Fenn et al., 2008):

$$(E_{x/y}) = \frac{(\mathrm{E}_{x/z})}{(\mathrm{E}_{y/z})}$$

The arbitrageur will try to benefit from the differences between the prices of the three currencies by moving from one currency to another, such that the currency he begins with is the currency he ends with. He can achieve profit by following the three steps below; let currency x be the currency he will begin with (Moosa, 2003):

- Step one: sell x and buy y to obtain$1/[E_{x/y}]$ units of y;

- Step two: sell y and buy z to obtain$1/[E_{x/y}E_{y/z}]$ units of z;
- Step three: sell z and buy x to obtain$E_{x/z}/[E_{x/y}E_{y/z}]$ units of x.

The return realized from the arbitrage operation can be expressed by the following equation (measured in units of x):

$$\pi = \frac{E_{x/z}}{E_{x/y}E_{y/z}} - 1$$

When$\pi = 0$, the equation$(E_{x/y}) = \frac{(E_{x/z})}{(E_{y/z})}$ means the absence of arbitrage; however, if:

$$(E_{x/y}) < \frac{(E_{x/z})}{(E_{y/z})}$$

that is:

$$(E_{x/z}) > (E_{x/y})(E_{y/z})$$

which is the case in which arbitrage takes place, because the return realized is positive (i.e.,$\pi > 0$), and hence the arbitrage operation is profitable if the following sequence is followed: x$\rightarrow y \rightarrow z \rightarrow x$.

In the case where there is a bid and an ask price for each currency, the arbitrageur will follow these steps:

- Step one: sell x and buy z at$E_{a(x/z)}$ to obtain$1/[E_{a(x/z)}]$ units of z;
- Step two: sell z and buy y at$E_{b(y/z)}$ to obtain$E_{b(y/z)}/[E_{a(x/z)}]$ units of y;
- Step three: sell y and buy x at$E_{a(x/y)}$ to obtain$E_{b(y/z)}E_{a(x/y)}/[E_{a(x/z)}]$ units of x;

where the return realized is (Moosa, 2003):

$$\pi = \frac{E_{b(y/z)}E_{a(x/y)}}{E_{a(x/z)}} - 1$$

Example:

An arbitrageur has 400,000 CHF and wants to carry out an arbitrage operation to benefit from price differences, given that the foreign currency prices in the London and New York markets were as follows:

London market	EUR/CHF= 4.5565/4.5653 EUR/USD= 1.1411/1.1416
New York market	USD/CHF= 3.8695/3.8905

If the arbitrageur buys the dollar with the Swiss francs he holds in the New York market, he pays 3.8905 CHF per dollar; so with the amount of Swiss francs he has he can buy 102,814.5 USD, where:

400 000/3.8905=102 814.5USD

The arbitrageur then, in the London market, buys EUR with 102,814.5 USD, where for each dollar he buys 1.1416 euros, that is: 102,814.5/1.1416 = 90,061 EUR; he then sells the euros he holds to buy Swiss francs (still in the London market), where he finally obtains:

$$90\ 061.79 \times 4.5565 = 410\ 366.55\ \text{CHF}$$

where he achieves a profit of 10,367 CHF from the arbitrage operation.

✓ ***Interest arbitrage: interest arbitrage is the movement of funds from one market to another to benefit from interest-rate differences between these markets, thereby achieving a profit as a result of the existing interest-rate differences between markets. For the desired profit to be realized, these differences must exceed the costs of covering the forward purchase of funds, in addition to the cost of transferring the funds. Interest arbitrage is divided into two types (Jeff-Madura, 2012):***

- ***Outward interest arbitrage: it is the movement of funds from the domestic market to the foreign market in order to benefit from interest-rate differences between the domestic and foreign markets, if these differences exceed the cost of purchasing the funds.***
- **Inward interest arbitrage: it is the movement of funds from the foreign market to the domestic market as a result of higher interest rates therein compared with its counterpart, thereby benefiting from price differences between the two markets, provided that the difference between interest rates covers the cost of obtaining the funds.**

Example:

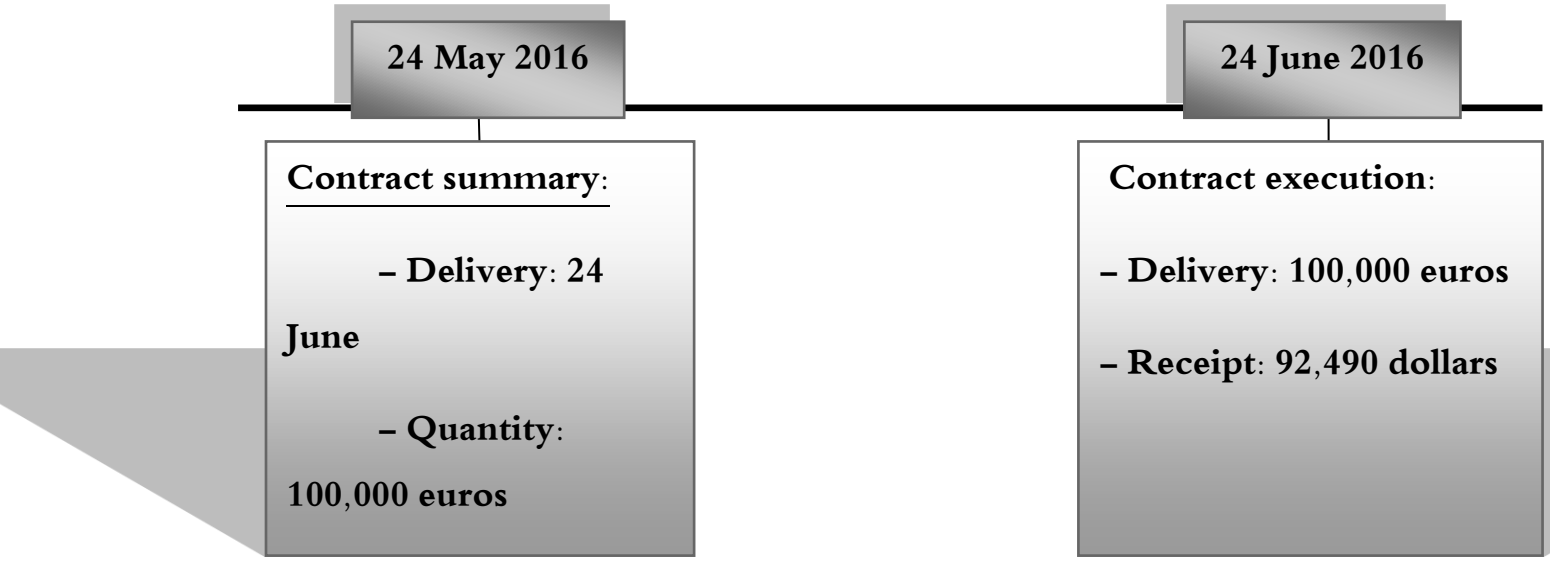
If we assume that the return on investing in the dollar for three months is 7% per annum, and that the return on investing in the pound sterling is 10% per annum, this prompts the investor to invest his funds in sterling rather than in the dollar, in order to achieve an additional profit of 3% per annum. But for this to happen, the return that this interest differential will yield for three months must exceed the cost of repurchasing the dollars on three-month delivery terms, and the cost of the transfer and movement of funds needed to complete this operation.

2.4 Forward exchange markets: forward exchange markets allow the purchase or sale of foreign currencies at the price on the day on which the operation took place, with delivery and payment on a specified future date called the settlement date. Forward contracts usually have maturities of 30, 60, 90, or 180 days, or one year (Abdel-Majid Qaddi, 2003), to match the

payment dates of export sales and the maturities of short-term financial assets such as treasury bills, commercial paper, and certificates of deposit (Dunn, Mutti, 2004). In general, this term begins after 48 hours have elapsed from the conclusion of the contract. The forward exchange rate is distinguished by reducing the degree of uncertainty resulting from exchange-rate fluctuations between currencies.

Example:

An investor decided on 24 May 2016 to sell 100,000 euros for US dollars, with delivery after one month, at an exchange rate of EUR/USD = 0.9249-0.9256 (the price agreed in advance). This means that the investor is obliged on 24 June 2016 to deliver 100,000 EUR and will receive in return 92,490 USD.



o Mechanism of trading in the forward exchange market: in foreign trade operations, the exporter, upon concluding a forward contract, knows in advance the value of what he will receive for the transaction in the future, regardless of the exchange-rate fluctuations that may occur after the goods have been dispatched; hence his profit in this operation will not be affected by those fluctuations. If he expects, for example, the price of the currency in which he will be paid to fall, he protects himself against this decline by selling the amount he will receive from that currency on the execution date at a price agreed upon immediately. The same applies to the importer, who knows in advance the amount he will pay for the transaction on the execution date, regardless of the fluctuations of the exchange rate of the currency in which he will pay after that date and its price on the execution date. If he expects the exchange rate of the settlement currency to rise,

he will protect himself by buying that amount of the currency in advance in the forward exchange market at a price agreed upon immediately, thereby avoiding the rise in the exchange rate at the time of settlement (Habib, 2023).

Example: An American exporter concluded a transaction on 15 January consisting of selling his goods to a European company for 1 million euros, with delivery and receipt after 3 months, at an exchange rate of EUR/USD=0.90, meaning that he will receive in the future 0.9 million dollars. However, this amount will be less if the value of the euro falls on 15 April to EUR/USD=0.85, meaning that the exporter will bear a loss of 50,000 dollars. In order to protect himself from the risk of a decline in the euro's price, the exporter must sell one million euros forward at a price agreed immediately with the European company. This price is called the forward rate.

The forward exchange rate is determined on the basis of the spot exchange rate (i.e., the prevailing rate at the time of contracting), plus the difference between the interest rates on the two currencies in the international markets; that is, the forward exchange rate is determined as follows (Michel Jura, 2003):

$$CT = C \times \frac{\left(1+\left(i_v \times \frac{j}{n}\right)\right)}{\left(1+\left(i_b \times \frac{j}{n}\right)\right)}$$

where:

- CT: the forward rate;
- C: the spot rate;
- i_v: the interest rate of the variable currency;
- i_b: the interest rate of the base currency;
- J: the duration of the forward contract (in days or months);
- N: the year (expressed in days/360, or expressed in months/12)

The forward exchange rate can also be expressed in the case of a given quotation method as follows:

- **Case of the certain quotation:**

$$CT = C \times \frac{\left(1+\left(i_e \times \frac{j}{n}\right)\right)}{\left(1+\left(i_d \times \frac{j}{n}\right)\right)}$$

- **Case of the uncertain quotation:**

$$CT = C \times \frac{\left(1+\left(i_d \times \frac{j}{n}\right)\right)}{\left(1+\left(i_e \times \frac{j}{n}\right)\right)}$$

where:i_e andi_d are the foreign and domestic interest rates, respectively.

Example 01:

A person has 100,000 US dollars deposited in a bank for three months (90 days) at an interest rate of 4%, and another person has the equivalent amount in euros deposited in a bank for three months at an interest rate of 2%. The spot price of the euro is 0.80 per dollar.

What is the forward rate of the euro, given that the dollar is the domestic currency?

Answer:

The forward rate of the euro is that rate which makes the total dollars at their maturity after three months equal to the total euros at their maturity for the same period.

$$CT = 0.80 \times \left(\frac{1+\left(0.02\times\frac{90}{360}\right)}{1+\left(0.04\times\left(\frac{90}{360}\right)\right)} \right)$$

$$= 0.7960 \text{ EURO}$$

The forward rate of the euro per dollar can be calculated as follows:

Principal amount: 100,000 US dollars;

Dollar interest rate: 4%

Euro interest rate: 2%

The spot price of the euro is 0.80 per dollar.

Let us assume that this person invested the sum of 100,000 dollars at 4% interest for three months:

$$100000 \text{ USD} \times \left(1 + \left(0.04 \times \frac{90}{360}\right)\right) = 101000 \text{ USD}$$

He then converted this amount (100,000 dollars) into euros at the rate of 0.80:

$$100000 \times 0.8 = 80000 \text{ EUR}$$

and invested it at 2% interest for three months.

$$80000 \text{ EUR} \times \left(1 + \left(0.02 \times \frac{90}{360}\right)\right) = 80400 \text{ EUR}$$

The forward rate is then as follows:

$$\text{Forward rate} = \frac{\text{Total amount invested in euros}}{\text{Total amount invested in dollars}} = \frac{80400}{101000} = 0.7960 \text{ euros.}$$

Example 02:

If you have 1,000,000 Swiss francs and wish to invest them for 92 days at an interest rate of 3%, and the spot rate is USD/CHF=1.7300, and the interest rate on the dollar is 4%.

Required: find the forward rate.

Solution:

$$CT = 1.7300 \times \left(\frac{1+\left(0.03\times\frac{92}{360}\right)}{1+\left(0.04\times\left(\frac{92}{360}\right)\right)} \right)$$

$= 1.7256$

In presenting how the forward exchange rate is determined, we assumed that the spot bid price equals the spot ask price, and we also assumed that the interest rates announced by the bank to clients, whether for borrowing or lending, are the same. But in practice we find otherwise: two different exchange rates are announced, one for buying and the other for selling, and two interest rates (White, 1963). Accordingly, we will have two forward exchange rates, the forward bid rate and the forward ask rate:

- **Forward bid rate: calculated from the spot bid rate; let us denote it by** CT_a where:

Case of the certain quotation: $$CT_a = C \times \frac{1+\left(i_e(o)\left(\frac{j}{n}\right)\right)}{1+\left(i_d(p)\frac{j}{n}\right)}$$

Case of the uncertain quotation: $$CT_a = C \times \frac{1+\left(i_d(o)\left(\frac{j}{n}\right)\right)}{1+\left(i_e(p)\frac{j}{n}\right)}$$

- **Forward ask rate: calculated from the spot bid rate; let us denote it by** CT_b where:

Case of the certain quotation: $$CT_b = C \times \frac{1+\left(i_e(p)\left(\frac{j}{n}\right)\right)}{1+\left(i_d(o)\frac{j}{n}\right)}$$

Case of the uncertain quotation: $$CT_b = C \times \frac{1+\left(i_d(p)\left(\frac{j}{n}\right)\right)}{1+\left(i_e(o)\frac{j}{n}\right)}$$

where: (o): is the cost at which the bank is prepared to borrow;

(p): is the cost at which the bank is prepared to lend.

Example:

If you have a 91-day forward operation on the euro, and the spot rate of the euro against the dollar is: EUR/USD= 0.9002-0.9006, and the interbank interest rate is 3-3.1% for the euro and 5-5.1% for the dollar.

Required: find the forward bid and ask rates.

- **Case of the uncertain quotation: where the dollar is the domestic currency and the euro is the foreign currency:**

Forward bid rate:

$$0.9045\ CT_a = 0.9002 \times \frac{1+\left(0.05\left(\frac{91}{360}\right)\right)}{1+\left(0.031\left(\frac{91}{360}\right)\right)} =$$

- **Forward ask rate:**

$$CT_b = 0.9006 \times \frac{1+\left(0.051\left(\frac{91}{360}\right)\right)}{1+\left(0.03\left(\frac{91}{360}\right)\right)} = 0.9053$$

Hence the forward rate is: EUR/USD= 0.9045-53

- **Case of the certain quotation: where the euro is the domestic currency and the dollar is the foreign currency:**

- **Forward bid rate:**

$$CT_a = 0.9002 \times \frac{1+\left(0.05\left(\frac{91}{360}\right)\right)}{1+\left(0.031\left(\frac{91}{360}\right)\right)} = 0.9045$$

- **Forward ask rate:**

$$CT_b = 0.9006 \times \frac{1+\left(0.051\left(\frac{91}{360}\right)\right)}{1+\left(0.03\left(\frac{91}{360}\right)\right)} = 0.9053$$

❖ *Mechanism of forward exchange rate formation: since the forward exchange rate is determined on the basis of the spot exchange rate plus the interest-rate differentials between the two currencies concerned, this means that the forward rate often differs from the spot rate. This is mainly attributable to the divergence of interest rates between currencies, which gives rise to two principal situations in the forward exchange market—the premium or the discount (Philippe D'Arvisenet, Thierry Schwob, 1990), where:*

Report (deport) $= \frac{CT-C}{C} \times \frac{n}{j}$

- ***Premium or forward premium (report): this is the positive difference between the forward exchange rate and the spot exchange rate, such that the forward exchange rate is greater than the spot exchange rate. For example, if the spot price of the euro is 0.9000 dollars and the forward exchange rate is 0.9022 dollars, the premium is 0.0022 dollars, or we say it is equivalent to 22 forward points.***

- *Discount (deport): this is the negative difference between the forward exchange rate and the spot exchange rate, such that the forward exchange rate is less than the spot exchange rate. For example, if the spot price of the euro is 0.9000 dollars and the forward exchange rate is 0.8970 dollars, the discount is 0.0030 dollars, i.e., 30 forward points.*

Chapter Three: Exchange Rate Regimes

The subject of exchange rate regimes is one of the most prominent issues that has received great attention in financial and economic thought, owing to its close connection with international trade, the movement of capital, and the stability of monetary transactions between countries. The world has witnessed, over its historical stages, profound transformations in the nature of these regimes, which in turn reflected the major economic and political changes that humanity has passed through—from reliance on bimetallism to determine the value of currencies, to the emergence of the gold standard as a dominant international system, to its collapse after World War One and the various subsequent experiments with pegging or floating exchange rates. With the development of the global economy and the increasing interconnection of markets, the need for more comprehensive modern classifications emerged, which the International Monetary Fund adopted in its division of contemporary exchange rate regimes according to degrees of flexibility and monetary intervention. This historical and contemporary gradation allows a deeper understanding of how countries have adapted to financial and economic challenges over time.

1. The Historical Evolution of Exchange Rate Regimes

1.1 The evolution of exchange rate regimes before 1870

The period preceding 1870 witnessed a multiplicity of exchange rate regimes, as many countries used the bimetallic system (Bimetallism), which is based on adopting both gold and silver as the basis for determining the value of the currency. The official value of the currency was determined on the basis of a specific quantity of gold or silver, with the state committing to exchange the currency for precious metals at a fixed exchange rate, which provided a degree of stability in international commercial transactions.

In this system, the state was obliged to maintain the value of the currency against one of the two metals, and it could be used to settle international payments, which granted it a degree of flexibility; but this also made it susceptible to changes in the global market, especially when large quantities of gold or silver were discovered, which led to disturbances in exchange rates.

The United States began applying the bimetallic system in 1792, but the official values of gold and silver did not always reflect the true market values, which led to instability in practical application (Burange, Ranadive, 2011). In contrast, Britain formally adopted the gold standard in 1816 (McKinnon, 1993), and the value of the pound was fixed on the basis of a certain quantity

of gold only. By the Paris Conference of 1867, most industrialized countries had begun to move toward adopting gold, and the gold standard system had become prevalent in international trade by 1880.

But this system faced challenges, the most prominent of which were commercial expansion and new discoveries that led to fluctuations in the supply of gold, causing economic volatility that affected monetary activities and exchange markets.

2.1 Before 1918

Before 1918, gold played a central role in determining the value and stability of currencies, which contributed to a relative stability in exchange rates; but over time challenges arose, such as fluctuations in the supply of gold. The gold standard had become an international benchmark by 1880.

3.1 The period 1918–1939

This phase witnessed economic disruptions as a result of World War One, which led to the collapse of the gold system. Countries adopted independent monetary policies and began to float their currencies. In 1925, Britain attempted to return to the gold standard at an unrealistic exchange rate, which contributed to new economic crises.

4.1 After 1944

In 1944, the Bretton Woods system was established to achieve monetary stability; currencies were pegged to the dollar, which was itself convertible into gold at a price of $35 per ounce. The system allowed limited fluctuation of ±1%, but later collapsed due to the American balance-of-payments deficit and fiscal expansion (Eichengreen et al., 2006).

2. Modern Exchange Rate Regimes and Their Classifications

The classification of modern regimes relies on the International Monetary Fund, which bases itself on the actual regimes of member states since 1 January 1999. This system classifies exchange rate regimes according to the degree of flexibility of exchange rate arrangements, or the formal or informal commitment to a specified path for the exchange rate. It draws on information obtained through technical assistance to member states and regular contacts with IMF economists in those countries (Rose, 2011). The new IMF system divides exchange rate arrangements into eight categories (Mitsuo, 2007):

1.2 Hard peg regimes

They include two regimes:

✓ Official dollarization (complete use of a foreign legal tender):

In this regime, the country adopts a foreign currency as the sole official legal tender for circulation, instead of issuing its own national currency. Examples include countries such as Ecuador, El Salvador, and the Marshall Islands using the US dollar as their official currency. This approach is known as "official dollarization" (Official Dollarization). Some other countries rely on the euro, such as Kosovo, Montenegro, and San Marino. Under this regime, the monetary authorities relinquish all authority to manage domestic monetary policy.

