Introduction to Currency Exchange Rates

The CFA Program level two topic on Economics and the reading on Currency Exchange Rates focuses on understanding equilibrium value. To approach this topic, it is helpful to visualize the foreign exchange market as a physical market with tables representing different currencies.

Understanding the Foreign Exchange Market

In this physical market, each table has a pile of individual currencies. For example, consider the US Dollar and the Canadian Dollar. If the size of the US economy and the Canadian economy are identical, and interest rates, inflation, and expected inflation are the same, then the exchange rate would be straightforward, with 1 US Dollar equal to 1 Canadian Dollar. However, this is an extreme example, and relaxing these assumptions reveals the complexities of the foreign exchange market.

Key Concepts

The following are key concepts in understanding currency exchange rates:

- Exchange rates are a function of two variables: the relative strength of two economies and the behavior of central banks.
- Equilibrium conditions hold true when interest rates and inflation are the same, resulting in no arbitrage opportunities.
- Forecasts of future spot rates of exchange are crucial in understanding the foreign exchange market.

Balance of Payments and Monetary Policy

Each country has a balance of payments, which affects exchange rates. Monetary policy and fiscal policy also play a significant role in the foreign exchange market.

Warning Signs of a Currency Crisis

Understanding the warning signs of a currency crisis is essential in navigating the foreign exchange market.

Quoted Exchange Rates

> A quoted exchange rate is the price of one currency in terms of another currency.

The price currency is in the numerator, and the base currency is in the denominator. For example, a US Dollar per Euro quote of 1.1813 means that 1 Euro is equal to 1.1813 US Dollars.

Direct and Indirect Quotations

- Direct quotation: The foreign currency is the base currency.
- Indirect quotation: The domestic currency is the base currency.

Bid and Offer Prices

The bid price is the price at which the dealer buys a currency, while the offer price (or ask price) is the price at which the dealer sells a currency. The difference between the bid and offer prices is known as the bid-offer spread or bid-ask spread.

Factors Influencing the Spread

The following factors influence the spread quoted by the dealer:

- Liquidity: Higher liquidity results in a narrower spread.
- Size of the transaction: Larger transactions may result in a wider spread.
- Relationship between the dealer and the client: Favorable rates may be quoted based on ongoing business relationships.

Example of Bid and Offer Prices

Currency	Bid Price	Offer Price	Spread
US Dollar/Great British Pound	3.776	3.778	2 pips

Note that spreads are typically more narrow in interbank markets.## Factors Affecting Currency Spreads The currency spread is influenced by several factors, including the currency pair involved, time of day, and market volatility.

- Currency pair: The spread is typically lower for liquid currencies such as the US dollar, British pound, and euro.
- Time of day: The overlap between London and New York trading sessions, which occurs between 8 a.m. and 11 a.m. New York time, is a period of high liquidity.
- Market volatility: When prices are more volatile, dealers will widen the spreads to protect themselves from risk.

Cross Rate Calculation

A cross rate is the exchange rate between two currencies that are not the base currency. It can be calculated using the following formula:

$$\text{Cross Rate} = \frac{\text{Currency A}}{\text{Currency B}} \times \frac{\text{Currency B}}{\text{Currency C}}$$

> The cross rate calculation involves multiplying the exchange rates of two currency pairs to obtain the exchange rate between the two currencies that are not the base currency.

Arbitrage Constraints

There are two key arbitrage constraints:

- The bid quoted by a dealer cannot be higher than the current interbank offer.
- The cross rate bid quoted by the dealer must be lower than the implied cross rate bid.

Triangular Arbitrage

Triangular arbitrage involves converting one currency to another, then to a third currency, and finally back to the original currency. The steps involved in triangular arbitrage are:

1. Convert currency A to currency B
2. Convert currency B to currency C
3. Convert currency C back to currency A

The following table illustrates an example of triangular arbitrage:

Currency Pair	Exchange Rate
USD/AUD	1.0723
AUD/CAD	1.2505

Using the exchange rates in the table, we can calculate the implied cross rate:
$\text{Implied Cross Rate} = 1.0723 \times 1.2505 = 1.343$

Example of Triangular Arbitrage

Suppose we start with $100,000 USD and convert it to AUD, then to CAD, and finally back to USD. The calculations are as follows:

Step	Currency	Amount
1	USD	$100,000
2	AUD	$134,000.23
3	CAD	$125,180.00
4	USD	$100,000.06

The arbitrage profit is $106.00.

Bid-Offer Quotations

When working with bid-offer quotations, we need to consider the bid and offer rates for each currency pair. The following table illustrates an example of bid-offer quotations:

Currency Pair	Bid	Offer
USD/MXN	19.8900	19.9000
MXN/CAD	0.05200	0.05250

Using the bid-offer quotations in the table, we can calculate the implied cross rate and determine if an arbitrage opportunity exists.## Triangular Arbitrage The concept of triangular arbitrage is used to exploit discrepancies in exchange rates between three currencies. To calculate the profit from triangular arbitrage, subtract the original amount from the final amount. In this case, the profit is $7540.

Key Considerations for Triangular Arbitrage

When engaging in triangular arbitrage, it is essential to remember that:

- You will always get the worst price when transacting with a dealer
- To ensure the correct calculation, always use the **bid** or **offer** price that results in the lower value

Spot Rates and Forward Rates

The relationship between **spot rates** and **forward rates** is crucial in understanding exchange rates.

> A spot rate is the current exchange rate, while a forward rate is the exchange rate for a future transaction.

Factors Affecting Exchange Rates

The following factors can affect exchange rates:

- **Imports** and **exports**
- **Interest rates** in different countries
- **Borrowing** and **lending** activities

Forward Premium and Forward Discount

A **forward premium** occurs when the forward rate is greater than the spot rate, while a **forward discount** occurs when the forward rate is less than the spot rate. The difference between the forward rate and the spot rate is known as the **forward premium** or **forward discount**.

Interest Rate Parity Equation

The **interest rate parity equation** is used to estimate the forward rate: $F = S \times \frac{1+r_f}{1+r_d}$ where:

Variable	Definition
F	Forward rate
S	Spot rate
r_f	Foreign interest rate
r_d	Domestic interest rate

Example

Suppose we want to estimate the forward rate for US dollars per Canadian dollars. We need to know the spot rate, foreign interest rate, and domestic interest rate. Using the interest rate parity equation, we can calculate the forward rate.

Key Points to Remember

- The forward market is a derivative market, and the forward rate is a function of the underlying assets.
- The foreign currency is in the numerator, and the domestic currency is in the denominator.
- The interest rate parity equation helps estimate the forward rate based on the spot rate and interest rates in different countries.## Forward Rates and Premiums/Discounts The forward rate is calculated by adjusting the spot rate by the relative interest rates. To remember this, note that the domestic currency is in the denominator, so the domestic interest rate is also placed in the denominator.

For example, given a spot rate of 0.7488 $USdollarsperAustraliandollar$, US interest rate of 3%, and Australian interest rate of 5%, the forward rate can be calculated as follows: $0.7488 \times \frac{1.03}{1.05} = 0.7380$

This results in a discount of $0.7488 - 0.7380 = 0.0108$.

Marking to Market

Marking to market refers to the process of valuing a forward contract at current market prices. The value of a forward contract is zero at the time of inception, but changes over time as spot rates and interest rates fluctuate.

To calculate the mark to market value, the following formula can be used:
$Value = (F - F_0) \times Notional \times \frac{1}{1+r}$

Where:

- F is the new forward price
- F_0 is the original forward price
- $Notional$ is the notional principle or contract size
- r is the interest rate

For example, given a notional principle of $100 million, a spot rate of 2.445, a 60-day forward of +140, and a 60-day Canadian dollar interest rate of 5%, the mark to market value can be calculated as follows: $F = 2.445 + 0.140 = 2.585$
$Value = (2.585 - F_0) \times 100,000,000 \times \frac{1}{1+0.05} = 2.7 million Canadian dollars$

International Parity Conditions

International parity conditions refer to the equilibrium conditions that exist between and among different currencies. These conditions help determine long-run fluctuations in exchange rates.