✓ Currency Board:

A currency board is a monetary system that pegs the domestic currency to a foreign currency (usually the US dollar or the euro) through a fixed and announced exchange rate, while imposing strict restrictions on the monetary-issuance authority to ensure full coverage of the domestic currency with foreign assets. This means that the monetary authorities issue domestic currency only when there is a corresponding cover from foreign currency, which leads to a reduction in the traditional functions of the central bank, such as monetary control and the provision of loans as a lender of last resort.

2.2 Flexible regimes

✓ Conventional peg arrangements (Conventional Peg Arrangements):

In this regime, the country commits formally, by law, to pegging its currency at a fixed exchange rate against a single foreign currency or a basket of currencies. The currency basket is usually built on the basis of the major currencies with which the country deals in its trade or financial relations, such that the weights of the currencies making up the basket reflect the distribution of foreign trade or capital flows. The composition of the basket may be publicly disclosed or communicated to the IMF.

Many Arab countries follow this regime, such as Saudi Arabia, the UAE, Oman, Qatar, Iraq, and Jordan, whose currencies are pegged to the US dollar. Other countries, such as Mali, Niger, Senegal, and Togo, peg their currencies to a basket of currencies in which the euro is the main component, as is also the case in Cameroon and Gabon. The monetary authorities maintain exchange

rate stability through direct interventions in the exchange market (buying or selling foreign currencies) or through indirect interventions using monetary policy instruments, such as adjusting interest rates or imposing controls on the exchange market.

✓ Stabilized arrangement (Stabilized Arrangement):

A stabilized exchange rate arrangement is considered to be in place when a country maintains the exchange rate of its currency at a relatively stable level against a single currency or a basket of currencies, within a fluctuation margin not exceeding ±2% for a period of not less than six months, excluding a limited number of exceptional cases or gradual adjustments. The exchange rate under this regime is not considered to be floating. The degree of stability is verified using statistical tools, and it is noted that this classification does not require an official announcement from the authorities.

✓ Crawling peg (Crawling Peg):

In this regime, the exchange rate is adjusted gradually in small amounts, either according to a fixed rate or in response to changes in certain economic indicators, such as inflation differentials with major trading partners or announced inflation targets. The crawl rate may be determined in advance to reflect regular changes, or it may be adjusted according to future expectations of inflation or exchange rates. This regime aims to ensure flexibility in the exchange rate while maintaining a degree of stability.

✓ Crawl-like arrangement (Crawl-like Arrangement):

The regime is classified under this type when the exchange rate remains within a narrow margin (±2%) in a statistically determined direction for a period of not less than six months, with a limited number of outlying values permitted. This regime is not considered floating. It generally requires a regular rate of change in the exchange rate, similar to a gradual annual crawl of not less than 1%, provided that changes in the exchange rate occur in a regular, steady, and sufficiently continuous manner.

✓ Pegged exchange rate within horizontal bands (Pegged Exchange Rate within Horizontal Bands):

In this regime, the country commits to maintaining the value of its currency within a certain fluctuation range of not less than ±1% around a fixed central

exchange rate. This band is considered wider than the narrow bands associated with other regimes, and it grants the monetary authorities some flexibility in dealing with market fluctuations while maintaining the currency's link to a reference level.

3.2 Floating regimes

Floating regimes represent a group of arrangements lying between managed floating and free floating, distinguished by varying degrees of intervention by the monetary authorities in the exchange market.

✓ **Managed floating (Managed Floating)**

Within this regime, the exchange rate is determined according to market forces (supply and demand) without commitment to a specific path or an announced target for the exchange rate. However, the monetary authorities may intervene, directly or indirectly, in the foreign exchange market when necessary, with the aim of adjusting the direction of the rate or limiting its sharp and undesirable fluctuations. These interventions are usually based on discretionary indicators such as the balance-of-payments position and the level of international reserves. The extent of variability under managed floating regimes differs according to the nature and magnitude of the shocks to which the economy is exposed.

✓ **Free floating (Free Floating)**

In this regime, the exchange rate of the currency is determined freely through the forces of supply and demand in the market, without regular or permanent intervention by the monetary authorities. Exceptional intervention may occur only in certain cases, without being intended to have a continuous effect on the level or direction of the exchange rate. The exchange rate is left to fluctuate naturally, which makes the regime more transparent and directly reflects market conditions.

✓ **Other exchange rate regimes (Residual Arrangements)**

This category includes the regimes that cannot be classified under any of the previously mentioned categories, owing to their frequent changes and the absence of a clear pattern in the monetary policy being followed. These regimes are characterized by their high flexibility, whereby the country does not adopt a fixed or stable exchange rate system; rather, their classifications

change from year to year according to the objectives of monetary and economic policy and the mechanisms for selecting the peg currency or determining the exchange rate.

This change is usually attributable to the countries' pursuit of external balance, support of economic growth, and avoidance of financial crises through adaptation to domestic and international developments.

Chapter Four: Theories Determining the Exchange Rate

Many economic theories attempt to explain exchange-rate differences between countries; the most important of these theories are:

1. Purchasing Power Parity Theory (PPP)

The concept of purchasing power parity is considered an important foundation when studying and forecasting exchange-rate movements. The credit for establishing the rules of this theory in its modern form goes to the economist Gustav Cassel in 1923, where we distinguish between two versions of this theory: the absolute and the relative (CASSEL, 1992) (Dohni, Hainaut, 2004).

1.1 The absolute version of PPP theory (PPP absolue):

The purchasing power parity theory in its absolute version rests on a basic idea, which is that the equilibrium exchange rate for a country's currency in the long run is determined by linking domestic prices to foreign prices; that is, the exchange rate of a currency is determined on the basis of the purchasing power of that currency domestically and abroad.

The law of one price is considered the cornerstone for the realization of the purchasing power parity condition, which states that when markets are competitive, a certain basket of goods and services will have the same price in different countries, if prices are expressed in terms of the same currency. This condition is realized in the case of international trade when there is perfect substitution of goods across countries, the absence of tariff or non-tariff restrictions, and the absence of transport costs (Nashat Nabil Mohammed Al-Wakeel, 2006).

If we assume that$E_{A/B}$ refers to the nominal exchange rate of currency A (the domestic currency),P_A represents the level of domestic prices denominated in the domestic currency,P_B represents the level of foreign prices denominated in the

foreign currency, then the expression of the absolute version of the law of one price is as follows:

$$P_B = E_{A/B} \times P_A$$

In other words, the equilibrium exchange rate is:

$$E_{A/B} = \frac{P_B}{P_A}$$

If, for example, the domestic price level (euro area) equals twice the foreign price level (United States), this requires that one unit of the foreign currency (dollar) be exchanged for two units of the domestic currency (euro), because the purchasing power of the dollar equals twice the purchasing power of the euro. It can therefore be said that the cost of buying a good from the United States must equal the cost of buying it in the euro area.

If we assume that the cost of producing a basket of goods in the United States is one dollar, while in the euro area it costs 2 euros, the exchange rate that equalizes the cost of buying this basket in the two countries is:

$$E_{EUR/USD} = \frac{P_{USD}}{P_{EUR}} = \frac{1}{2} = 0.5$$

However, this theory faces several criticisms, the most important of which are:

- *This theory's focus on tradable goods in determining the exchange rate, and its disregard of goods that do not enter into international trade;*
- *This theory's assumption of the absence of any transport costs or barriers to the flow of international trade;*
- *The assumption of homogeneity of traded commodity units, given that homogeneity occurs in a limited number of commodities such as gold, silver, copper, etc., which are dealt with internationally.*

These criticisms were the impetus for the emergence of the purchasing power parity theory in its relative version.

2.1 The relative version of PPP theory (PPP relative)

This theory modified the simplified initial formulation of its counterpart, absolute purchasing power parity, by taking the element of time into account, such that the comparison is made between both the exchange rate and the level of domestic and foreign prices over two time periods, t and t-1. The interpretation of this is that the level of the exchange rate will not remain the same during those two periods.

Starting from the previous equation:

$$E_{A/B} = \frac{P_B}{P_A}$$

Assuming that there is a change in the general level of domestic and foreign prices during the two periods t and t-1, the change in the exchange rate during these two periods will take the form:

$$\left(E^{t}_{A/B}/E^{t-1}_{A/B}\right) \times \left(P^{t}_{A}/P^{t-1}_{A}\right) = \left(P^{t}_{B}/P^{t-1}_{B}\right)$$

That is:

$$\left(E^{t}_{A/B}/E^{t-1}_{A/B}\right) = \left(P^{t}_{B}/P^{t-1}_{B}\right)/\left(P^{t}_{A}/P^{t-1}_{A}\right)$$

To clarify this relationship, we take the following example:

On 1 January 2011, the price indices for a basket of goods in the euro area and the United States were as follows:$P^{2011}_{EUR} = 100$, and$P^{2011}_{USD} = 137$*; let us assume that the price indices for the same goods in 2010 are:*$P^{2010}_{EUR} = 95$,$P^{2010}_{USD} = 135$.

According to the relative version of the purchasing power parity theory, the changes between the exchange rate of the euro and the dollar during the two periods 2010 and 2011 are determined as follows:

$$\left(E^{2011}_{EUR/USD}/E^{2010}_{EUR/USD}\right) = (137/135)/100/95 = 0.9640$$

From this we conclude that the euro experienced a depreciation compared with the dollar between 2010 and 2011.

To clarify the picture further, we will compare the relative changes between the price indices, meaning calculating the inflation rates between the two periods t and t-1, where:

$$\inf_A = \left(P^{t}_{A} - P^{t-1}_{A}\right)/P^{t-1}_{A}$$

and also:

$$\inf_B = \left(P^{t}_{B} - P^{t-1}_{B}\right)/P^{t-1}_{B}$$

As for the relative changes in the exchange rate during the period t and t-1, they take the following form:

$$\left(E^{t}_{A/B} - E^{t-1}_{A/B}/E^{t-1}_{A/B}\right) = \left(E^{t}_{A/B}/E^{t-1}_{A/B}\right) - 1$$

which is equivalent to:

$(P_B^t/P_B^{t-1})/(P_A^t/P_A^{t-1}) - 1$

The relative changes in domestic and foreign prices can be substituted by their equivalent inflation rates, so that we have:

$$\left(E_{A/B}^t - E_{A/B}^{t-1}/E_{A/B}^{t-1}\right) = (1 + inf_A/1 + inf_B) - 1 = (inf_A - inf_B/1 + inf_B)$$

The relative difference in the exchange rate is approximately equal to changes in inflation levels. The relative version of the purchasing power parity theory holds that changes in the exchange rate are the result of differences in inflation rates between countries, where:

$$\boldsymbol{\left(E_{A/B}^t - E_{A/B}^{t-1}/E_{A/B}^{t-1}\right) = (1 + inf_A/1 + inf_B) - 1 \approx inf_A - inf_B}$$

To clarify the relationship, we take the previous example where:

We calculate the inflation in the euro area and the United States:

$$inf_{EUR} = (100 - 95/95) \approx 5.26\%$$

$$inf_{USD} = (137 - 135/135) \approx 1.48\%$$

This means that inflation is estimated at 5.26% in the euro area, while in the United States it is 1.48%.

According to the purchasing power parity theory, the relative change in the exchange rate between the euro and the dollar as a result of this difference in inflation between the two countries is calculated as follows:

$$\frac{1 + 5.26\%}{1 + 1.48\%} - 1 = 3.72\%$$

$$inf_{EUR} - inf_{USD} = 5.26\% - 1.48\% = 3.78\% \approx 3.72\%$$

*The interpretation of this result is that there is a depreciation in the value of the euro at a rate of*3.72% *against the dollar between 2010 and 2011.*

Thus the PPP theory in its relative form has become more widely accepted among economists than its predecessor; but this has not prevented the existence of some shortcomings, consisting primarily of its assumption of the absence of transport costs and tariff and non-tariff barriers. The proponents of this theory attempted to justify this by arguing that the law of one price and purchasing power parity apply only to internationally tradable goods, and this means that

the exchange rate is determined on the basis of the ratio between the domestic and foreign prices of those goods, with the assumption of the absence of tariff barriers, that is:

$$E_{A/B} = \frac{P_{BT}}{P_{AT}}$$

where the general level of domestic prices (P_A) encompasses the prices of internationally tradable goods (P_{AT}) and the prices of non-tradable goods (P_{AN}), and hence:

$$P_A = a \times P_{AT} + (1 - \alpha)P_{AN}$$

And the same applies to the general level of foreign prices:

$$P_B = a \times P_{BT} + (1 - \alpha)P_{BN}$$

(α) represents the share of internationally tradable goods in total production of the economy under study.

If we assume that (β_A) refers to the ratio between domestic tradable and non-tradable goods, where:

$$\beta_A = \frac{P_{AN}}{P_{AT}}$$

And the same applies to the foreign economy:

$$\beta_B = \frac{P_{BN}}{P_{BT}}$$

These two equations can be reformulated as follows:

$$P_{AN} = \beta_A \times P_{AT}$$

$$P_{BN} = \beta_B \times P_{BT}$$

It is then possible to define the price level in terms of the prices of internationally tradable goods only, in each of the domestic and foreign economies:

$$P_A = a \times P_{AT} + (1 - \alpha)\beta_A \times P_{AT}$$

$$= [\alpha + (1 - \alpha)\beta]P_{AT}$$

$$P_B = a \times P_{BT} + (1 - \alpha)\beta_B \times P_{BT}$$

$$= [\alpha + (1 - \alpha)\beta]P_{BT}$$

If we denote the part$[\alpha + (1 - \alpha)\beta]P_{AT}$ byδ_A and similarly for$[\alpha + (1 - \alpha)\beta]P_{BT}$ byδ_B, we can then define the domestic and foreign price levels as follows:

$$P_A = \delta_A \times P_{AT}$$

$$P_B = \delta_B \times P_{BT}$$

Accordingly, the exchange rate equation can be reformulated as follows:

$$E_{A/B} = \frac{P_{BT}}{P_{AT}}$$

$$= (P_B/\delta_B)/(P_A/\delta_A)$$

$$= \frac{P_B}{\delta_B} \times \frac{\delta_A}{P_A}$$

$$E_{A/B} = \frac{P_B}{P_A} \times \frac{\delta_A}{\delta_B}$$

This formulation clarifies that the exchange rate is determined not only by the ratio between domestic and foreign price levels but also by real factors; the exchange rate in this case equals the ratio between prices ifδ_A andδ_B are equal to unity, meaning a perfect homogeneity between them. Hence:

$$E_{A/B} = \frac{dP_B}{P_B} - \frac{dP_A}{P_A}$$

However, the PPP theory in its relative version assumes thatδ_A andδ_B do not change their values in the short run, and it explains this through the linkage between price levels in industrialized countries, where the prices of tradable goods change if the prices of non-tradable goods change.

2. Interest rate parity theory:

This theory was presented by the economist J.M. Keynes in 1923. It states that if there are two currencies with different interest rates, this difference will be reflected in the forward exchange rates and the expected future exchange rates anticipated by market participants. We distinguish between two types: covered and uncovered interest rate parity.

1.2 Covered interest rate parity theory (CIP)

This theory posits the existence of a link between the spot and forward exchange rates and the differences between domestic and foreign interest rates. The covered interest rate parity theory starts from the idea that the investor has two options when placing his funds, namely (Jean-Pierre Allegret, 1997):

- Placing his funds in assets denominated in the domestic currency (A) at an interest rate ofi_A over the period t to t+1;
- Placing his funds in assets denominated in the foreign currency (B) at an interest rate ofi_B over the period t to t+1.

If the investor chooses to place his funds in the domestic market, at the end of the period (say, one week) he will obtain the invested amount (x) plus the return at the domestic interest rate, that is:

$$X\ (1 + i_A)$$

If the investor chooses to invest in the foreign market, he will obtain the return from the interest rate; but this operation entails risks represented by a potential decline in the value of the foreign currency during the investment period, which means that the return realized from the interest rate may decline as a result of the potential deterioration of the foreign currency. In this case, the investor can hedge against this risk in the forward market by selling the foreign currency forward. He does so by following these steps:

He will convert the amount he holds into the foreign currency, i.e., he sells currency A and buys in return, with that amount, currency B at the spot exchange rate$S_{A/B}$, obtaining$(1 \times S_{A/B})$ in the foreign currency B, which he also invests for one week at an interest rate ofi_B, thereby obtaining at the end of the investment period an amount of$(1 \times S_{A/B}) \times (1 + i_B)$ in the foreign currency B; he then reconverts the expected amount to the domestic currency at the forward exchange rate$F_{B/A}$, i.e., he sells the foreign currency B forward for A, so he will obtain:

$$(1 \times S_{A/B}) \times (1 + i_B) \times F_{B/A}$$

which is equivalent to (Paphalle B, Armande, 1993):

$$(1 + i_B) \times S_{A/B}/F_{A/B}$$

Here the investor faces two situations:

- In the case where the return realized in the domestic market$(1 + i_A)$ is greater than the return realized in the foreign market$(1 + i_B) \times S_{A/B}/F_{A/B}$, the investor will move to invest in the domestic market;

- *In the case where the return realized in the domestic market* $(1 + \mathrm{i_A})$ is less than the return realized in the foreign market $(1 + \mathrm{i_B}) \times S_{\mathrm{A/B}}/\mathrm{F_{A/B}}$, the investor will move to invest in the foreign market.
- *If the return realized in the domestic market* $(1 + \mathrm{i_A})$ equals the return realized in the foreign market $(1 + \mathrm{i_B}) \times S_{\mathrm{A/B}}/\mathrm{F_{A/B}}$*, the investor will have the choice of either investing in the domestic or the foreign market, as he will achieve the same return, where:*

$$\mathbf{i_B - i_A = (F_{A/B} - S_{A/B})/S_{A/B}}$$

That is:

$$\mathbf{i_B \approx i_A + (F_{A/B} - S_{A/B})/S_{A/B}}$$

This is the formula expressing that there is a slight difference between the exchange rate in the forward and spot markets, where the right-hand side of the formula expresses the relative difference between the spot and forward rates; if the difference is positive it is called a discount, while if it is negative that difference is called a premium on currency A forward.

This expression also indicates that when short-term capital movements between financial centers limit the differences between the spot and forward rates, the premium or discount of one currency against another is the result of the interest-rate differential in each center. It also indicates that if the forward and spot rates do not achieve equality, there is an arbitrage opportunity that can be exploited to restore equilibrium between the various rates.

2.2 Uncovered interest rate parity theory (UIP)

The investor, if he chooses to invest in the foreign market, can choose not to hedge against the risks to which he may be exposed as a result; he is not obligated to do so. Given that the investor is characterized by rational behavior, he will expect a rise in the price of the foreign currency (a depreciation of the domestic currency), or that the depreciation that may occur will not completely eliminate the possibility of benefiting from the interest-rate differentials resulting from his depositing capital in the foreign center. There is also a difference between the forward exchange rate and the expected exchange rate in that the latter is not known in advance until the maturity date, and the return from the investment is also undetermined. The rate of appreciation or depreciation of the currency $\mathrm{i_B}$ is added to the return on the foreign asset $\left(\mathrm{i_B} + \mathrm{E}\left(\mathrm{S_{A/B}}\right)\right)$, where $\mathrm{E}\left(\mathrm{S_{A/B}}\right)$ represents the expected exchange rate (Boughton, 2006). This theory can be expressed in a

formula similar to its predecessor, where the forward rate is replaced by the expected exchange rate, on the grounds that arbitrage takes place without cover, that is:

$$\mathbf{i_B - i_A = \left(E\left(S_{A/B}\right) - S_{A/B}\right)/S_{A/B}}$$

The equation shows that changes in the expected exchange rate equal the interest-rate differentials; if this equality is not realized, arbitrage gains are achievable, and so the spot exchange rate will adjust in order to restore equality.

Example:

Let us assume that a European investor wishes to invest his euro-denominated assets for one week; he has two options: to invest his funds in Canada or in France, given the following market data:

- The spot exchange rate between the euro and the Canadian dollar is: $S_{EUR/CAD} = 1.3726$*;*

- The investment rate in Canada for one week is: $i_c = 4.5\%$*;*

- The investment rate in France for one week is: $i_F = 2.5\%$.

Required: determine the expected exchange rate.

The value of the interest-rate differential in the two countries is:

$2 = i_C - i_F$ points

The expected exchange rate between the euro and the Canadian dollar can then be found, where:

$$0.02 = \left(E\left(S_{A/B}\right) - 1.3726\right)/1.3726$$

The relationship between the interest-rate differential and the rate of change in the exchange rate is a direct one, where:

- *If the interest-rate differential is positive (*$i_B > i_A$*), the price of the foreign currency will fall relative to a rise in the price of the domestic currency, i.e., the expected exchange rate will rise (*$E\left(S_{A/B}\right) > 0$*);*
- *If, however, the interest-rate differential (*$i_B < i_A$*) is the case, the price of the foreign currency will rise relative to its counterpart, i.e., the expected exchange rate will fall (*$E\left(S_{A/B}\right) < 0$*).*

Example:

Let us assume that the interest rate on the euro for three months is 4%, and the interest rate on the dollar is 6%. This means that if the expected exchange rate is quoted using the certain quotation for the euro against the dollar, it will rise, which means a depreciation of the euro against the dollar by: (6% - 4%) / 4 = 0.5%. The division by 4 is to annualize the interest rate equivalent to 3 months.

There is a difference between the expected spot exchange rate and the forward exchange rate determined by the market or banks: if the expected spot exchange rate is higher than the forward exchange rate ($E(S_{A/B}) > F_{A/B}$*); the domestic currency is expected to rise, which leads to additional capital being present in the domestic market given its attractiveness, and hence a decline in the return on the interest rate* i_A; whereas in the foreign market there is a capital shortage and a rise in the return on the foreign interest rate i_B. The opposite occurs if ($\mathbf{E(S_{A/B}) < F_{A/B}}$*). And if (*$\mathbf{E(S_{A/B}) = F_{A/B}}$*), there will be no arbitrage operation.*

Nevertheless, economic theory acknowledges that investors often exhibit some form of risk aversion that leads them to deviate from this simple arbitrage rule; in this case the forward rate differs from the expected exchange rate by a risk premium π*, where:*

$$\mathbf{F_{A/B} = E(S_{A/B}) + \pi}$$

where the risk premium is determined by the difference between the expected spot exchange rate and the forward exchange rate; if the forward exchange rate is higher than the expected spot exchange rate ($E(S_{A/B}) < F_{A/B}$*), then the risk premium is positive (*$\pi > 0$*), and investors must therefore avoid risks; conversely, if the forward exchange rate is lower than the expected spot exchange rate (*$E(S_{A/B}) > F_{A/B}$*), this encourages the investor to invest in the foreign market.*

Both the covered and uncovered interest rate parity theories explain the development of the exchange rate in the short term through the behavior of two categories of agents in the monetary and foreign exchange markets: arbitrageurs, who seek to benefit from exchange-rate differences at a given moment between different financial centers, and also from the gap between interest rates without changing the currency position (found in CIP); and speculators, who seek to achieve greater capital gains while deliberately exposing themselves to risk on the basis of their expectations (found in UIP).

When combining the two theories' relationships, we note that the expected market exchange rate should be greater or less than the forward exchange rate in the forward foreign exchange market. This implies an important result: that the particular currency of a country or its high interest rates tend to fall against the currency offering a low interest rate until interest rate parity is achieved.

3. The monetary approach to determining the exchange rate:

The monetary approach explains changes in the exchange rate through the changes that occur in the supply of and demand for money. This approach assumes that domestic and foreign bonds are perfect substitutes, i.e., there is

perfect substitution between domestic and foreign financial assets. This approach is considered an extension of the purchasing power parity theory, by examining the extent to which relative changes in prices (inflation rates) can determine changes in exchange rates.

Assuming that:

❖ The money demand function in the domestic economy is:

$$L_A = K_A P_A Y_A$$

❖ The money demand function in the foreign economy is:

$$L_B = K_B P_B Y_B$$

❖ *Equilibrium in the money market in the two countries:*

$$L_A = M_A$$
$$L_B = M_B$$

❖ *Purchasing power parity:*

$$P_B = E_{A/B} \times P_A$$

where:

L: money demand, M: money supply, Y: income, K: liquidity preference ratio.

By substituting the money demand functions in both economies into the purchasing power parity equation, we obtain:

$$E_{A/B} = \frac{P_B}{P_A} = (M_B/K_B Y_B)/(M_A/K_A Y_A)$$

Assuming that K is constant:

$$E_{A/B} = (M_B/M_A) \times (Y_A/Y_B)$$

This means that:

➢ The domestic currency A depreciates when the growth rate of the domestic money supplyM_A is greater than the foreign money supplyM_B; and the foreign income growth rateY_B is greater than the domestic income growth rateY_A;

➢ The domestic currency A appreciates when the foreign money supply is greater than the domestic money supply, and the growth rate of domestic income is greater than its foreign counterpart.

Example:

Given the following data about a domestic economy A and a foreign economy B, where:

$M_A = 5\%, M_B = 3\%, Y_A = 3, Y_B = 1$

the change in the exchange rate will be equal to zero$E_{A/B} = 0$ *because the increase in the domestic money supply over its foreign counterpart has been offset by the same increase in domestic income over foreign income.*

4. The portfolio balance approach to determining the exchange rate:

The contributions of Kouria, Porter 1974, Dolly, and Isard 1979 are credited with formulating the portfolio balance model, which rests on the idea that the determination of the exchange rate involves comparing the demand for and supply of the domestic currency with its foreign counterpart, and assumes that there is an imperfect substitution of domestic financial assets for foreign financial assets and vice versa.

This approach also extends the money demand function to include other financial assets in addition to money; the model of demand for financial assets assumes demand, whether domestic or foreign, for money and domestic and foreign bonds. The demand function for domestic money can be expressed by the following equation (Hazzaa Mufleh, 2007):

$$L_A = f(i_A^-, i_B^-, x^-, Y_A^+, P_A^+, W_A^+)$$

where:

i_A^- *: the interest rate on the domestic bond;*

i_B^- : the interest rate on the foreign bond;

x^- : the expected rate of change in the foreign currency;

Y_A^+: domestic real income;

W_A^+ : domestic real wealth.

Wealth (W) = domestic money + domestic bonds + foreign bonds.

$W = L_A + B_A + B_B$

The signs above the variables in the equation indicate their relationship with money demand.

Similarly, the money demand function in the foreign economy is as follows:

$$L_A = f(i_A^-, i_B^-, x^-, Y_B^+, P_B^+, W_B^+)$$

The demand function for domestic bonds can be expressed by the following equation:

$$B_A = f(i_A^+, i_B^-, x^-, Y_A^-, P_A^-, W_A^+)$$

A rise in domestic interest rates compared with foreign rates makes domestic bonds attractive, which leads to increased demand for them; while a rise in foreign interest rates compared with their domestic counterparts makes foreign bonds attractive, increasing demand for them and reducing demand for domestic bonds.

A rise in x also works in the same way. The relationship between demand for domestic bonds and domestic prices and domestic income is an inverse one, stemming from the relationship between money demand for transaction purposes, income, and the price level. A rise in income leads to increased demand for money for transaction purposes, and the investor will therefore reduce his holdings of bonds to obtain money; this also applies to a change in price (Hazzaa Mufleh, 2007).

As for demand for foreign bonds, it can be expressed by the following equation:

$$B_B = f(i_A^-, i_B^+, x^+, Y_A^-, P_A^-, W_A^+)$$

where the signs forW_A^+, P_A^-, Y_A^- *have the same interpretation given for demand for domestic bonds, while the signs on interest rates are the reverse of what they were for domestic bond demand. This is because the financial assets making up wealth are substitutes for one another, so any change in one of the variables causes a number of reactions in the investor.*

Chapter Five: Exchange Rate Risk and Its Hedging Techniques

Most developed countries have moved toward applying a floating exchange rate system, which has led to increasing fluctuations in exchange rates. As a result, the risks faced by various economic agents in the financial and monetary markets have increased, whether real or financial. This situation has necessitated the reliance on modern techniques for managing exchange rate risk and an accurate understanding of the nature of these risks, particularly when dealing in the foreign exchange market. It has also become necessary to be well acquainted with the procedures that must be followed to avoid exposure to the potential risks arising from international transactions.

1. Definition of exchange rate risk:

Foreign exchange risk arises when an institution conducts business, invests in debt instruments, or carries out financial transactions in a currency other than the currency in which it prepares its accounts. These risks are defined as the probability that the institution will be exposed to losses as a result of changes in exchange rates—changes that may affect positively or negatively the flow of expenditures and revenues, including the cost of raw materials, the proceeds from the sale of goods, and the cash flows related to borrowing and investment in foreign currencies, as well as their direct impact on the

institution's profitability and book value. Companies with international commercial or financial activities typically face three main types of exchange risk: transaction risk, translation risk, and economic risk (Catherine Mercier-Suissa, Laurence Abadie, 2011).

In this context, the institution faces multiple types of risks, and dealing with them is an essential part of its strategic activity. Among these risks, an important question arises as to whether exchange risk represents an independent category distinct from other risks borne by the institution. From the perspective of financial markets, this risk is viewed as a purely financial, unsystematic, and diversifiable risk; it therefore does not require direct management by the institution itself but is left to investors who are able to manage it according to their own preferences and utility (Haberer, 1999).

However, practical reality within the institution shows that exchange risk is often intertwined with the commercial risk arising from price fluctuations in input and output markets, making it an inseparable part of the institution's operational risks. Consequently, the management of this type of risk is not carried out in isolation from the general context of commercial risk management but is integrated within the institution's comprehensive strategy.

2. Types of exchange rate risk:

1.2 Transaction risk:

This refers to the risks to which non-financial institutions are exposed when conducting exchange transactions with foreign countries, represented by revenues and expenses related to import and export operations, and hence commercial transactions and financial transactions such as borrowing and lending in foreign currencies (Adams et al., 2021).

Exporting institutions that sell goods and services abroad and receive the financial consideration in foreign currency are exposed to negative fluctuations in the exchange rate, represented by a decline in the value of the foreign currency; hence the amount received in the domestic currency is less than originally planned. Conversely, importing institutions that pay for the goods and services they import in foreign currency are exposed to exchange risks arising from a rise in the value of the foreign currency, being compelled to pay more domestic currency than the amount originally set.

The period of exposure to transaction risk is relatively short, being between the time of signing the transaction and the actual payment or receipt of the goods, ranging from a few weeks to a few months.

2.2 Translation and consolidation exchange risk:

This reflects the foreign exchange risks arising from the translation of the financial statements (statements of assets and liabilities) of foreign subsidiaries—prepared in the foreign currency—of the parent company into the domestic currency. Accounting risks are thus of particular concern to companies that have branches abroad (direct investment), which consolidate the accounts of those branches in the financial results of the parent company (or what is called the consolidated balance sheet) (Jean Louis Amelon, Jean Marie Cardebat, 2010); or companies that hold foreign financial assets (indirect investments) and receive financial returns in the foreign currency from those holdings. Furthermore, the exchange rates applied in the accounting field are not uniform according to the provisions of international accounting standards: inventories, for example, are recorded at the current exchange rate at the closing date, and not at the acquisition exchange rate; conversely, investments are recorded at the acquisition exchange rate and not at the exchange rate in force at the balance-sheet closing date.

3.2 Economic risk:

Also called operational risk, this measures the change in the present value of the company resulting from the unexpected change related to the exchange rate, which may be reflected in the company's future operating results as a result of its competitive ability being affected (Jean Louis Amelon, Jean Marie Cardebat, 2010). Companies in countries experiencing a rise in their currency value sharply lose their competitive capacities, unlike companies in countries whose currency values are declining, which are likely to gain market share. The change in the exchange rate affects the prices of goods and services produced by domestic actors relative to foreign competitors; but companies can reduce the negative impact of the exchange rate change on their competitiveness by influencing the selling price. To clarify further, let us assume that there is a European exporting company that may be exposed to one of the following four situations (Peyrard Josette, 1999):

- Case 1: a rise in the value of the euro in which sales are invoiced. In this case the company will not be concerned with the changes that occurred in the

exchange rate, as the value of sales will remain the same; however, the appreciation makes its products less competitive, and in order not to lose that capacity the European company reduces its euro prices to keep the foreign currency unchanged.

- Case 2: a decline in the value of the euro in which sales are invoiced. In this case the value of sales remains unchanged but its products become more competitive in the market; but if the company does not wish to increase its market share, it can raise the prices of its products to increase its turnover and profit without resorting to increasing its production.
- Case 3: a rise in the value of the euro against the foreign currency in which sales are invoiced. In this context, the company's market share will not change but the value of its sales will fall when converted into euros—a very uncomfortable situation for the company.
- Case 4: a decline in the value of the euro against the foreign currency in which sales are invoiced. This is the favorable position for the company, where its competitive ability does not change but on the other hand the value of its euro sales rises.

Not only exporting and importing companies are concerned with changes in exchange rates; in the financial sector, managers of international financial assets are also concerned, owing to the increased volatility occurring in the financial portfolio, and hence the impact on the financial performance of their managers compared with their competitors.

Accordingly, two types of economic risk can be distinguished:

✓ Direct risks: these relate to the effect of changes in exchange rates on current cash flows, whether they are inflows or outflows of the company;

✓ Indirect risks (anticipated transaction risks): these relate to the effect of changes in exchange rates on expected future cash flows; in this case the degree of risk is multiplied, as the amount of the cash flow in foreign currency is uncertain, in addition to the volatility in the exchange rate of the foreign currency against the domestic currency.

3. Measuring exchange rate risk:

Exchange rate risk can be measured by determining the exchange position.

1.3 Definition of the exchange position

It consists of the document through which the amounts of foreign-currency receivables and payables arising from the various obligations of the company are inventoried; this inventory is carried out according to maturities and currencies, and these obligations may be recorded on or off the balance sheet,

and may also arise from future operations (Jobard Jean-Pierre, Navatte Patrick, 1997).

It also represents the balances in respect of each foreign currency of amounts receivable and payable, which are earmarked for coverage by the institution that deals with external parties; as a result, it remains exposed to risk (Wapler Nicolas, 1990).

It can also be defined as the positive or negative difference between foreign-currency receivables and payables (Yaici Farid, 2008).

From the foregoing definitions it can be concluded that the exchange position is a concise organized document containing the balances of all commercial and financial transactions in foreign currency.

2.3 Methods of calculating the exchange position

The exchange position is determined by the difference between assets and liabilities denominated in foreign currency, over a given reference period according to the institution's customs and the nature of its activity. Accordingly, the following methods of calculating the exchange position can be distinguished:

- ✓ **Calculating the transaction exchange position**

The calculation of the transaction (deal) exchange position is entrusted originally to the financial department or the company's treasurer, representing all the accounting transactions in foreign currencies carried out by the company. In order to measure the exchange position, a single currency must be identified into which all those accounting transactions are to be converted, which is primarily the currency of the country where the company is located; if it is a multinational group of companies, the currency is that of the country where the parent company is located.

The exchange position is calculated for each currency separately, and the various time periods are taken into account by grouping debts and receivables with close maturities (such as grouping assets and liabilities with maturities of one month or less, between 3 and 6 months, more than 6 months, etc.). We take the following table, which illustrates the transaction exchange position during period t (month) (Catherine Mercier-Suissa & Laurence Abadie, 2011).

Example:

Based on the data of a European company that has commercial and financial dealings with several foreign countries, as follows:

Table No. (5-1): Position of the transaction exchange during period t (month)

Australian dollar (AUD)	Canadian dollar (CAD)	US dollar (USD)	Euro (EUR)	Currencies	
				Transactions	
				Invoiced commercial transactions	
8000	3000	5000	10000	Customer account (+)	
(0)	(500)	(2000)	(5000)	Supplier account (-)	
				Financial transactions	
0	2500	0	6000	Lending (+)	
(9000)	(1200)	(0)	(12000)	Borrowing (-)	
0	(50)	200	500	**Other commercial and financial transactions**	
(1000)	3750	3200	(500)	**Transaction exchange risk position**	
				Non-invoiced commercial transactions	
3000	2000	4000	7000	Sales (+)	
(1500)	(500)	(1000)	(6500)	Purchases (-)	
				Other economic transactions	
500	5250	6200	0	**Transaction exchange risk position**	

The amounts of transactions with maturity t, consisting of commercial transactions (invoiced exports and imports of goods and services) and financial transactions (currency receivables and payables), plus other commercial and financial transactions (represented by interest receipts and payments, realized profits, royalties on patents or licenses, etc.), allow determination of the transaction exchange position by summing the positive and negative flows for each currency. Non-invoiced commercial transactions, as well as other economic elements, can also be added to the above operation to assess the company's economic position.

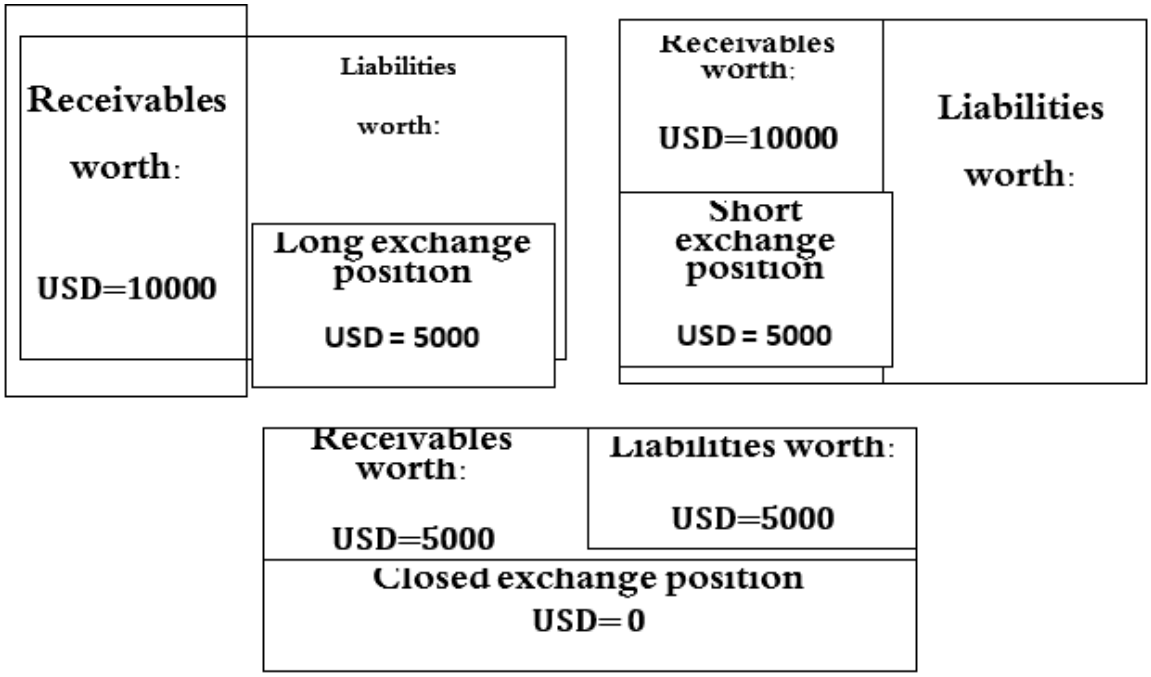
We distinguish here between two types of exchange position: the open exchange position and the closed exchange position.

- Open exchange position: it is divided into a long position and a short position.
  - Long exchange position: the amount of liabilities is less than the amount of receivables in the foreign currency (Rousselot Philippe, 1998), which is the situation of the US and Canadian dollar in our previous example. In this case the company is exposed to the risk of a decline in the US and Canadian dollar against the euro (assuming the euro is the currency of the country where the company is located).
  - Short exchange position: the amount of the credit side is greater than the amount of the debit side (Rousselot Philippe, 1998), which is the situation of both the Australian dollar and the euro in our previous example. In this case the company is exposed to the risk of a rise in the Australian dollar against the euro (assuming the euro is the functional currency of the company).
- Closed exchange position: one in which the amount of the credit side equals the amount of the debit side for the currency, where automatic coverage of exchange risk has occurred, and exchange risk is therefore nonexistent.

Another example:

Another example can be given showing the receivables and payables of a European company in its dealings with American companies:

Figure No. (5-1): Illustrative example of open and closed exchange positions



Calculating the translation exchange position:

The determination of the accounting exchange position for multinational companies depends on the size and location of the foreign branches, in addition to the accounting methods used in consolidating the financial accounts, which present some differences from country to country; however, they can be confined to two main methods of consolidation at the international level: the closing-rate method and the temporal method (Catherine Mercier-Suissa, Laurence Abadie, 2011).