The following are some key international parity conditions:

- Interest Rate Parity: A no-arbitrage condition in which a foreign money market instrument is completely hedged against exchange rate risk.
- Uncovered Interest Rate Parity: A condition in which the difference in interest rates between two countries is equal to the expected change in the exchange rate.
- Purchasing Power Parity: A condition in which the exchange rate between two countries is equal to the ratio of the price levels in the two countries.

  The interest rate parity condition can be defined as: An equilibrium condition in which the return on a domestic asset is equal to the return on a foreign asset, adjusted for the forward premium or discount.

Some key points to note about international parity conditions are:

- They help to determine long-run fluctuations in exchange rates
- They are based on the idea that arbitrage opportunities should not exist in the market
- They take into account the behavior of central banks in determining interest rates

The following table summarizes the key international parity conditions:

Condition	Definition
Interest Rate Parity	A no-arbitrage condition in which a foreign money market instrument is completely hedged against exchange rate risk
Uncovered Interest Rate Parity	A condition in which the difference in interest rates between two countries is equal to the expected change in the exchange rate
Purchasing Power Parity	A condition in which the exchange rate between two countries is equal to the ratio of the price levels in the two countries

Some key factors that affect **exchange rates** and **international parity conditions** are:

- **Relative economic strength**
- **Behavior of central banks** in determining **interest rates**
- **Inflation rates**
- **Market imperfections** and **disequilibrium**## Covered Interest Parity The **covered interest parity** states that the return on a foreign investment should be equal to the return on a domestic investment, after adjusting for the exchange rate. This means that if an investor converts their money to a foreign currency, invests it, and then uses a **forward contract** to exchange it back to their domestic currency, the return should be the same as if they had invested in a domestic **money market instrument**.

Uncovered Interest Rate Parity

The **uncovered interest rate parity** states that the expected return on an unhedged foreign investment should be equal to the return on a domestic investment. This means that if an investor invests in a foreign **money market instrument** without using a **forward contract** to hedge the exchange rate risk, the expected return should be the same as if they had invested in a domestic **money market instrument**.

Forward Rate Parity

The **forward rate parity** states that the **forward exchange rate** is an unbiased estimator of the future **spot exchange rate**. This means that the forward exchange rate should be equal to the expected future spot exchange rate.

> An unbiased estimator is a statistical estimate that is not skewed or biased in any way. It means that the estimate is equally likely to be above or below the true value, and that the average of many estimates will be close to the true value.

Parity Conditions

The following table summarizes the different parity conditions:

Parity Condition	Description
Covered Interest Parity	Return on foreign investment = Return on domestic investment
Uncovered Interest Rate Parity	Expected return on unhedged foreign investment = Return on domestic investment
Forward Rate Parity	Forward exchange rate = Expected future spot exchange rate
Purchasing Power Parity	Ratio of national price levels = Spot exchange rate
Fisher Effect	Nominal interest rate = Real interest rate + Expected inflation rate

Purchasing Power Parity

The purchasing power parity states that the ratio of the national price levels should be equal to the spot exchange rate. This means that if a basket of goods costs $100 in the US and 150 in Canada, the exchange rate should be 1 USD = 1.5 CAD.

There are two versions of the purchasing power parity:

- Absolute version: The ratio of the national price levels = Spot exchange rate
- Relative version: The difference between the foreign and domestic inflation rates = Percentage change in the spot exchange rate

Fisher Effect

The Fisher effect states that the nominal interest rate is equal to the real interest rate plus the expected inflation rate. This means that the nominal interest rate should be high enough to compensate for the expected inflation rate, so that the real return on investment is positive.

For example:

- Real interest rate: 2%
- Expected inflation rate: 3%
- Nominal interest rate: 5%

The Fisher effect can be extended to the foreign exchange market, where the difference between the expected rates of inflation and the difference between the nominal interest rates are important.

Some key points to note about the Fisher effect:

- It applies to both domestic and international investments
- It takes into account the expected inflation rate, which can affect the real return on investment
- It is an important concept in understanding the relationship between interest rates, inflation, and exchange rates.

Key terms:

- **Nominal interest rate**: The interest rate that is quoted by banks and other financial institutions
- **Real interest rate**: The interest rate that is adjusted for inflation
- **Expected inflation rate**: The rate at which prices are expected to rise in the future
- **Forward contract**: A contract to exchange a certain amount of one currency for another currency at a fixed exchange rate on a specific date in the future.## Introduction to International Parity Conditions The concept of international parity conditions is crucial in understanding the relationship between different economic variables. **Irving Fisher**, a renowned economist, once announced that high stock prices were permanent, just before the stock market crash in 1929. This example illustrates the importance of being aware of the **new normal** and understanding the fundamentals of economics.

International Parity Conditions

Most international parity conditions do not hold over short time periods. However, they are essential in understanding the interaction between different input variables over the longer term. The following table summarizes the relationships between different parity conditions:

Parity Condition	Description
PPP $Purchasing Power Parity$	Holds when the exchange rate between two currencies is equal to the ratio of the price levels of the two countries
Uncovered Interest Rate Parity	Holds when the difference in interest rates between two countries is equal to the expected change in the exchange rate
Covered Interest Rate Parity	Holds when the difference in interest rates between two countries is equal to the forward premium or discount
Fischer Effect	Holds when the difference in interest rates between two countries is equal to the difference in expected inflation rates

Relationships Between Parity Conditions

The following relationships exist between the parity conditions:

- If PPP holds and International Fisher Effect holds, then Uncovered Interest Rate Parity will hold
- If Fischer Effect holds, then International Fisher Effect will hold
- If both Covered and Uncovered Interest Rate Parity hold, then forward exchange rates will be an unbiased predictor of future spot exchange rates

Forecasting Future Spot Rates

To forecast future spot rates, we can use the following equation:
$E(S_{t+1}) = S_t + (r_{dom} - r_{for}) + (E(\Delta S) - F_{t+1})$ where:

- $E(S_{t+1})$ is the expected future spot rate
- S_t is the current spot rate
- r_{dom} is the domestic interest rate
- r_{for} is the foreign interest rate
- $E(\Delta S)$ is the expected change in the spot rate
- F_{t+1} is the forward premium or discount

Carry Trade

A carry trade involves taking a long position in a high-yielding currency and a short position in a low-yielding currency. The following table summarizes the steps involved in a carry trade:

Step	Description
1	Borrow a million units of the low-yielding currency
2	Convert the borrowed amount to the high-yielding currency at the current spot rate
3	Invest the converted amount in a high-yielding asset
4	Wait for the maturity of the investment
5	Convert the investment proceeds back to the low-yielding currency at the future spot rate
6	Repay the borrowed amount with interest

A carry trade is a strategy that involves exploiting the difference in interest rates between two countries. However, it is essential to note that high-yielding currencies do not always depreciate, and the **interest rate parity** condition may not hold in the short term.

Key Takeaways

- International parity conditions are essential in understanding the relationship between different economic variables
- **Uncovered Interest Rate Parity** and **Covered Interest Rate Parity** are crucial in forecasting future spot rates
- A **carry trade** involves taking a long position in a high-yielding currency and a short position in a low-yielding currency
- It is essential to understand the relationships between different parity conditions and to be aware of the **new normal** in the economy.

Some key points to consider when analyzing international parity conditions include:

- The difference in interest rates between two countries
- The expected change in the exchange rate
- The forward premium or discount
- The difference in expected inflation rates between two countries
- The relationship between the spot rate and the forward rate
- The concept of **unbiased estimates** and how to compute them
- The **build-up model** and how to use it to forecast future spot rates.