- **The closing-rate method: under this method, all balance sheet items of the subsidiary companies are converted using the exchange rate at the closing date of the financial year (the current exchange rate), except for the net initial items constituting the balance sheet (which are recorded at the exchange rate at the closing date of the previous financial year). This method is simple as it does not require individual assessment of the relevant elements but merely the application of the current exchange rate, which does not need to be evaluated because it is known. However, it has a variable effect on the book value (accounting value) of assets based on fluctuations in the reference currency (in which the asset was recorded) and the domestic currency, when that currency is low.**

- **The temporal method: derived from the older method (the monetary/non-monetary method), it converts monetary items (liquidity, receivables, and payables) in foreign currency into domestic currency at the current exchange rate, while non-monetary items (tangible and intangible assets, securities, other investments, inventories, equity capital, and various income statement account elements) are converted at the historical exchange rate if the valuation is based on historical items, and at the closing rate if the valuation is based on current or future items; inventories are converted at the historical rate if valued at previous cost, and at the current exchange rate if valued at the current rate. Translation differences that appear are linked to the institution's result, given that the operations conducted abroad are an extension of the parent company's activity.**

This standard method was recommended by International Accounting Standard IAS 21, whereby at each financial year closing date: monetary items in foreign currency must be converted using the closing rate; non-monetary items measured at historical cost are converted at the exchange rates prevailing on the date of the transaction; and non-monetary items measured at current cost are converted at the current exchange rates before the closing date of the financial year.

We take the following example to illustrate both methods:

Example:

Let us assume that at t=0 a European company acquired a Canadian company, i.e., the Canadian company became a subsidiary of the European company, and therefore the balance sheet items of the subsidiary in the Canadian currency will be converted into the parent company's currency, the euro, where the exchange rate between the Canadian dollar and the euro at t=0 is CAD/EUR=0.70. The Canadian company's balance sheet in the Canadian currency on the same date is as follows:

Table No. (5-2): Balance sheet of the Canadian company in Canadian dollars as of t=0

Balance sheet of the Canadian company in Canadian dollars as of t=0			
Liabilities		**Assets**	
700	Equity capital	1100	Investments
400	Reserves	300	Inventories
100	Depreciation and provision allowances	100	Long-term receivables

100	Long-term liabilities	400	Short-term receivables
900	Short-term liabilities	300	Current liquidity
2200	**Total**	**2200**	**Total**

Source: Catherine Mercier- Suissa, & Laurence Abadie. (2011). *Finance internationale*. Armand Colin.

The Canadian company's balance sheet as of t=0 in the reference currency (euro) is as follows:

Table No. (5-3): Balance sheet of the Canadian company in euros as of t=0

Balance sheet of the Canadian company in euros as of t=0			
Liabilities		**Assets**	
490	Equity capital	770	Investments
280	Reserves	210	Inventories
70	Depreciation and provision allowances	70	Long-term receivables
70	Long-term liabilities	280	Short-term receivables
630	Short-term liabilities	210	Current liquidity
1540	**Total**	**1540**	**Total**

Source: Catherine Mercier- Suissa, & Laurence Abadie. (2011). *Finance internationale*. Armand Colin.

Let t=1 be the closing date of the financial year; the Canadian company's balance sheet on that date is as follows:

Table No. (5-4): Balance sheet of the Canadian company in Canadian dollars as of t=1

Balance sheet of the Canadian company in Canadian dollars as of t=1			
Liabilities		**Assets**	
700	Equity capital	1300	Investments
550	Reserves	400	Inventories
200	Depreciation and provision allowances	200	Long-term receivables

200	Long-term liabilities	500	Short-term receivables
1000	Short-term liabilities	300	Current liquidity
	50	**Balance**	
2650	**Total**	**2700**	**Total**

Source: Catherine Mercier- Suissa, & Laurence Abadie. (2011). *Finance internationale*. Armand Colin.

To be able to consolidate the accounts at the closing date, we assume the availability of the following key information about the CAD/EUR exchange rates:

0.70=	Exchange rate at t=0
=0.73	Historical exchange rate for inventories
=0.72	Historical exchange rate for new reserves
=0.71	Historical exchange rate for new investments
=0.70	Historical exchange rate for long-term liabilities
=0.75	Exchange rate at closing date t=1

Source: Catherine Mercier- Suissa, & Laurence Abadie. (2011). *Finance internationale*. Armand Colin.

- **Using the closing-rate method:**

For assets, the operation is very simple: all elements are translated at the closing exchange rate of 0.75; whereas for liabilities, the closing exchange rate is not applied to the elements making up the initial net balance sheet, which are translated at the historical exchange rate—consisting of equity capital and reserves—where the exchange rate at the date of merger is used, which is 0.70, while new reserves are recorded at their acquisition exchange rate of 0.72.

Table No. (5-5): Presentation of the balance sheet in euros as of t=1 using the closing-rate method

Presentation of the balance sheet in euros as of t=1 using the closing-rate method			
Liabilities		**Assets**	
490	Equity capital	975	Investments
388	Reserves	300	Inventories
142	Depreciation and provision allowances	150	Long-term receivables
150	Long-term liabilities	375	Short-term receivables

375	Short-term liabilities	225	Current liquidity
225	**Net income**		
2025	**Total**	**2025**	**Total**

Source: Catherine Mercier- Suissa, & Laurence Abadie. (2011). *Finance internationale*. Armand Colin.

- **Using the temporal method: under this method, receivables and liabilities are translated at the closing rate of 0.75. As for inventories: inventories as of t=0 (300) are converted at the exchange rate of 0.73, and new inventories (100) are converted at the closing exchange rate of 0.75. Old investments are converted at the exchange rate at the time of the transaction, i.e., at t=0, which is 0.70, while new investments are converted at their acquisition exchange rate of 0.71. Equity capital and reserves making up the initial balance sheet are converted at the exchange rate as of t=0, which is 0.70, while new reserves are recorded at their historical exchange rate of 0.72.**

Table No. (5-6): Presentation of the balance sheet in euros as of t=1 using the temporal method

Presentation of the balance sheet in euros as of t=1 using the temporal method			
Liabilities		**Assets**	
490	Equity capital	912	Investments
388	Reserves	294	Inventories
142	Depreciation and provision allowances	150	Long-term receivables
150	Long-term liabilities	375	Short-term receivables
375	Short-term liabilities	225	Current liquidity
225	**Net income**		
1956	**Total**	**1956**	**Total**

Source: Catherine Mercier- Suissa, & Laurence Abadie. (2011). *Finance internationale*. Armand Colin.

✓ **Calculating the economic exchange position:**

The economic exchange position refers to the degree of exposure to exchange-rate fluctuations, taking into account the company's current and

expected situation. In this case, the assessment of economic exchange risk does not take into account only recorded operations but also all expected, unrecorded operations, and the effect of currency fluctuations on the economic value of the company. This is what the financial markets authority AMF recommends for listed companies that have an obligation to present their financial results to investors: "When calculating foreign exchange risk, the analysis is not limited to the field of financial assets (foreign-currency receivables and payables, foreign-currency debts, and financial derivatives), but also includes a presentation of economic exchange risks from the operational perspective, and how to hedge against future operating cash flows and against net investment abroad." But the whole problem lies in estimating these future cash flows, since they are the determinant of the company's overall value (which is the sum of the discounted cash flows) (Catherine Mercier-Suissa, Laurence Abadie, 2011).

Company value = present value of expected future cash flows

$$\mathbf{V}= \sum_{t=1}^{\infty} \left[\frac{CF_{EUR}}{(1+r_{EUR})^t} + \frac{CF_{USD}}{(1+r_{USD})^t} \mathbf{USD/EUR_t} + \frac{CF_{GBP}}{(1+r_{GBP})^t} \mathbf{GBP/EUR_t} + \cdots \right]$$

Exchange risks also have an effect on the company's value through:

- The direct effect of exchange-rate fluctuations;
- The indirect effect (1): cash flows (per currency) depend on the exchange rate;
- The indirect effect (2): discount rates depend on developments that occur in the exchange rate (interest rate parity).

From a statistical perspective, exposure to economic exchange risk can be estimated from the regression equation, by linking the company's value (calculated in the reference currency) and developments in exchange rates. The multiplicity of currencies may also affect the company's value, and the general formula for this type of relationship with n foreign currencies is as follows (Patrice Fontaine, Carole Gresse, 2003):

$$\mathbf{\Delta V/V = a + b_1(\Delta S_1/S_1) + b_2(\Delta S_2/S_2) + \cdots + (\Delta S_n/S_n) + \varepsilon}$$

V: company value;

$\Delta V/V$: *the change in the company's value;*

S_i: *the expected exchange rate of currency i against the reference currency;*

ΔS_i: *the unexpected changes in currency prices;*

b_i: *the regression coefficient reflects the sensitivity of V to unexpected changes in currency i;*

a: the constant intercept.

- On the basis of future cash flows, and under different assumptions of developments in the various currency prices, it is possible to estimate both the exchange risks to which the company is exposed and the degree of its sensitivity to this risk. The coefficientb_i indicates the nature of the risk exposure. If the coefficient is positive, the company's value increases with an unexpected rise in the value of currency i, meaning a long exchange position toward that currency, and a shorter one in the event of that currency's depreciation. Conversely, if the coefficient is negative, the company's value will decline with a rise in the currency's value, implying a short position. Moreover, the same coefficient reflects the importance of the sensitivity of the company's value to fluctuations in the exchange rate of currency i.

4. The main methods for managing foreign exchange risk:

Risk management is an approach or scientific method for dealing with pure risks by anticipating potential accidental losses, and designing and implementing procedures that will minimize the possibility of loss or minimize the financial impact of losses that occur (Tariq Abdel-Aal Hammad, 2003).
Corporate groups resort to using certain hedging methods that make it possible to limit the risks of exchange-rate fluctuations. These methods are either internal or external.

1.4 Internal hedging methods:

These methods consist of:

- ***Influencing maturities: maturities refer to the period within which receivables may be collected or debts or obligations between economic agents at the international level may be paid. In this field we distinguish between the following measures (Shrit Iman, 2022):***

  - **Managing the maturities of the operation: this consists of diversifying payment maturities in order to benefit from positive developments in exchange rates, whereby the maturities or dates of collecting receivables (exporter) or paying obligations (importer) are adjusted, wherever possible, in line with exchange-rate changes.**

When the exporter expects the exchange rate of the currency in which the export contract is denominated to rise, he grants the importer long maturities for collecting the amount due to him. But if he expects the opposite, i.e., a decline in the value of the contractual currency, he will try to accelerate the collection of the amounts due. As for the importer, he will take exactly the opposite position. This can be illustrated by the following table:

Table No. (5-7): Illustration of exchange-rate change scenarios

Import scenario	Export scenario	Domestic currency versus billing currency
Delay payment	Accelerate collection	In case of appreciation
Accelerate payment	Delay collection	In case of depreciation

Source: Mariam Aya Bara, Mohammed Sari. (2014). Managing exchange rate risk in the economic institution. Case study of Arcelor Mittal, Annaba branch. Researcher Journal. Issue 14. Ouargla. p. 246.

However, this technique faces some difficulties relating primarily to the accuracy of exchange-rate forecasts on the one hand, and to the company's negotiating power to retain its partners on the other.

- **Granting discounts for early payment: the exporter can manage exchange-rate risk by granting a discount in exchange for the client paying the amount due to the exporter before the due date, if the exporter expects the exchange rate of the billing currency to be subject to a significant change in a short period of time. This discounted amount is usually commensurate with the cost of the exporter's exchange-rate cover, and the result is avoiding the exchange risk in addition to increasing the exporter's liquidity, with no need to bear the borrowing risk. On the other hand, the exporter may invest the amount collected in the market to obtain a return enabling him to cancel or reduce the cost of the discount.**
- **Interception accounts: these are bank accounts located in a foreign country, the purpose of which is to receive payments in favor of the exporting company from clients residing in these foreign countries, thereby reducing the time needed to collect these amounts and thus significantly reducing exchange risk and the probability of its occurrence.**
- **The lock box or post box system: here, checks received by the company for the settlement of a debt or the payment of the value of certain exports are sent to a postal box located abroad, and local banks in the country where those boxes are located collect them directly, saving time instead of following the traditional method of collection, which takes a long time and increases the likelihood of exchange risk occurring and hence losses resulting from changes in the exchange rates of the currencies in which those checks are denominated.**

- **Influencing the volume of debts through netting (Abdelhaq Bouatrous, n.d.)**

o **Self-hedging and application markets: this consists of setting off a receivable and a payable denominated in the same currency and having the same maturity, such that the company mutually hedges the smaller amount; the possibility of the institution's exposure to exchange risk then continues only with respect to the remaining balance.**

As for the application market, it is a method that allows the company holding a balance of hard currency to use it to settle payment of debts or obligations arising from financial or commercial operations in hard currency as well, through a financial intermediary, usually a bank. There are also two types of application markets:

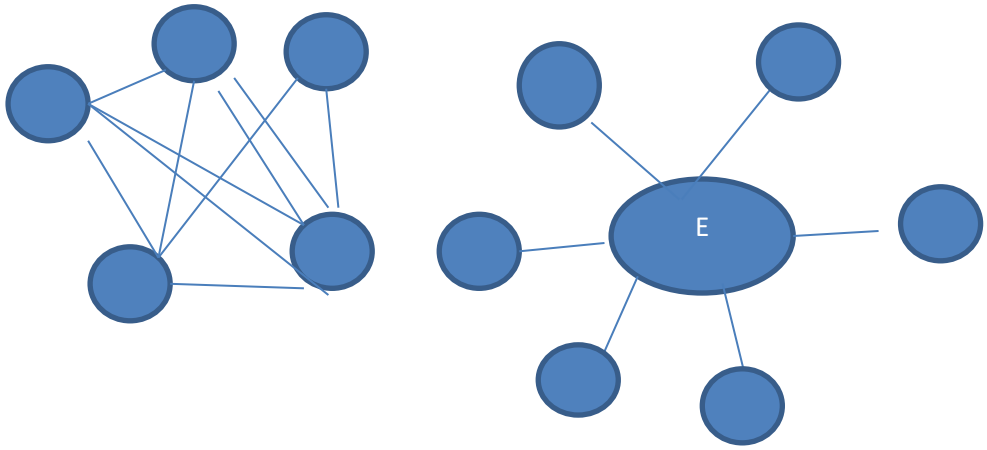
✓ Application markets with mandatory transfer of funds: this method rests on an actual currency transfer; the company that pays amounts due to its suppliers using the currencies it receives from its foreign clients will not be exposed to exchange risks, in addition to a reduction in the bank commissions it pays, especially exchange commissions.

✓ Application markets without transfer of funds: these are netting operations of a special type and are possible when both parties, i.e., the creditor and the debtor, are each debtor and creditor to the other for a certain amount; here, only the balance resulting from the netting operation is subject to transfer or exchange-risk cover, and this is also considered self-hedging.

o **Multilateral payments netting: this method is applied especially to companies with multiple branches located in foreign countries and having financial or commercial links between them. Under this method, netting of the debts and receivables of these branches is organized, allowing a reduction in the number and amounts of transfers between them, with payments limited to the differences in debts. Here, agreement must be reached on a reference date for settlement operations between these various branches, as well as the currency to be used and the agreed exchange rate to be applied.**

The most suitable method for applying this approach is the preparation of a matrix called the payment matrix, by an independent entity affiliated with this group, such as a bank or a specialized financial institution. The following figure illustrates this:

Figure No. (5-2): The payments matrix before and after the multilateral netting operation



Source: Wafaa Abdel-Basit Mohammed. Risks arising from price fluctuations in the foreign exchange market: their causes, types, and avoidance methods. Dar Al-Nahda Al-Arabiyya, Egypt, 1998, p. 58.

From the figure we observe that the existence of a clearing center (Center Meeting) contributes to reducing the financial flows exchanged between the institutions, as only the net balance is transferred. In other words, after the netting operation, only the final balance due to each institution vis-à-vis the other institutions within the group appears.

Among the results of this multilateral netting is a reduction in the volume of transferred amounts and the consequent saving in the bank commissions linked to them, in addition to avoiding recourse to the specific operations for hedging exchange risk, which are sometimes very costly.

However, this method may encounter the legislation of certain countries that does not permit such transfers, thereby affecting its effectiveness.

- **Hard-currency reinvoicing centers: in some global groups or business centers, the management of exchange risk is concentrated in the hands of a reinvoicing center. This technique is broadly similar to its predecessor, but the basic goal of the reinvoicing operation is not to set off flows between**

members of the same group; its goal is either to consolidate the payments specific to import operations to or from outside the group, or to consolidate the receipts arising from export operations within the group or among members of the same group.

In the case of concentrating payments going outside the group, the reinvoicing center operates as a billing company that manages exchange risk and credit risk simultaneously. The reinvoicing center acts as a financial intermediary, limiting itself to executing operations without making any modifications to the various material flows.

This type of center is of great importance in view of the tax exemptions it may benefit from owing to its geographical location, in addition to the fact that centralizing exchange-risk management increases the effectiveness of this operation. Finally, the fact that this center is the sole party dealing with the banks strengthens its negotiating position.

2.4 Other internal methods:

- **Influencing the institution's commercial flows: the company resorts to this measure on the basis of its future expectations regarding currency exchange rates; if it expects a rise in the foreign currency against the domestic currency over a short period, it adjusts its import program for production inputs by increasing the quantities imported, and seeks to accelerate its orders to avoid potential losses, and vice versa in the case of exports.**

This should be done through a thorough study of the company's financial capabilities, its negotiating and storage capacity, and the client's ability to meet those needs. The trade-off between the cost of the study and the cost of the expected risk must also be evaluated, as it also requires the formulation of a strategy for the institution with regard to exports and imports and achieving a balance between them.

- **Billing in the domestic currency or choosing a less volatile currency: some companies that have this option available may choose the billing currency, selecting the one whose value is known to be stable. However, companies in developing countries are usually compelled to accept international currencies imposed on them and rarely have the option of choosing the billing currency.**

3.4 External methods of hedging exchange rate risk:

When the measures taken by the company at its own level are insufficient to avoid exchange risk, it can resort to other hedging methods, whether by resorting to the market or by dealing with specialized financial institutions in this field. These methods are called external methods, and we distinguish among them between two groups of mechanisms, which can be described as follows:

- The group of methods centered on the final fixation of the exchange rate at the time the risk arises, such as forward exchange and futures contracts, in addition to swaps; their main drawback is that they do not allow the company using them to benefit from any positive development that may arise in the exchange rate in the future.
- The group of methods that protect the company from exchange risk while allowing it to benefit from any positive development in the exchange rate; these consist primarily of the use of options of various types.

✓ **Hedging through the forward exchange market:**

Both parties can reduce uncertainty about expected returns and costs by entering into a forward contract. A forward contract is an agreement to buy or sell an asset in the future at a specified date and price agreed in advance. Forward contracts arise when one party agrees to buy a commodity at a specified price and date in the future, and the other party agrees to sell the asset, with delivery usually occurring on the execution date. There may be significant credit risks arising from one party's inability to fulfill the contract, especially if there are major changes in the price of the underlying asset at the maturity date. Individuals or companies can buy and sell foreign currency forward contracts as a means of hedging against the risks of currency fluctuations. In the foreign currency forward market, currencies are bought and sold for future delivery; dealers in this market will pay or receive foreign currencies on a future date, enabling them to hedge their positions against risks arising from unfavorable changes in exchange rates by purchasing forward contracts. A foreign exchange forward contract is an agreement to buy or sell a specified quantity of foreign currencies at a specified future date (usually 12 months) at a price fixed today. This gives rise to two situations:

- First, by buying a currency forward contract, hedgers can protect themselves from a rise or appreciation of the currency;
- Second, by selling a forward contract, hedgers can protect themselves from a depreciation of the currency.

The forward contract fixes the nominal exchange rate until the contract settlement date. Therefore, hedging using forward contracts avoids exposure to transaction risks.

We mentioned earlier, when addressing the forward exchange market, that forward exchange is an agreement to buy or sell an amount in one currency

for another currency at a pre-determined, non-revisable, and final exchange rate, at a subsequently agreed date.

The consequences of the currency forward exchange contract include the possibility of fixing the exchange rate at the time of contracting; it eliminates exchange risk at its origin by fixing the exchange rate, which allows the cost of the commercial transaction to be determined before the currencies are exchanged (i.e., before the payment operation at the maturity date).

Usually the forward exchange rate differs from the spot or current exchange rate; when the difference between the two rates is positive it is called REPORT (forward premium) and when it is negative it is called DEPORT (forward discount); the following equation can therefore be written:

Forward exchange rate = Spot exchange rate + REPORT or - DEPORT

The forward exchange aims, among other things, to enable the company that will receive or pay an amount in foreign currency to resort to a commercial bank or any other financial institution in order to fix the exchange rate that this bank will use in buying or selling this currency amount. This subject can be addressed from the perspective of both the importer and the exporter as follows:

✓ **From the exporter's perspective: the exporter who will receive an amount in foreign currency fears or expects a decline in the value of this currency and the potential losses and erosion of its profits from the export operation on the maturity date. He can avoid this by selling the currency forward, by fixing the exchange rate of his domestic currency against the foreign currency, and thus knowing in advance the amount in domestic currency he will receive at the maturity date (Saud Jayid Mashkour Al-Ameri, 2010).**

In this case the bank receives an order from the exporter to sell the foreign currency for the domestic currency, i.e., the bank will buy the foreign currency from the exporter at the maturity date. The second step the bank takes after committing to the exporter is to borrow the amount in foreign currency, sell it to obtain the equivalent in domestic currency, and invest it at interest until the maturity date. On the maturity date, the bank repays the borrowed foreign currency amount after receiving it from the client in exchange for the client obtaining the equivalent in domestic currency.