By understanding these concepts and relationships, we can better analyze the economy and make informed decisions as financial analysts.## Covered Interest Rate Parity vs Uncovered Interest Rate Parity The **covered interest rate parity** involves investing in a **risk-free security**, where the future value is known precisely. On the other hand, **uncovered interest rate parity** does not use a **forward contract**, and the investment can be in various assets, such as **country-wide denominated bonds** or **stocks**, which are riskier.

Carry Trade Strategy

A **carry trade strategy** involves borrowing at a low interest rate and investing in a higher-yielding asset. For example, borrowing $1 million at 5 3,000, calculated as follows: $1,391,000 (future value) - 1,053,000$ converted back to US dollars - $1,050,000 (initial loan) = 3,000$ profit

However, this strategy can **miserably fail during turbulent periods**. The key is to determine what constitutes **turbulent** and **low volatility** periods.

Balance of Payments

The **balance of payments** is a way for governments to track transactions between a country and its international trading partners. It consists of two accounts:

- **Current Account**: records the flow of goods and services, such as **exports** and **imports**, as well as **tax services**, **dividend payments**, and **unilateral gifts**.
- **Capital Account** (also known as **Financial Account**): measures the flow of funds for **debt** and **equity investment** into and out of a country.

  A country with a current account surplus will have a capital account deficit, as the excess funds are invested abroad.

Impact of Balance of Payments on Currency Exchange Rates

The balance of payments can impact currency exchange rates through two channels:

- Flow Supply and Demand Channel: a country that exports more than it imports will have an increased demand for its currency, resulting in currency appreciation.
- Portfolio Balance Channel: a country with a trade surplus will have a deficit in its currency, putting downward pressure on the currency.

Monetary and Fiscal Policy

The Mundell-Fleming model describes how changes in fiscal and monetary policy impact interest rates and GDP, which in turn affect exchange rates. The key factors to consider are:

- Interest rates: changes in interest rates can impact the attractiveness of a country's assets and influence exchange rates.
- Economic growth: changes in GDP can impact exchange rates, as a stronger economy can attract foreign investment and appreciate the currency.

Emerging Markets

When investing in emerging markets, consider the following conditions:

- Appreciation of emerging market currencies: a strong currency can make investments more attractive.
- Great buildup of external debt: high levels of debt can increase the risk of investment.
- Overinvestment in risky projects: investing in risky projects can increase the potential for losses.
- Market bubbles: investing in a market with a bubble can increase the risk of losses.

The following table summarizes the key factors to consider when investing in emerging markets:

Factor	Description
Appreciation of emerging market currencies	A strong currency can make investments more attractive
Great buildup of external debt	High levels of debt can increase the risk of investment
Overinvestment in risky projects	Investing in risky projects can increase the potential for losses
Market bubbles	Investing in a market with a bubble can increase the risk of losses

Key Takeaways

- The balance of payments can impact currency exchange rates through the flow supply and demand channel and the portfolio balance channel.
- Monetary and fiscal policy changes can impact interest rates and GDP, which in turn affect exchange rates.
- When investing in emerging markets, consider the appreciation of emerging market currencies, great buildup of external debt, overinvestment in risky projects, and market bubbles.## Capital Mobility and Exchange Rates The relationship between capital mobility and exchange rates is crucial in understanding the impact of economic policies on a country's currency. The Mundell-Fleming model divides outcomes into two capital mobility possibilities: high and low.

High Capital Mobility

When capital mobility is high, the impact of monetary policy and fiscal policy on exchange rates can be significant. The following table summarizes the effects of different policy combinations:

Monetary Policy	Fiscal Policy	Effect on Exchange Rate
Expansionary	Restrictive	Domestic currency depreciation
Restrictive	Expansionary	Domestic currency appreciation

Low Capital Mobility

When capital mobility is low, the impact of monetary policy and fiscal policy on exchange rates is different. The following table summarizes the effects of different policy combinations:

Monetary Policy	Fiscal Policy	Effect on Exchange Rate
Expansionary	Expansionary	Domestic currency depreciation
Restrictive	Restrictive	Domestic currency appreciation

Monetary Model

The monetary model assumes that output is fixed and that monetary policy affects exchange rates through its impact on prices and inflation, not through interest rates and GDP. As Milton Friedman said:

> Inflation is always and everywhere a money supply issue.