✓ **From the importer's perspective: the importer who expects to pay a debt in foreign currency at a future date and fears a rise in the value of this currency against the domestic currency can protect himself from this risk by**

buying the currency forward; he will thus know in advance the domestic currency that will be payable to extinguish this debt at the maturity date, enabling him to determine the cost price of the imported goods accurately and avoid subsequent losses.

In this case the bank receives an order from the importer to buy the foreign currency for the domestic currency, i.e., the bank must sell a specific foreign currency to the importer. The first step the bank takes is to buy the required amount of foreign currency for domestic currency usually borrowed from the interbank market. The foreign currency amount obtained is then invested until the maturity date. On the maturity date the bank sells the foreign currency amount to the client (the importer) and repays the previously obtained domestic-currency loan from the amount received from the client in exchange for selling the foreign currency.

Example for the exporter:

Let us assume that a European exporter expects, in exchange for his export of a certain commodity, to receive an amount of 100,000 US dollars after 3 months. Fearing a decline in the US dollar against the euro, he must sell 100,000 dollars forward for the domestic currency, by immediately and finally fixing the spot exchange rate at which the operation will take place (i.e., the exchange rate at which the dollar-for-euro sale operation will take place after 3 months), where:

The spot exchange rate between the euro and the dollar is:$C_{USD/EUR} = 1.3890 - 1.3895$;

The annual interest rate on the euro is:$i_{EUR} = 0.65\% - 0.85\%$;

The annual interest rate on the dollar is:$i_{USD} = 0.31\% - 0.55\%$.

The exporter therefore gives the bank an order to sell 100,000 US dollars; in this case the bank follows these steps:

1. Borrow an amount of 100,000 US dollars for 3 months at an interest rate of$0.55\%/4 = 0.1375\%$;

2. Sell the dollar amount to obtain the equivalent in euros at an exchange rate of 1.3890;

3. Invest the euro amount obtained for 3 months at an interest rate of$0.65\%/4 = 0.1625\%$ on condition that the bank does not need those euros before the maturity date;

When the maturity date arrives, the bank sells the euro amount (excluding the interest received) to the exporter in exchange for receiving 100,000 US dollars at an exchange rate of 1.3895, then repays this amount plus the borrowing costs to the lending party.

The forward rate at which the bank achieves neither profit nor loss (the dollar bid rate) is:

$$CT_{\text{USD/EUR}} = 1.3890 \times (1.001625)/(1.00375)$$

$$CT_{\text{USD/EUR}} = 1.3860$$

This means the company must deliver to the bank an amount of 100,000 dollars at the exchange rate of 1.3893, and the bank pays it in return an amount of 138,930 euros.

Example for the importer:

Let us assume that a European importer expects, in exchange for his import of a certain commodity, to pay an amount of 100,000 US dollars after 3 months. Fearing a rise in the US dollar against the euro, he must buy 100,000 dollars forward for the domestic currency, by immediately and finally fixing the spot exchange rate at which the operation will take place (i.e., the exchange rate at which the dollar-for-euro purchase operation will take place after 3 months), where:

The spot exchange rate between the euro and the dollar is:$\text{C}_{\text{USD/EUR}} = 1.3890 - 1.3895$;

The annual interest rate on the euro is:$\text{i}_{\text{EUR}} = 0.65\% - 0.85\%$;

The annual interest rate on the dollar is:$\text{i}_{\text{USD}} = 0.31\% - 0.55\%$.

The importer therefore gives the bank an order to buy 100,000 US dollars; in this case the bank follows these steps:

1. Borrow an amount in euros for 3 months at an interest rate of$0.85\%/4 = 0.2125\%$;

2. Sell the euro amount to obtain the equivalent in dollars at an exchange rate of 1.3895, in order to eliminate entirely the risk of a rise in the dollar;

3. Invest the dollar amount obtained for 3 months at an interest rate of$0.31\%/4 = 0.0775\%$ on condition that the bank does not need those euros before the maturity date;

After three months have elapsed, the bank sells an amount of 100,000 US dollars (excluding the interest received) to the importer in exchange for receiving 138,950 euros at an exchange rate of 1.3895, then repays this amount plus the borrowing costs to the lending party.

The forward rate that guarantees the bank neither profit nor loss (the rate at which it should sell the US dollar) is:

$$CT_{\text{USD/EUR}} = 1.3890 \times (1.00215)/(1.000775)$$

$$CT_{\text{USD/EUR}} = 1.3909$$

This means the bank must deliver to the importer an amount of 100,000 US dollars, on the condition that it delivers to the bank an amount of 139,140 euros.

- ✓ **Hedging through futures contracts: initially futures contracts were traded in commodity markets, especially agricultural products; their first trading took place in 1860 at the Chicago Board of Trade, in order to enable farmers to avoid the risks of price fluctuations and thereby know in advance the income they would receive from exploiting these products.**

The first currency futures contract was created on the International Monetary Market (IMM), a division of the Chicago Mercantile Exchange (CME), in 1972. Since then futures contracts have been established in other markets, including: the New York Stock Exchange; the London International Financial Futures and Options Exchange (LIFFE), subsequently renamed Euronext LIFFE; and the Singapore International Monetary Exchange (SIMEX). However, the IMM is considered the most active market in foreign exchange futures transactions (Bassam Al-Hajjar, 2009).

A futures contract is an obligation arising upon signing the contract to buy or sell a specific currency at a specified price and a known date. This definition is identical to that of forward contracts, except that the latter are traded in an unorganized (OTC) market, while futures contracts are traded

in an organized exchange located in a specific place and under regulatory authority supervision. Futures contracts are also standardized forward contracts (Munir Ibrahim Hindi, 2003), while forward contracts are non-standardized.

Foreign currency price quotes are provided through an electronic system called Globex; the adopted quotation method is: the number of US dollar units to buy one unit of the foreign currency. But for cross rates (e.g., the euro against the Canadian dollar), the quotation is in another currency.

- Elements of futures contracts

The elements of futures contracts can be identified in the following points (Mohammed Ali Ibrahim Al-Ameri, 2010):

- The buyer and the seller: these are the original two parties to the contract. Given the nature of this market, which imposes conditions for joining and dealing in it, each party (seller and buyer) authorizes a financial brokerage firm to deal on his behalf.
- The financial brokerage firm: a specialized firm and member of the clearing house, which executes the orders of its clients, whether they are in a buyer or seller position;
- The exchange: the place where trading sessions are held; it takes the form of a voluntary non-profit company that establishes and formulates a set of rules governing dealing therein, and monitors members' compliance with them. These rules aim to create a market that operates with transparency, where dealers feel that their orders are executed correctly and at a fair price, without fraud or price manipulation that could cause losses;
- The clearing house (settlement house): the first clearing house was established in 1928 in Chicago; it is responsible for determining the new value of the contract and comparing it with the old value, which results in profits or losses added to or deducted from the dealer's account. The daily settlement of accounts ensures equitable distribution between the winning and losing parties, making futures market transactions a zero-sum game;
- Monitoring the maintenance margin: losses in futures markets affect the initial deposit, and losses may exceed the amount initially deposited. Therefore, the clearing house imposes a maintenance margin of between 75% and 85% of the initial deposit, and requires the client to make up

the shortfall if the remaining balance falls below this margin, in order to guarantee the continuity of the contract;

- The futures contract price: this is the price agreed upon by both parties (seller and buyer) for trading the asset on the agreed date. The difference between the current price of the asset in the spot market and the futures contract price is calculated such that the difference between the actual position and the position in the futures market equals zero at the expiry of the contract;
- Uses of futures contracts: futures contracts are used either for trading (speculation) or for risk coverage:

- Use of futures contracts for trading: this means speculating on future price changes, whereby speculators make profits from buying or selling contracts based on their expectations of the direction of prices (upward or downward). The speculator does not aim to hold the asset but to profit from price differences;
- Use of futures contracts for hedging: they are used as a protective measure to reduce the risk of losses arising from adverse price fluctuations in interest rates, exchange rates, or equities, by taking an opposing position in the futures market equivalent to the original position.

As with any organized market, there is a clearing house that exists legally as a counterparty in all transactions, guaranteeing the performance of the operation even if one of the participants fails; it does not take any position but acts as a substitute for the seller or buyer to protect against non-performance of the contract by the buyer or seller. It therefore requires dealers to pay the insurance amount or initial margin, which ranges from 1-10% of the contract value (Anani Al-Said, 2006). The deposit amount is calculated to cover any decline in contract value over at least two days, and dealers are allowed to request netting to renew their deposits in the event of a loss, or to close their accounts if they are unable to do so. The deposit is made in cash.

Operations in futures contract markets are also valued at daily market prices, and accounts are valued at market prices to calculate gains and losses from one period to the next. In the event of a loss, margin calls are made, and if a margin call goes unanswered, the account is closed. If the maintenance margin equals the initial deposit, the margin call occurs upon recognition of the loss; if they are unequal, a loss occurs when the initial deposit falls below the maintenance margin, and the margin call is made to restore the initial deposit.

For example: assume that the initial deposit equals 1,400 US dollars and the maintenance margin is 1,000 US dollars. Here, losses of 200 US dollars are incurred if the initial deposit falls to 1,200 US dollars; no margin call is made because the initial deposit has not fallen below 1,000 US dollars.

- **The mechanism of futures contracts: the basic idea in hedging against exchange risk in the futures market is to try to reach a future exchange position opposite to the current exchange position in the spot market.**

The operating mechanism of this method is that the party concerned with hedging the expected exchange risk in futures contracts takes an opposing position to its position in the forward foreign exchange market, which allows it to offset the potential loss in one of the markets with the profits realized in the other. The dealer who wishes to cover a long position buys a contract whose value corresponds to that position, and after the maturity date compares the forward rate with the purchase contract price; if the forward rate is greater than the contracted price, this is considered a loss that is offset through the forward contract, and vice versa. Physical delivery of the contract does not usually take place; rather, a netting is made between the forward rate and the contract price, and vice versa for the holder of a short position.

For example, if a person needs a certain amount of dollars in three months to settle a purchase of imported goods, he will buy dollars with a futures contract maturing in 3 months, thereby hedging against the risk of a rise in the dollar. If, on the other hand, he is expecting to receive a certain amount of dollars in exchange for his export of a certain commodity after three months, he will sell dollars with a futures contract maturing in three months—as is the case with a forward contract.

Example of how futures contracts work:

On 29 February 2016, the following transaction was offered in the International Monetary Market: a euro futures contract maturing in March at an exchange rate of 1 euro = 1.5185 US dollars, where the contract value is 125,000 euros, equivalent to 189,812.5 US dollars.

In the case of buying the futures contract, a deposit of 2,835 US dollars must be made as an initial margin used to guarantee proper execution of the contract, meaning that the contract buyer commits at maturity to buying 125,000 euros at

an exchange rate of 1 euro = 1.5185 US dollars. The futures purchase price changes daily, and the contract is renewed daily at market prices; these price changes may lead to a loss triggering a margin call, or to profits credited to the account. The minimum deposit (maintenance margin) is 2,100 US dollars.

For example, if on 3 March 2016 the exchange rate between the euro and the dollar becomes 1.5140, this leads to a decline in the contract value of 562.5 dollars, i.e., a fall in the deposit from 2,835 to 2,272.5 dollars; but despite this, no compensation of the loss is required, as the deposit has not fallen below the minimum permitted value, i.e., the maintenance margin.

On the following day, 4 March 2016, the exchange rate experienced another decline, the EUR/USD rate becoming 1.5000, implying a loss of 500 dollars and hence a fall in the deposit from 2,272.5 to 1,772.5 dollars—below the maintenance margin of 2,100 dollars—which requires restoring the amount to its original value of 2,835 dollars, meaning submitting a new deposit of 1,062.5 dollars.

On 5 March 2016 the exchange rate rose to 1.5130, achieving a profit of 375 dollars; and at the maturity date the exchange rate became 1.5160, achieving the same gain of 375 dollars.

At the maturity date, the futures contract buyer will find himself having paid the initial deposit (2,835 dollars) and the new deposit (1,062.5 dollars) plus the futures contract value minus the deposit value (189,500 - 2,385 dollars), and having received the two profits of 375 dollars each. That is:

2,385 + 1,062.5 - 375 - 375 + 189,500 - 2,385 = 189,812.5 dollars

This is the amount he committed to paying on 29 February 2016, equivalent to 125,000 euros at an exchange rate of 1.5185 dollars per euro. The following table illustrates the foregoing.

Table No. (5-8): Summary of the execution of futures contracts

Margin call	Deposit value	Profit or loss	Contract value	Exchange rate EUR/USD	Operation date
-	2385	-	189812.5	1.5185	29/02/16
2100 <	2272.5	562.5-	189250	1.5140	03/03/16

Increase in deposit worth 1,062.5	1772.5	500-	188750	1.5100	04/03/16
-	3210	375	189125	1.5130	05/03/16
-	3585	375	189500	1.5160	Maturity date

Source : Catherine Mercier- Suissa, & Laurence Abadie. (2011). *Finance internationale*. Armand Colin.

✓ **Distinction between forward and futures contracts: the main differences between the two contracts can be illustrated in the following table:**

Table No. (5-9): The difference between futures and forward contracts

Futures contract	**Forward contract**
Traded in an organized exchange	Traded in an unorganized (OTC) market
Standardized contract in terms of amount and delivery date	Contract tailored to clients in terms of amount and delivery date
Standardized contract between each party and the clearing house	Private contract between two parties
Ability to take an offsetting position before the maturity date; good liquidity	Difficulty of taking an offsetting position to settle the account; low liquidity
Profit and loss are determined each day until the maturity date	Profit and loss are determined at the delivery date
A margin level must be maintained to reflect price movements	Margin is set on the first day of entering the transaction

Source: prepared by the researcher based on the foregoing information.

o **Swap contracts: these are flow-exchange contracts, whereby the swap contract involves the drafting of two simultaneous contracts, one a purchase contract and the other a sale contract; the value of each of the two contracts is the same, but their maturity dates are different, separated by a time interval.**

Here we distinguish between two types of swap contracts:

✓ **Currency swap contracts: 1981 is considered the first occurrence of a currency swap, in an agreement between a company and a bank (IBM and the World Bank). Since that time this market has grown steadily, offering a**

range of advanced currency products, in addition to allowing companies to effectively manage their exchange positions and interest rates.

A currency swap contract (cross currency swap or Xccy swap) is a private agreement between two parties under which notional amounts (loans) and the interest flows arising from these amounts, denominated in two different currencies, are exchanged.

There are many types of currency swaps that have evolved to suit the needs of investors and borrowers; but all of them fall into the following three forms:

- Both swap parties borrow at fixed interest rates and exchange loans in two different currencies;
- Both swap parties borrow at variable interest rates in two different currencies and exchange those loans;
- One swap party borrows at a fixed interest rate and the other at a variable interest rate in two different currencies, and they exchange those loans.

Unlike most exchange-risk hedging contracts (including exchange swap contracts), currency swap contracts are medium- and long-term contracts, with maturities ranging from 2 to 15 years and sometimes reaching 30 or 40 years.

Dealing between the two parties may occur directly, with them agreeing on the conditions related to the swap operation, or it may be done through an intermediary—a company or a bank specialized in this—that links the two parties and acts as an intermediary in the transactions. The bank in this case is called a broker.

The bank may also represent one of the parties in the swap operation to guarantee the performance of the subject of the transaction, in exchange for a margin used to cover those transactions; in this case the bank is in the position of a dealer. When banks play the role of their clients, they are exposed to currency risks; a margin must therefore be established as the cost of covering this swap.

General characteristics of currency swaps: the principle of currency swaps rests on the idea that the lending and borrowing transaction is simultaneous and takes place in three stages:

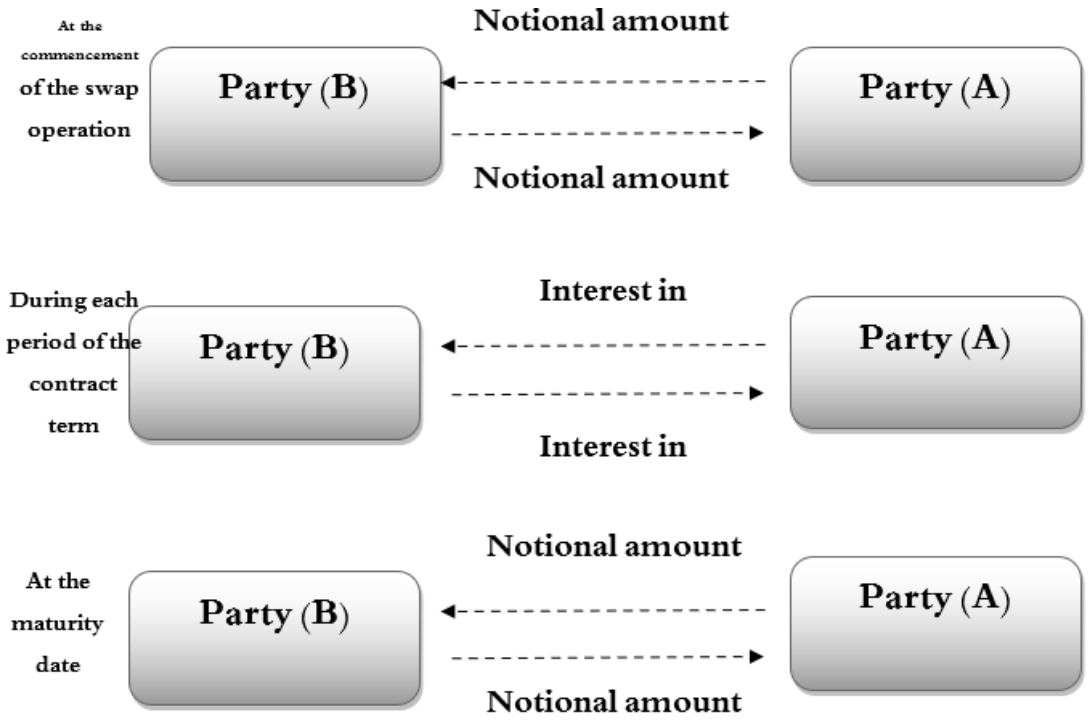
- During the commencement of the swap operation: both swap parties lend each other an amount of money denominated in a currency different from the currency of the other party, in addition to agreeing to pay the interest arising from those loans throughout the contract period.

- During the contract period: both parties commit to paying the interest arising from the principal debt received from the other party, according to agreed periods, which may be monthly or annual; sometimes interest is not paid by both parties

in the same period—they may agree that one pays monthly and the other annually. Both parties may also pay fixed rates, or agree that one pays fixed rates and the other variable rates, or both agree to pay at variable rates. It will be necessary to revalue all amounts paid and received in interest.

- At the swap maturity date: both parties to the contract repay the previously exchanged amounts at the exchange rate prevailing at the time of contracting (meaning there will be no future reference rate on the basis of which the previously exchanged debt amounts will be settled). The following figure illustrates the currency swap operation:

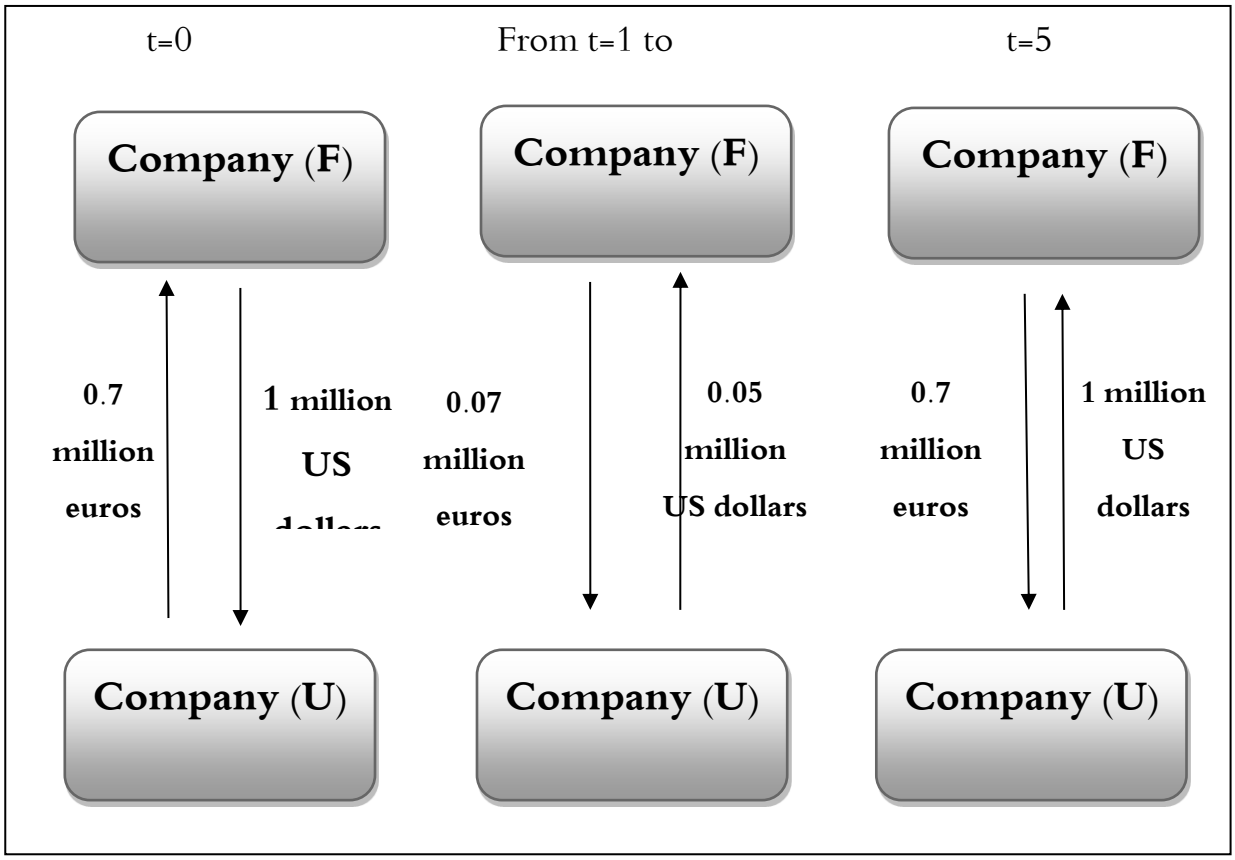
Figure No. (5-3): The currency swap operation between two parties (A) and (B)



Illustrative example of a currency swap between two companies:

Let us assume that company (F) will borrow 0.7 million euros at an interest rate of 10%, repayable in full within 5 years, and company (U) will borrow 1 million dollars at an interest rate of 5%, repayable in full within 5 years. The two companies decided to carry out the following currency swap:

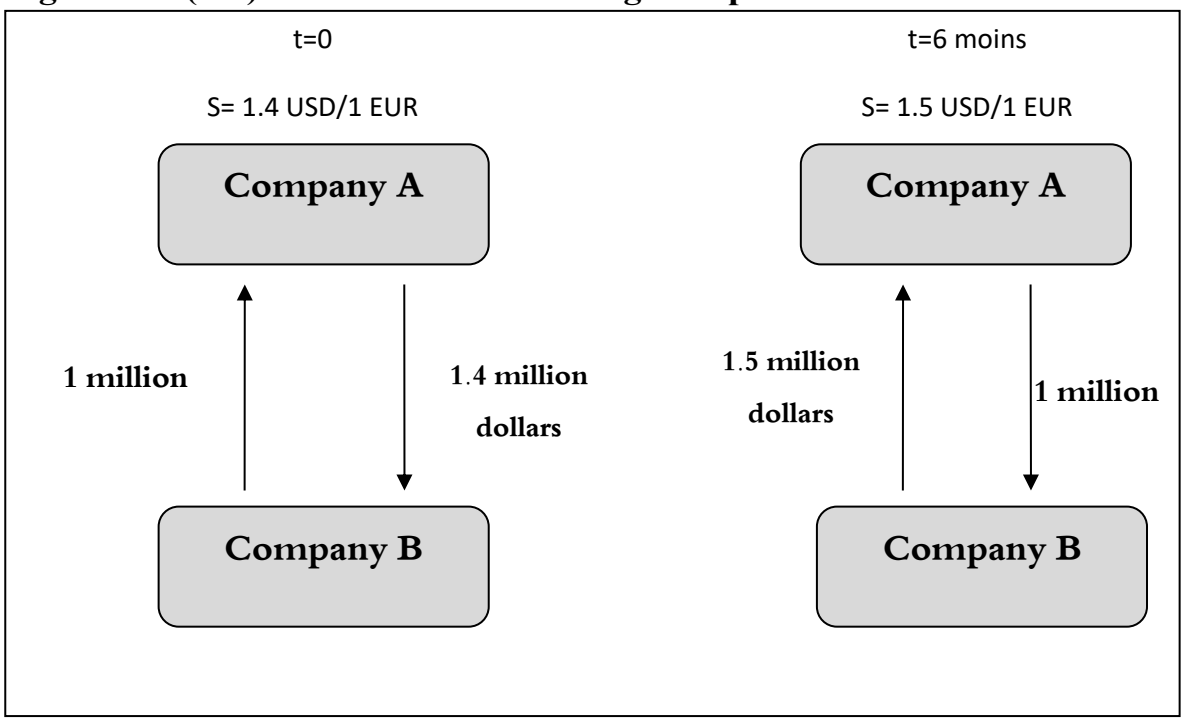
Figure No. (5-4): Illustrative example of a currency swap between company (F) and (U)



✓ **Exchange swap contracts (Les swaps de change): an exchange swap operation is the purchase and sale of a currency on the basis of spot delivery and the simultaneous resale or repurchase of it on the basis of forward delivery at a forward delivery price. In other words, it is a financial transaction in which two parties agree to exchange currencies today—for example, euros for dollars at the current exchange rate—and to re-exchange the same currencies at the contract's maturity date (3 months, one year, etc.) at a forward rate agreed upon at the time of contracting.**

Example: company A and B wish to swap the euro and the dollar; company A agrees to pay 1.4 million dollars to company B, while company B pays 1 million euros to company A at t=0; at the maturity date, say 6 months, company B pays 1.5 million dollars to company A, and company A pays 1 million euros to company B. This can be illustrated by the following figure:

Figure No. (5-5): Illustration of exchange swap contracts



Exchange swaps are also called currency-trader swaps, because they were originally used by currency dealers from banks to carry out their treasury operations (financing and investment) without appearing on the balance sheet. They were developed and used in the foreign exchange market since 1970. They are also widely used by banks and companies wishing to improve treasury operations and achieve automatic risk reduction (through the switching of exchange positions).

Example: a company that has currently received 150,000 US dollars and knows that it will pay the same amount after 90 days may enter into a swap agreement whereby the company sells 150,000 US dollars (for euros) and agrees to buy the same quantity of US dollars after 90 days at a pre-determined forward exchange rate; thanks to this exchange, the company has the possibility of obtaining the euro equivalent of US dollars after 90 days, thereby benefiting from additional liquidity and covering against exchange risks.

We note that the exchange swap consists of two similar exchange operations carried out by all the parties participating in the swap, namely:

- Buying currencies at the spot exchange rate: each party buys a currency different from the other;

- Selling those currencies at a forward exchange rate: in exchange for obtaining the counterparty's currency in the operation.

The principle of exchange swaps: an exchange swap operation is in fact an exchange of debts between two parties, where the operation takes place in two stages:

- Exchange of principal: on the date of the agreement, the original amounts of the debts are exchanged between the two parties to the transaction, using the spot exchange rate as a reference for the operation.

- Repayment of principal: at the maturity date, both parties to the contract present the original amounts previously exchanged plus the interest arising from that period, using the forward exchange rate as a reference for the operation.

It is important to clarify why the forward exchange rate is used as a reference for the repayment of principal, which is in fact determined on the basis of the spot exchange rate and the interest rates applied to the various currencies:

$$\mathbf{CT_{A/B} = C_{A/B}\frac{1 + i_B}{1 + i_A}}$$

Recalling that the rationale for calculating the forward exchange rate (arising from borrowing, foreign exchange, or investment transactions, etc.) is the interest-rate differentials, which appear in the forward exchange rate as a premium or discount against the spot exchange rate.

Consequently, the difference between the spot exchange rate and the forward rate is in some way equivalent to the swap points, i.e., the net interest rates paid by each of the two swap parties. From the relationship linking the spot and forward exchange rates, the premium or discount rate of currency A can be expressed by subtracting$\mathbf{C_{A/B}}$ *from both sides of the previous equation, simplifying the calculations, and rewriting the equation's terms in the form:*

$$\mathbf{\frac{CT_{A/B} - C_{A/B}}{C_{A/B}} = \frac{i_B - i_A}{1 + i_A} \approx i_B - i_A}$$

The left-hand side of the equation refers to the premium rate (if positive) or discount (if negative) of currency A, which is approximately equivalent to the interest-rate differentials, i.e., the swap points.

This equality is necessary for each party who has the same interest through concluding the swap contract or going through two separate operations (spot and forward) to arrive at the same result. The operations that take place in the final stage of the swap operation (consisting of the repayment of the principal plus interest) are similar to the hedging operation in the forward exchange market, where the forward rate represents the forward reference rate in this operation.

Illustrative example of an exchange swap operation between two commercial companies:

A European company (E) holds 1.45 million US dollars but does not currently need it and will need it after 6 months to settle a dollar invoice; it wishes to exchange this cash surplus into euros currently and to recover the dollars after 6 months at a pre-determined forward exchange rate.

On the other side, there is an American company (A) that has a cash surplus of 1 million euros it needs after 6 months and wishes to exchange it for dollars currently to limit exchange risks.

Both companies, through the relationship between their respective banks, conclude on the same day an exchange swap between the euro and the dollar for 6 months against a notional amount of 1 million euros. The spot exchange rate of the euro against the dollar is:$C_{EUR/USD} = 1.4500$, and the forward exchange rate after 6 months is:$CT_{EUR/USD} = 1.4580$. These will be used in the spot and forward exchange operations respectively.

The swap operation will take the following form:

- At date t: company (E) will exchange 1.45 million dollars to obtain 1 million euros from company (A); in other words, company (E) will sell 1.45 million dollars at the spot exchange rate to obtain 1.45/1.45 = 1 million euros. The same applies to company (A), which will sell 1 million euros on the same terms to obtain: 1 × 1.45 = 1.45 million US dollars. This can be illustrated by the following figure:

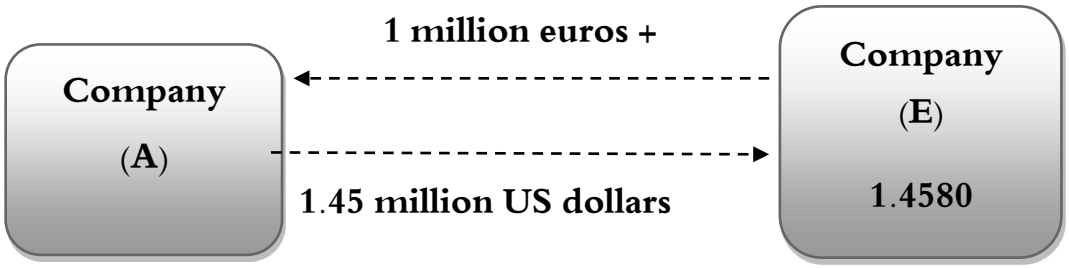
Figure No. (5-6): The swap operation between company (E) and company (A) on date t



At maturity date t+6 months: the borrowed amounts plus the interest accrued on each currency are recovered by both companies at the forward exchange rate agreed in advance at the time of contracting, which is:$CT_{EUR/USD} = 1.4580$; where company (E) recovers an amount of:

1.4580 million US dollars for 1 million euros, i.e.: 1 million euros × 1.4580 = 1.4580 million US dollars, which is larger than the original amount (1.45 million US dollars); while company (A) recovers 994,513 euros (1.45 million dollars ÷ 1.4580), which is less than the original amount of 1 million euros. The following figure illustrates this:

Figure No. (5-7): The swap operation between company (E) and company (A) on date t+6



We observe in our example that the euro carries a premium against the US dollar, which means that interest rates on the US currency are higher compared with interest rates on the European currency. This explains the fact that the amount recovered by company (E) exceeds the original amount of 1.45 million US dollars, since the interest it receives will be greater than the interest it pays in the context of the swap operation; it will therefore benefit from a cash profit of 8,000 US dollars, equivalent to 5,487 euros (8,000 US dollars ÷ 1.4580 = 5,487 euros). This represents the difference between the interest rates paid and received at the maturity date.

Ifi_{EUR} andi_{USD} are the annual interest rates on the European and American currencies respectively, andi^*_{EUR} andi^*_{USD} are the interest rates on the same two currencies at the maturity date, i.e., after 6 months, then the cash flows of company (E) will be as follows:

- Interest earned on 1.45 million US dollars after 6 months is 1.45 ×i^*_{USD} million US dollars, i.e., the equivalent in euros: (1.45 × (1 ×i^*_{USD}) / 1.4580) million euros.

- Interest paid on 1 million euros borrowed from company (A) is 1 ×i^*_{EUR} million euros.

As for company (A), it will suffer a cash loss of 5,487 euros resulting from the negative difference between the interest it paid on the dollar and what it collected on the euro; the cash flows were as follows:

- Interest paid on the borrowed amount of 1.45 million dollars from company (E): (1.45 $\times i^*_{USD}$) million US dollars;

- Interest received on the 1 million euros recovered: (1 $\times i^*_{EUR}$) million euros, i.e., the equivalent of ((1 $\times i^*_{EUR}$) × 1.4580) million US dollars.

The following question may come to mind: what drives company (A) to enter into a swap operation, given that the cash loss is a natural result of a risk-free transaction with a guaranteed forward exchange rate?

Advantages of exchange swap operations: there are several advantages to exchange swap operations, which can be summarized as follows:

- Exchange swap operations allow the temporary exchange of foreign currencies among themselves; they also grant their participants a kind of confidence to carry out the reverse exchange at a pre-determined date and price;
- Exchange swaps do not lead to an increase in the company's balance-sheet size compared with classic receivables and payables that are recorded as assets or liabilities; recording exchange swap transactions as a hedging instrument does not affect the company's financial structure, which is considered an important advantage for companies as it does not lead to a deterioration in their financial ratios;
- Exchange swap operations provide very high liquidity, as the risks arising from exchange swap operations are lower compared with monetary transactions.

✓ **Combined exchange and currency swap contracts (Les swaps de change et devises): combined exchange and currency swap contracts (combined interest rate and currency swaps—CIRCUS) are contracts that combine exchange swaps and currency swaps, involving the exchange of interest at variable rates denominated in one currency for interest at fixed rates denominated in another currency.**

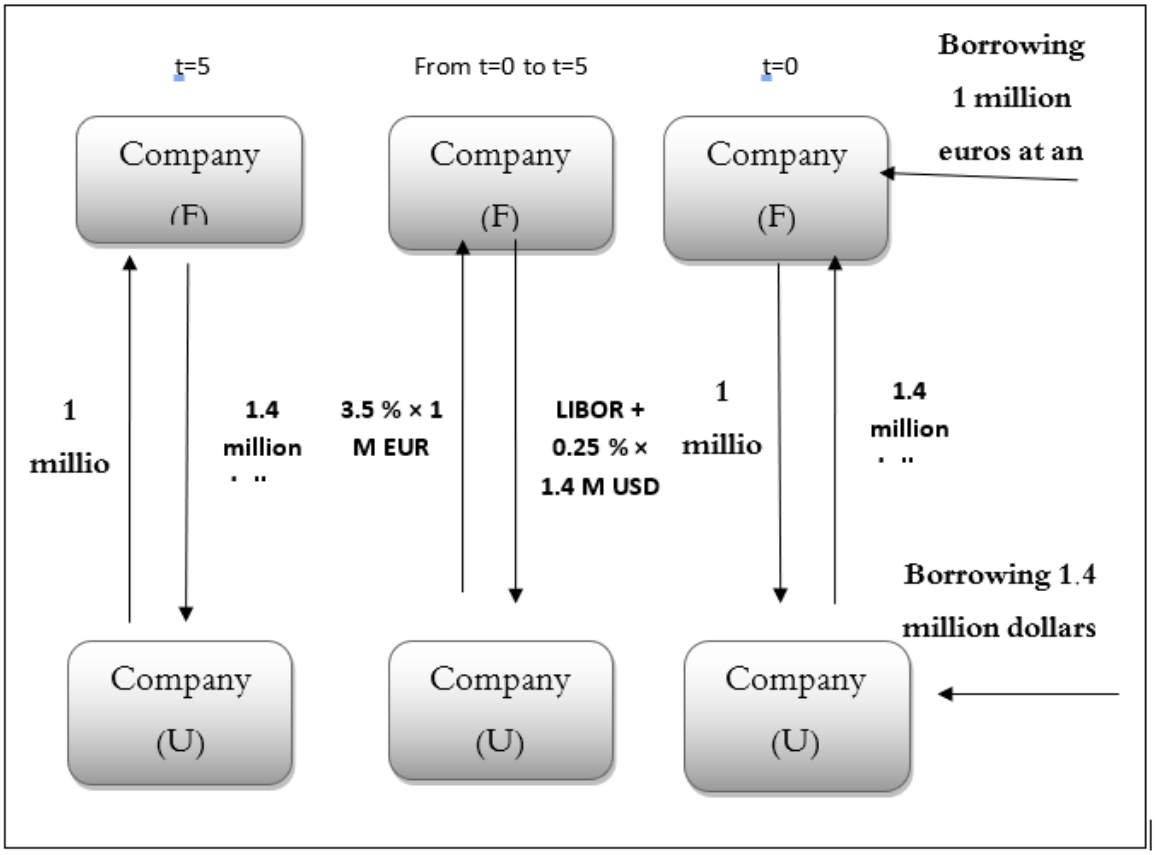
Example:

Company (F) wishes to borrow 1.4 million US dollars; it can currently borrow 1 million euros at an interest rate of 4% for 5 years, and 1.4 million euro-dollars at an interest rate of LIBOR + 1%; while company (U) wishes to borrow 1 million euros and can, for 5 years, borrow 1 million euros at an interest rate of 3.5% and 1.4 million euro-dollars at an interest rate of LIBOR. The spot exchange rate of

the euro against the dollar is: 1 euro equals 1.4 US dollars. The two companies conclude a swap.

In this case, company (U) will finance at the dollar at an interest rate of LIBOR and let us say +0.25% and lend to company (F), while company (F) will finance in euros at an interest rate of 4% and lend to company (U) at an interest rate of 3.5%. That is, the swap will take the following form:

Figure No. (5-8): The exchange and currency swap operation between the two companies (F) and (U)



▪ **The difference between exchange swaps and currency swaps: exchange and currency swap contracts are somewhat similar in that they are based on the same principle: borrowing in one currency and lending in another simultaneously and with the same counterparty. Nevertheless, they differ in other respects, including:**

- Exchange swap contracts are short-term, while currency swap contracts are medium- and long-term;

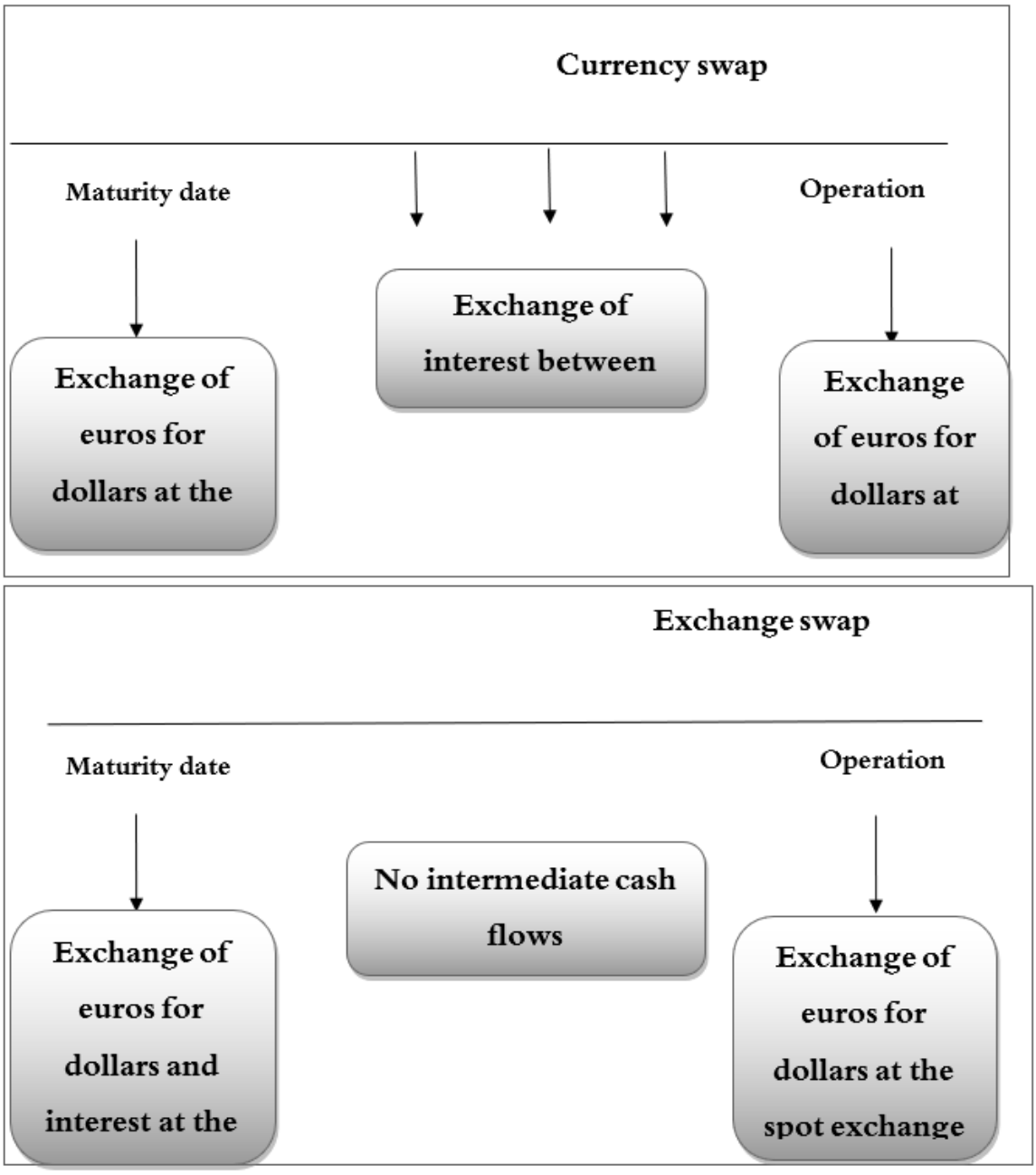
- In exchange swap contracts, interest rates are exchanged at the maturity date together with the currencies, while in currency swap contracts the interest rates are exchanged during the contract period;

- At the maturity date in exchange swaps, the final exchange is based on the pre-agreed forward exchange rate, while in currency swap contracts it is based on the exchange rate previously prevailing at the time of contracting.