A relative increase in the domestic money supply causes its currency to depreciate.

Dornbusch Overshooting Model

The Dornbusch overshooting model frees us from some of the limitations of the pure monetary approach model. The key features of this model are:

- Short-run prices are fixed, but in the long run, prices are fully flexible
- An increase in the money supply over the long run leads to an increase in domestic prices, making the domestic currency depreciate
- Exchange rates overshoot in the short term, meaning they react more strongly to changes in monetary policy than they would in the long term

Portfolio Balance Approach

The portfolio balance approach considers the impact of fiscal policy on exchange rates. The following points summarize the key effects:

- An expansive fiscal policy leads to an increase in the real interest rate differential, causing currency appreciation in the short term
- However, this also leads to an increase in government debt, which can lead to currency depreciation in the long term
- The central bank may monetize the debt, leading to an increase in the money supply and currency depreciation

Government Intervention

Government intervention in the markets can have significant effects on exchange rates. The following points summarize the key effects:

- Liberalization of financial markets can lead to an increase in capital flows and currency appreciation
- An upgrade in sovereign debt can also lead to an increase in capital flows and currency appreciation
- Capital will flow to its most efficient use, leading to an increase in investment in countries with attractive assets and securities.

Some key factors to consider when evaluating government intervention include:

- Push factors, such as capital mobility and interest rates
- Pull factors, such as liberalization of financial markets and sovereign debt upgrades
- The impact of government intervention on exchange rates and capital flows.## Government Interventions and Controls Government interventions and controls in the foreign exchange market can be useful in terms of decreasing the aggregate volume of capital inflows and allowing monetary authorities to adapt independent policies. The main goals of these interventions are to:
- Prevent excessive appreciation of the currency
- Allow the currency to appreciate if it is undervalued
- Intervene in the foreign exchange market if the currency is overvalued

Types of Interventions

There are several types of interventions that can be used to achieve these goals, including:

- Direct intervention: the government directly intervenes in the foreign exchange market to influence the exchange rate
- Expanding the monetary base: increasing the amount of money in circulation to reduce the value of the currency
- Selling securities: selling government securities to reduce the amount of money in circulation and reduce excess liquidity
- Instituting capital controls: implementing policies to control the flow of capital into or out of the country

Warning Signs of a Currency Crisis

A currency crisis can be predicted by looking for certain warning signs, including:

Warning Sign	Description
High **inflation**	a high rate of inflation can lead to a decrease in the value of the currency
Low **exports**	a low level of exports can lead to a trade deficit and a decrease in the value of the currency
Decline in **exchange reserves**	a decline in the country's exchange reserves can indicate a lack of confidence in the currency
High **currency value**	a currency value that is high compared to its historical average can be a sign of overvaluation
High **money growth**	a high rate of money growth can lead to inflation and a decrease in the value of the currency
Banking crisis	a banking crisis can lead to a loss of confidence in the financial system and a decrease in the value of the currency

> A **currency crisis** occurs when there is a sudden and significant decrease in the value of a country's currency, often accompanied by a loss of confidence in the financial system and a decline in economic activity.

Long-term Predictions for Exchange Rates

When predicting **exchange rates**, it is more important to focus on **long-term predictions** rather than **short-term predictions**. This is because long-term predictions can help investors and businesses make informed decisions about their investments and operations. **Monetary authorities** can use **independent monetary policies** to influence the exchange rate and achieve their economic goals. **Capital controls** can also be used to regulate the flow of capital into or out of the country and prevent excessive **appreciation** or **depreciation** of the currency.