Despite the differences between them, both are considered important instruments for hedging against exchange risks in the short, medium, or long term.

The financial flows relating to both types of swap operation can be summarized and compared in the following figure:

Figure No. (5-9): The financial flows related to the two types of swap operation



- ✓ Currency options: an option contract is a contract that allows its holder to buy or sell a specified asset (a security, commodity, or foreign currency) at a price fixed at the time of agreement, with delivery at a specified future time.

Option contracts are by nature forward operations and futures contracts, with an important difference: the buyer has the right of choice to complete or not complete the operation (i.e., he is not obligated to complete it), and in order to enjoy this right he must pay the seller in advance and upon the conclusion of the contract an agreed premium called the option premium (Najib Samir Khris, 2012). Once he has paid it, the buyer in this market is called the option buyer, and the seller who receives the premium is called the option seller.

✓ **Definition of a currency option: it is a contract that grants its holder the right, but not the obligation, to buy or sell a specified amount of currency at a specified price, called the strike price, on a specified date or during a specified period, in exchange for a cost called a commission "Prime" or "Premium".**

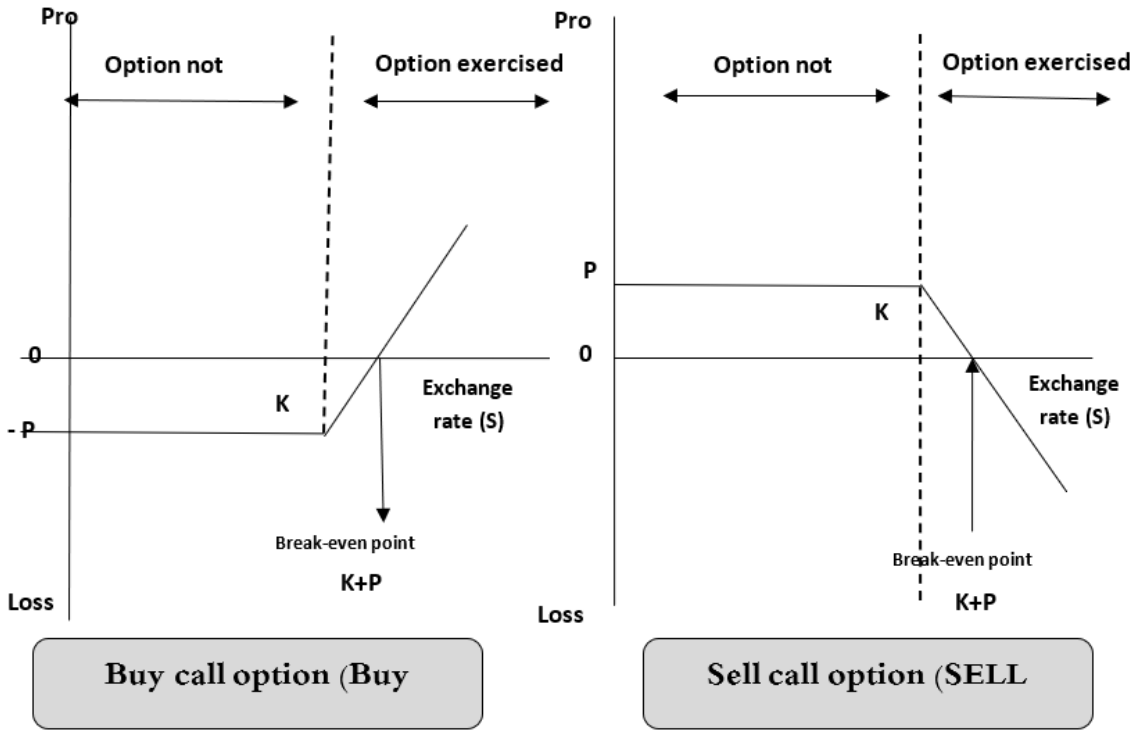
Options are divided into two main types: call options and put options (Hakem Al-Rubaie, 2011a).

- **Call option (Call Option):** a call option grants its holder the right, but not the obligation, to buy the agreed quantity at a price fixed at the time of agreement, called the exercise price, with delivery at a specified future time called the exercise date; the party selling this option receives a premium from the option holder upon conclusion of the contract. It is in turn divided into two parts:

Buying a call option: the buyer in this case holds the right to buy the agreed quantity at the agreed price within a specified period or at the contract maturity date as agreed.

- Selling a call option: the seller gives his commitment to sell the agreed quantity at the agreed price, if the buyer decides to exercise, within a specified period of time, or at the option contract maturity date as agreed in the contract.

Figure No. (5-10): Illustration of the call option (CALL)



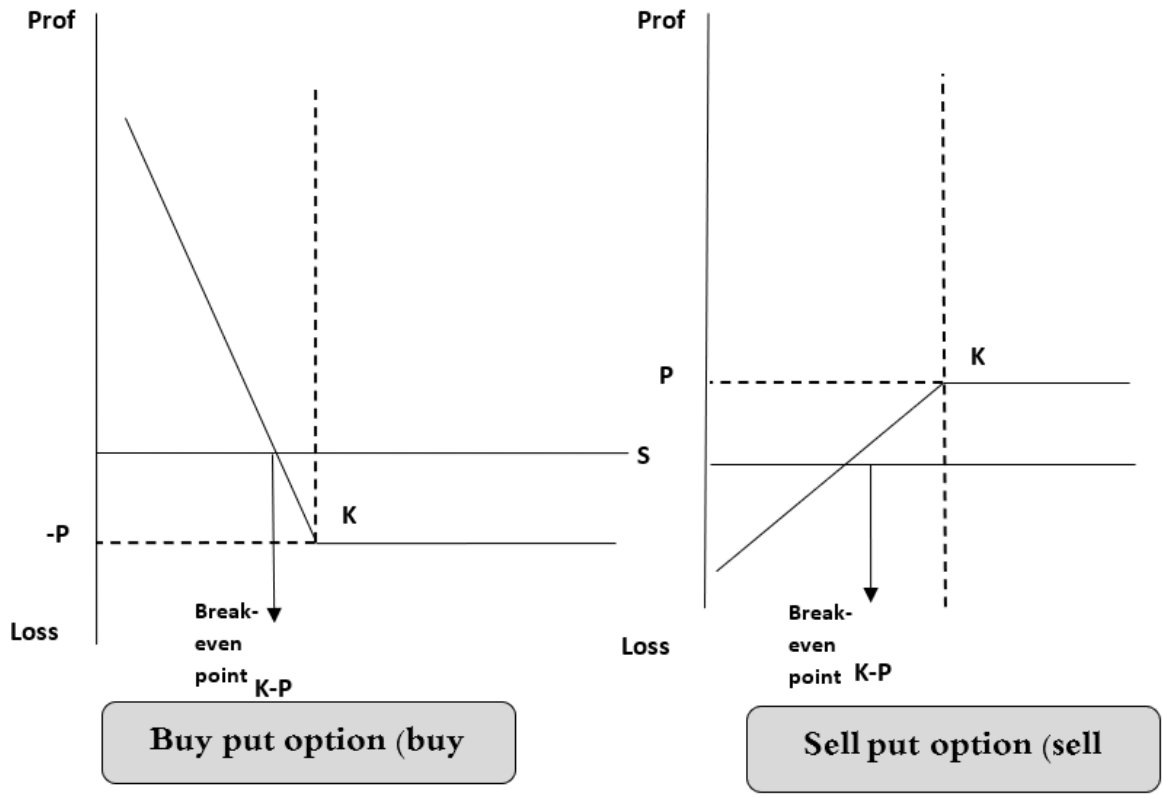
Source : (Peyrard Josette, 1999)

- Put option (Put Option): the put option is the reverse of the call option; this option gives its holder the right, but not the obligation, to sell the agreed quantity at a price fixed at the time of agreement, with delivery at a specified future time.

Buying a put option: the buyer in this case holds the right to sell the agreed quantity at the agreed price within a specified period of time or at the option contract maturity date as agreed in the contract.

Selling a put option: the seller gives his commitment to sell the agreed quantity at the agreed price if the buyer so wishes within a specified period of time or at the option contract maturity date as agreed in the contract.

Figure No. (5-11): Illustration of the put option (PUT)



Source : (Peyrard Josette, 1999)

Table No. (5-13): Summary of profit and loss for both types of options upon exercise and non-exercise

S>K	S≤K	Transaction exchange rate
Call option (CALL)		
S-K-P	-P	Buy call option (buy CALL)
-S+K+P	+P	Sell call option (sell CALL)
Put option (PUT)		
-P	K-S-P	Buy put option (buy PUT)
+P	-K+S+P	Sell put option (sell PUT)

Source : (Peyrard Josette, 1999)

- European option and American option: there are two types of option with regard to the maturity date: the American option and the European option. The European option may be exercised only on its maturity date, while the American

option may be exercised during the period between the conclusion of the contract and the maturity date (Hakem Al-Rubaie, 2011b).

✓ Factors affecting the prices of option contracts: the prices of option contracts depend on the value of the premium imposed by the seller on the buyer. The most important factors affecting the size of the premium are as follows:

1. Contract duration: the longer the contract period, the higher the premium.
2. Interest rate: there is a positive relationship between the interest rate and the size of the premium.
3. Supply and demand: contract prices fall if supply exceeds demand.
4. Fair value: the size of the premium is affected by the price to be fixed; if the price to be fixed is lower than the market price, the premium tends to rise, while if the price to be fixed is higher than the market price, the premium tends to fall.

Currency options are used either to cover the long position or the short position.

- **Hedging the long exchange position (exercising the put option)**

This position arises in a company that expects to receive a currency from a third party, such as a company that has exported a commodity or one that expects to collect an amount in a hard currency and fears a decline in the value of this currency against the domestic currency. In this case, by paying a commission it can buy a put option on the currency, which enables it to avoid exchange risk while at the same time benefiting from any positive market development; it also has the right to waive or sell this option before maturity. Fearing a decline in the value of the currency expected to be received, it buys a put right at the exercise price for a specified period, paying a premium to the seller; if the forward spot rate of the currency falls below the exercise price at maturity, it exercises its right to sell at the agreed price. If, however, the forward spot rate rises above the exercise price at maturity, it waives its right, as long as the difference between the two prices covers its premium cost and can generate a profit, thereby avoiding the expected exchange-rate loss.

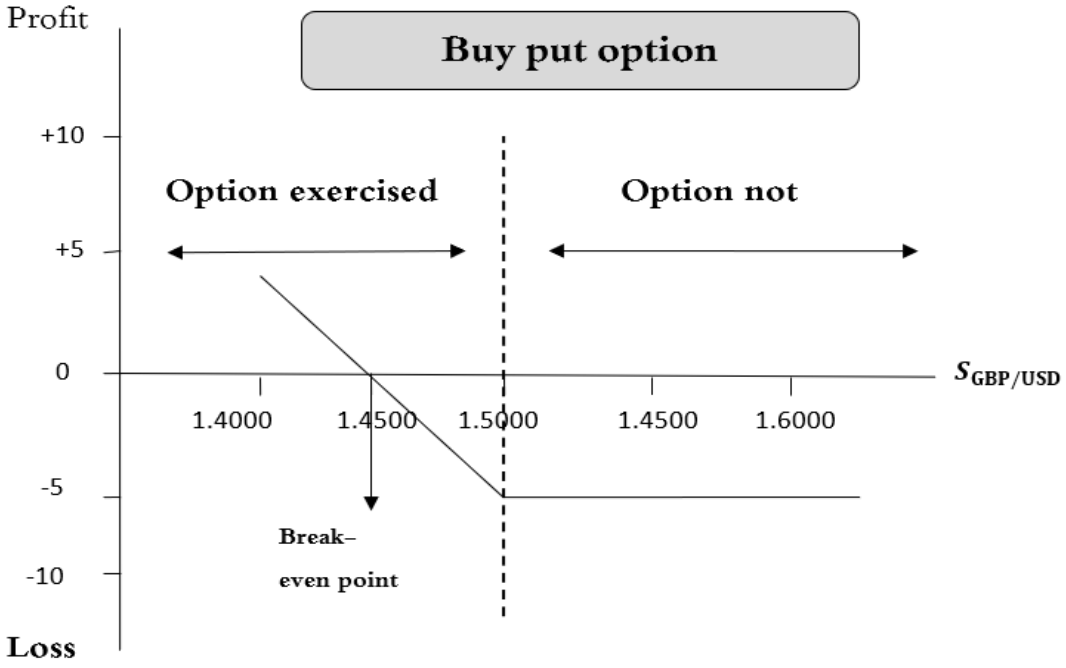
Example:

If an American company wishes to convert the pounds it will receive in Britain into dollars, assuming that the current exchange rate is GBP/USD=1.5000 and the premium is 5 US cents per pound, what would you advise the company to do if the exchange rate falls to GBP/USD=1.4000 or GBP/USD=1.4500, or if the exchange rate rises to GBP/USD=1.5500 or GBP/USD=1.6000?

If an American company wishes to convert the pounds it will receive in Britain into dollars, it must resort to buying a put option at an exchange rate of

1.5000 dollars per pound sterling and a premium of 5 US cents per pound. If the spot rate falls at the maturity date, it will be better for the put option buyer company to exercise its right to sell: if the price falls to 1.4000 dollars the company will exercise and achieve a profit of (10 cents - 5 cents = 5 cents per pound sterling); likewise if the price falls to 1.4500 dollars the company will exercise but achieve neither profit nor loss, merely recovering the premium value (5 - 5 = 0 cents per pound sterling); if the exchange rate rises to 1.5500 the company will not exercise and will be content with losing the premium of 5 cents; and the same occurs if the rate rises to 1.6000 dollars per pound sterling, the loss being limited to the premium value. The following graph illustrates this:

Figure No. (5-12): Illustrative example of buying a put option



Source: prepared by the researcher based on the foregoing.

From the figure we observe that:

- If the spot rate at maturity remains at 1.5000, the put option buyer (the company) exercises or does not exercise and incurs a loss equal to the premium;
- If the spot rate at maturity falls to 1.4500, the put option buyer will exercise, achieving a profit of (1.5000-1.4000) = 10 cents, and (10 cents - the premium = 5 cents);
- If the spot rate at maturity falls to 1.4000, the put option buyer will exercise but achieve neither profit nor loss, merely recovering the premium: 1.5000-1.4500 = 1.0500 dollars per pound sterling, i.e., 5 cents, and (5 cents - the premium = 0).
- If the spot rate at maturity rises to 1.5500, the put option buyer will not exercise and suffers a loss equal to the premium;

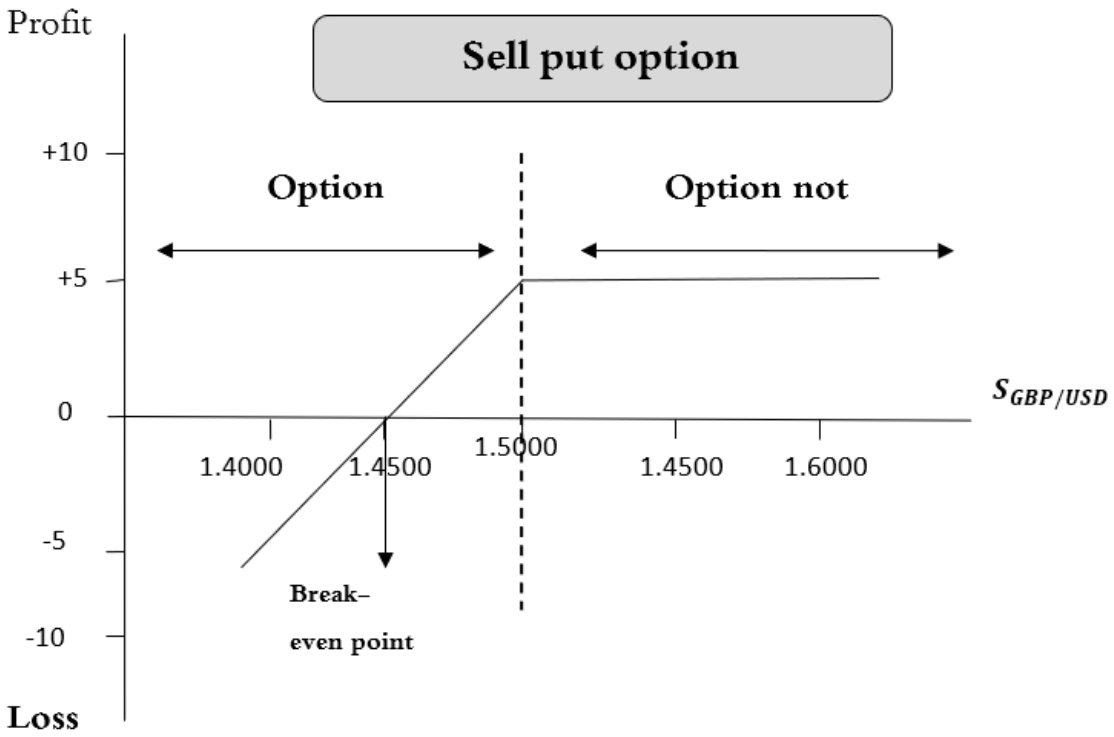
- If the spot rate at maturity rises to 1.6000, the put option buyer (the company) will not exercise and loses the premium value.

As for the counterparty, the put option seller: he will be committed to exercising if the put option buyer decides to exercise, where:

- If the spot rate at maturity remains at 1.5000, the put option seller exercises or does not exercise and achieves a profit equal to the premium;

- If the spot rate at maturity falls to 1.4500, the put option seller will exercise, incurring a loss of 5 cents;
- If the spot rate at maturity falls to 1.4000, the put option seller will exercise but achieve neither profit nor loss;
- If the spot rate at maturity rises to 1.5500, the put option seller will not exercise and achieves a profit equal to the premium;
- If the spot rate at maturity rises to 1.6000, the put option seller will not exercise and achieves a profit equal to the premium.

Figure No. (5-14): Illustrative example of selling a put option



Source: prepared by the researcher based on the foregoing.

- **Hedging the short exchange position (exercising the call option)**

This position arises when dealing with an importing company that has a debt in foreign currency, or a company that has borrowed a foreign currency and must repay these amounts in the future; this institution protects itself by buying currency exchange options and paying the seller a premium. When the period expires, two situations arise: either the repayment currency price (forward rate) has risen, in which case the institution exercises its right to buy because the exercise price plus the premium is lower than the forward rate; or the forward rate has fallen at maturity, in which case it is in the interest of the institution to waive its right (call option), as long as the difference between the two prices covers its premium and can generate a profit, thereby avoiding the expected exchange-rate loss.

Example: an American company wishes to import goods from the euro area and over 6 months pays the value of the goods in euros; assuming that the current spot exchange rate is EUR/USD=1.5950, and this company is looking for a way to cover exchange-rate fluctuations, how should the company act if the exchange rate rises to EUR/USD=1.6060, to EUR/USD=1.6065, and falls to EUR/USD=1.4500, the premium being estimated at 0.0115 dollars per euro?

In this case the company will resort to buying a call option, at a spot exchange rate of 1.5950 dollars per euro and a premium of 0.0115 dollars per euro. The

company therefore has the right, but not the obligation, to buy the contracted amount in euros at the agreed exchange rate for six months.

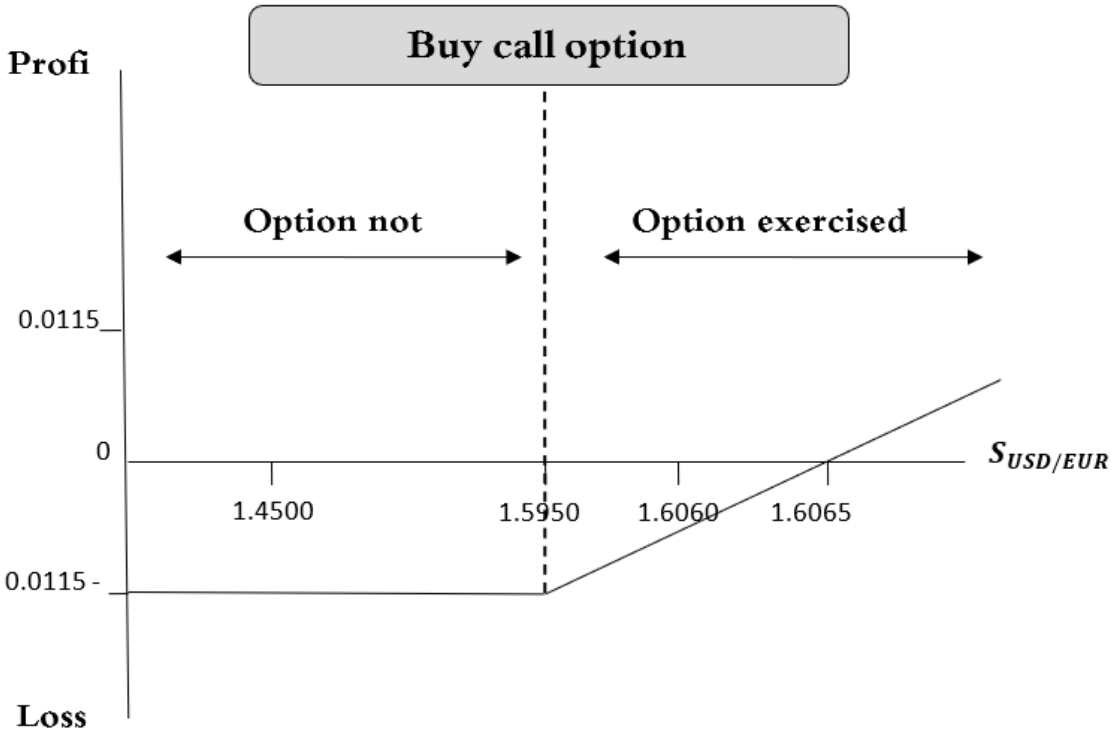
If the rate rises after 6 months to more than 1.5950 dollars per euro, the call option buyer (the company) will exercise its right to buy; if it is less, it will not exercise that right.

So if the rate rises after 6 months to 1.6060, the company will exercise; it will achieve a profit but not enough to cover the premium it already paid: (1.6060 - 1.5950) - 0.0115 (the premium) = -0.0005 dollars per euro.

If the rate rises after the maturity date to 1.6065 dollars, the company will exercise because it will achieve a profit just sufficient to cover the premium paid: (1.6065 - 1.5950) - 0.0115 = 0.

If the rate falls to 1.4500 dollars, the company will not exercise and will be content with losing the premium of 0.0115 dollars per euro. The following figure illustrates this:

Figure No. (5-15): Illustrative example of buying a call option



Source: prepared by the researcher based on the foregoing.

As for selling a call option: the call option seller will be committed to exercising if the option buyer wishes to exercise, and will commit to the opposite if the option buyer does not wish to exercise. Where:

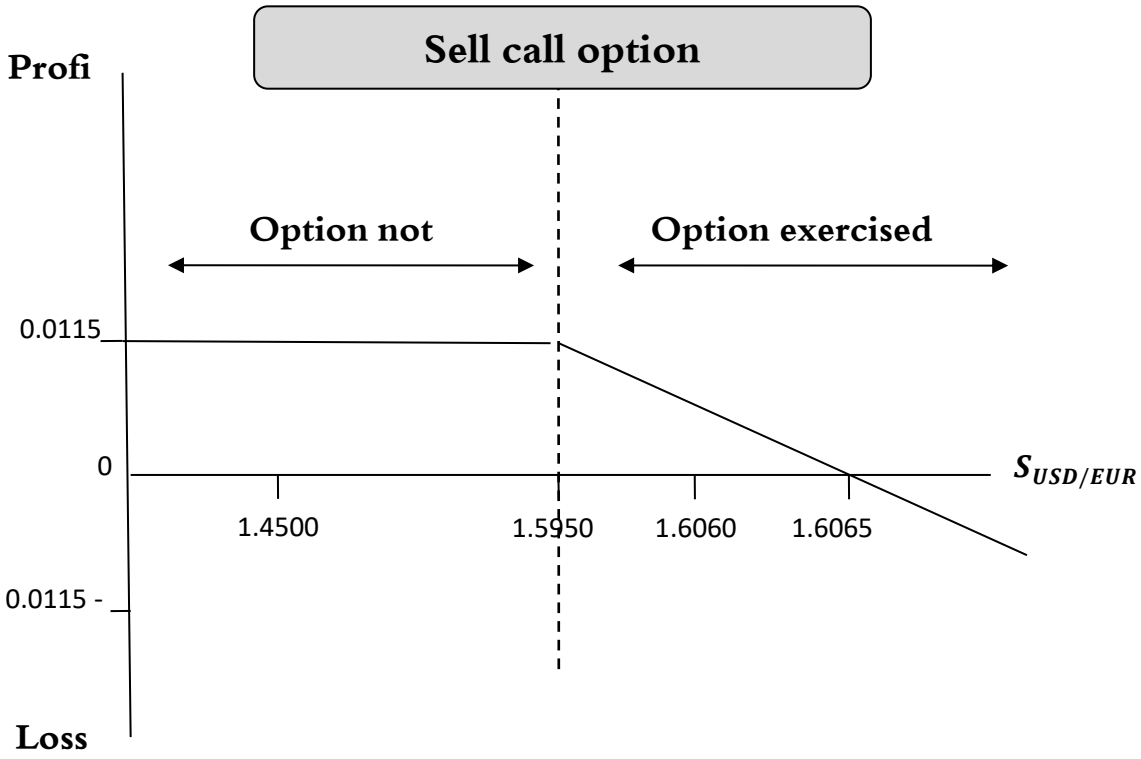
- If the rate rises at maturity to 1.6060, he will be committed to exercising and will achieve a limited net profit of 0.0005 dollars per euro;

- If the rate rises at maturity to 1.6065, he will be committed to exercising but will achieve neither profit nor loss;

If the rate falls below 1.5950 dollars per euro, the call option seller will be committed to not exercising (selling) and will be content with the premium received.

The following figure illustrates this:

Figure No. (5-16): Illustrative example of selling a call option



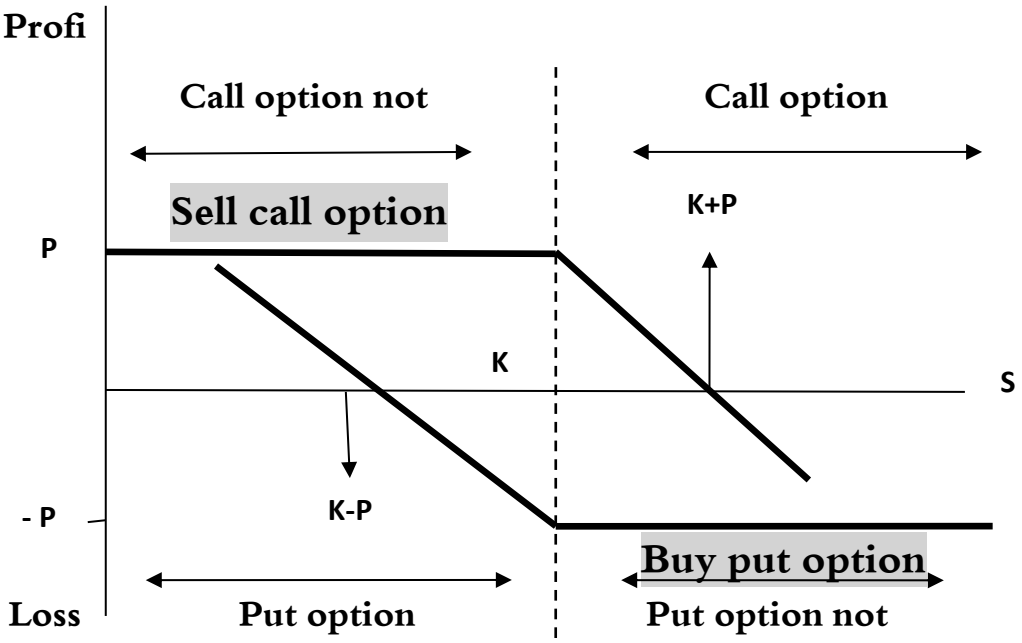
Source: prepared by the researcher based on the foregoing.

From the graph we observe that at a spot price at maturity of 1.6065, the call option seller will achieve neither profit nor loss if the call option buyer exercises his right; however, if the price rises beyond that, he will bear a loss exceeding the premium he received.

- ***Comparison of option strategies:***

- Selling a call option and buying a put option generates a profit if spot prices fall at the maturity date, as shown in the following figure:

Figure No. (5-17): Illustrative example of selling a call option and buying a put option

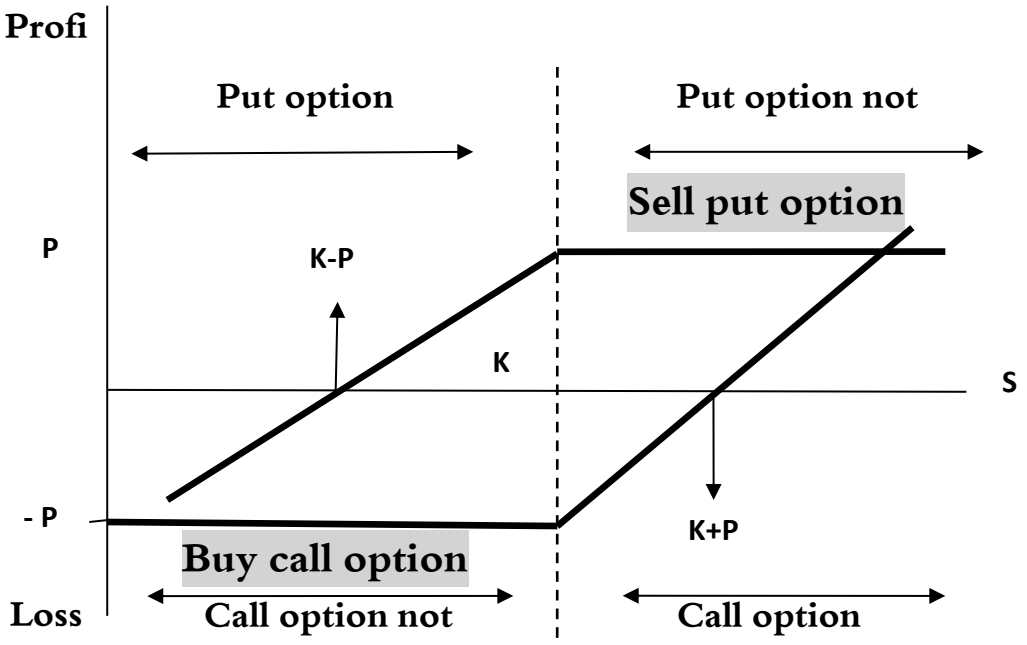


Source: prepared by the researcher based on the foregoing.

The put option buyer will not exercise, while the put option holder exercises his right to sell because he will achieve a profit.

- Buying a call option and selling a put option generates a profit if spot prices rise at the maturity date, as shown in the figure:

Figure No. (5-18): Illustrative example of selling a put option and buying a call option



Source: prepared by the researcher based on the foregoing.

As prices rise, the call option holder exercises his right to buy because he will achieve a profit, while the put option holder will not exercise his right to sell because he can sell in the market and achieve better gains.

Sample examination questions

Yahia Fares University - Medea **Academic year: 2017/2018**

Faculty of Economic Sciences, Commercial Sciences and Management Sciences **Department of Economic Sciences**
Surname: .....

First name: .....

Second year Master's in Monetary and Banking Economics
Group: .....

First-semester ordinary session examination in the module: Exchange and Its Risks

Q (1): Answer true or false, with justification for incorrect answers (6 points)

- Currency speculation differs from arbitrage in that the former consists of buying an asset in order to resell it at the same time, while arbitrage consists of substituting a financial asset for a monetary asset.

A/.....
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- The monetary/non-monetary method allows the conversion of an asset's value at the exchange rate prevailing on the day the transaction was recorded.

A/.....
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- Institutions are exposed to accounting, trading, and capital exchange risks.

A/.....
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- By swap points we mean the conversion of the interest differential into a number of points added to the spot exchange rate.

A/.....
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- Proponents of the absolute purchasing power parity theory hold that the real exchange rate is constant.

A/.....
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Q (2): Name the two types of swap contract, highlighting their similarities and differences (4 points)

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Q (3): What type of relationship exists between the real exchange rate and competitiveness? (justify your answer) (3 points)

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Exercise (7 points): as of 31/12/2017 the position of a European institution was as follows:

- **Customer account: 1,500 USD, 1,500 EUR, 1,200 JPY.**
- **Supplier account: 1,300 USD, 1,700 EUR, 1,400 JPY.**
- **Lending: 1,600 EUR, 1,000 JPY. Borrowing: 1,800 EUR, 1,100 JPY.**
- **Sales: 1,600 USD, 5,500 EUR, 2,000 JPY.**
- **Purchases: 1,000 USD, 5,000 EUR, 2,500 JPY.**

Required:

1. Determine the exchange position for each currency and the exchange risk.
2. Determine the total exchange risk in Japanese yen (JPY), given that: USD/EUR= 0.9000, USD/JPY= 1.2500.

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Yahia Fares University - Medea **Academic year: 2018/2019**

Faculty of Economic Sciences, Commercial Sciences and Management Sciences **Department of Economic Sciences**
Surname: .....

First name: .....

Second year Master's in Monetary and Banking Economics
Group: .....

First-semester ordinary session examination in the module: Exchange and Its Risks

Q (1): Answer true or false, with justification for incorrect answers (5 points)

- Currency speculation differs from arbitrage in that the former consists of buying an asset in order to resell it at the same time, while arbitrage consists of substituting a financial asset for a monetary asset.

A/.....
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- The temporal method allows the conversion of an asset's value at the exchange rate prevailing on the day the transaction was recorded.

A/.....
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- Institutions are exposed to accounting, trading, and capital exchange risks.

A/.....
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- By swap points we mean the conversion of the interest differential into a number of points added to the spot exchange rate.

A/.....
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- Proponents of the absolute purchasing power parity theory hold that the real exchange rate is constant.

A/.....
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Q (2): What is the rationale behind Levy-Yati and Sturzenegger's use of exchange-rate changes and reserves in classifying exchange rate regimes? (2 points)

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Q (3): Why do developing countries declare an exchange regime that is not actually adopted? (2 points)

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Q (4): Identify the similarities and differences between forward contracts and futures contracts for exchange (4 points)

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Q (5): Exercise: at midday, the following quotations were observed in the foreign spot exchange market: (7 points)

Tokyo market: CHF/JPY = 95.3120	New York market: 100 JPY/USD = 0.7530 CHF/USD = 0.7185

- Calculate the cross rate between the Swiss franc and the Japanese yen (CHF/JPY) in the New York market.

- If the arbitrageur holds 100,000 US dollars, calculate the profit he will achieve from the arbitrage operation between the two markets.

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Yahia Fares University - Medea **Academic year: 2019/2020**

Faculty of Economic Sciences, Commercial Sciences and Management Sciences **Department of Economic Sciences**
Surname: .....

First name: .....

Second year Master's in Monetary and Banking Economics
Group: .....

First-semester make-up session examination in the module: Exchange and Its Risks

Q (1): Place a mark (X) in front of one correct answer (5 points)

- Companies that consolidate their accounts are exposed to:

(a) accounting exchange risk (b) accounting and economic exchange risk (c) accounting, transaction, and capital exchange risk (d) accounting, transaction, and economic exchange risk

- Under the certain quotation (EUR/CAD= 1.2329), the Canadian dollar is called:

(a) the base currency (b) the counter currency (c) the arbitrage currency

- The forward exchange rate of a bank that buys a currency forward represents:

(a) an estimate of the future spot exchange rate (b) the exchange rate that guarantees no risk for the bank
(c) all of the above (d) none of the above

- The long exchange position of an institution means:

(a) the volume of foreign currency held is greater relative to its assets (b) its transaction account balance is debit
(c) its transaction account balance is credit (d) none of the above

- The monetary/non-monetary method allows the conversion of an asset's value:

(a) at the exchange rate prevailing on the day of recording the transaction (b) at the closing exchange rate (c) a+b

Q (2): Why do developing countries declare an exchange regime that is not actually adopted? (2 points)

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Q (3): How are the maturities of the operation managed by the exporting company? (2 points)

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Q (4): What criteria did Levy Yeyati and Sturzenegger rely on to classify exchange rate regimes? (3 points)

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Q (5): Identify the similarities and differences between forward contracts and futures contracts for exchange (4 points)

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Exercise: at midday, the following quotations were observed in the foreign spot exchange market: (7 points)

Tokyo market: CHF/JPY = 95.3120	New York market: 100 JPY/USD = 0.7530 CHF/USD = 0.7185

- Calculate the cross rate between the Swiss franc and the Japanese yen (CHF/JPY) in the New York market

Yahia Fares University - Medea **Academic year: 2021/2022**
Faculty of Economic Sciences and Commercial Sciences and Management Sciences **Department of Economic Sciences**
Surname:.....
First name:.....
Second year Master's in Monetary and Banking Economics
Group:.....

First-semester examination in the module: Exchange and Its Risks

Q(1): Place a mark (X) in front of one correct answer (6 points)

- Companies that consolidate their accounts are exposed to:

(a) accounting exchange risk (b) accounting and economic exchange risk (c) accounting, transaction, and capital exchange risk (d) accounting, transaction, and economic exchange risk

- Under the certain quotation (EUR/CAD= 1.2329), the Canadian dollar is called:

(a) the base currency (b) the counter currency (c) the arbitrage currency

- Based on the foregoing, the uncertain quotation for CAD/EUR equals:
  (a) CAD/EUR = 0.8101 (b) CAD/EUR= 0.8110 (c) CAD/EUR=0.8100 (d) CAD/EUR= 0.9000
- The forward exchange rate of a bank that buys a currency forward represents:

(a) an estimate of the future spot exchange rate (b) the exchange rate that guarantees no risk for the bank
(c) all of the above (d) none of the above

- The long exchange position of an institution means:

(a) the volume of foreign currency held is greater relative to its assets (b) its transaction account balance is debit
(c) its transaction account balance is credit (d) none of the above

- The monetary/non-monetary method allows the conversion of an asset's value:

(a) at the exchange rate prevailing on the day of recording the transaction (b) at the closing exchange rate (c) a+b

Q (2): What type of relationship exists between the real exchange rate and competitiveness? (justify your answer) (4 points)

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Q (3): What criteria did Levy Yeyati and Sturzenegger rely on to classify exchange rate regimes? (3 points)

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Exercise: a Japanese arbitrageur holds an amount of 500,000 JPY and wishes to carry out an arbitrage operation to benefit from price differences, given that the foreign currency prices in the Tokyo and New York markets were as follows:

Tokyo market	EUR/JPY= 4.5565/4.5653 EUR/USD= 1.1411/1.1416
New York market	USD/JPY= 3.8695/3.8905

Required: calculate the profit that the arbitrageur will achieve from the arbitrage operation between the two markets

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