Level II of the CFA® 2025 Exam

Study Notes - Economics

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Reading 8: Currency Exchange Rates: Understanding Equilibrium Value

LOS 6a: Calculate and interpret the bid-offer spread on a spot or forward currency quotation and describe the factors that affect the bid-offer spread

An exchange rate is the price of the **base currency** expressed in terms of the **price currency**. For example, assume that the USD/CAD rate is 0.7625. This implies that the Canadian dollar, the base currency, costs 0.7625 US dollars (One Canadian dollar is worth 0.7625 US dollars).

***Note**: You might come across different notations in different sources. For consistency, we will quote exchange rates using the convention "P/B," where the price of base currency "B" is expressed in terms of the price currency "P." CFA Institute's convention for exchange rate quotations is the reverse of what you see on most forex websites.*

The currency exchange rate for immediate delivery is called the **spot exchange rate**. On the other hand, the rate for an exchange to be done in the future is called the **forward exchange rate**.

The spot exchange rate is used for settlement on day T + 2, the second business day following the trade date. The only exception is CAD/USD, where the standard settlement is T + 1. In most financial markets, potential counterparties quote a two-sided price for market participants: the bid price and the offer price.

The **bid price** is expressed in terms of the price currency. It is the price at which a counterparty is willing to buy one unit of the base currency. On the other hand, the **offer price** is expressed in terms of the price currency. It is the price at which that counterparty is ready to dispose of (sell) one unit of the base currency. For example, a dealer might quote a USD/EUR exchange rate of 1.3849/1.3851. What does this imply?

This quote implies that the dealer is willing to pay USD 1.3849 to buy 1 euro. On the flip side, they are prepared to sell 1 euro for USD 1.3851. Intuitively, we expect the bid price to be slightly less than the offer price because the dealer's goal is to make a profit in every transaction. With that in mind, given a quote, it is easier to single out the bid price or the offer price.

The **bid-offer spread** is the amount by which the offer price exceeds the bid price. It is the difference between the highest price a purchaser is willing to pay and the least amount a seller is willing to accept.

Characteristics of Bid-offer Quotes

1. The offer price should always be higher than the bid price.
2. A market participant requesting the two-sided price quote has the option but not the obligation to transact at either the bid or the offer quoted by a dealer. If a party decides to trade at the quoted prices, they are said to have “hit the bid” or “paid the offer.” In other words, if a trader decides to sell to a dealer at the (dealer's) bid price, they are said to hit the bid. If they decide to buy at the offer price, they are said to have paid the offer.

Although most transactions involve a dealer and a client, dealers often transact amongst themselves in an environment referred to as the **interbank market**. Sales in the interbank market are usually large and involve at least a million units of the base currency.

The bid-offer spread is usually narrower in the interbank market than in the dealer-client market. This implies that dealers offer their fellow dealers slightly more favorable rates. Almost all currencies are quoted to four decimal places except the Japanese Yen, usually quoted to two decimal places. The last decimal point is called a pip.

Example: Calculating the Bid-offer Spread

The USD/GBP spot market rate is quoted at 1.3849/1.3851 in the interbank market. A dealer in the same market quotes the same spot rate as 1.3847/1.3852. Calculate the bid-offer spread in each case.

Solution

For the interbank quote, the spread is 2 pips wide (1.3851 – 1.3849 = 0.0002), while the dealer-client quote is 5 pips wide (1.3852 – 1.3847 = 0.0005).

In both cases, the bid-offer spread represents the compensation sought by a party in exchange

for providing liquidity to other market participants.

Factors Affecting the Bid-offer Spread

The size of the bid-offer spread depends primarily on the following three factors:

1. **The bid-offer spread in the interbank foreign exchange market for the two currencies involved**: The spread in the interbank market is directly proportional to the spread in the dealer-client market. As the spread in the interbank market increases (decreases), the spread in the dealer-client market increases (decreases).
2. **The transaction size**: The spread increases as the transaction size increases to reflect the difficulties the dealer faces while trying to offset the risk of the position in the interbank market. For example, a client eyeing a transaction to the tune of $100 million will receive a wider spread than another client whose deal is worth, say, $10 million.
3. **The relationship between the dealer and the client**: For instance, a seasoned (repeat) client might be provided with a spread smaller than that offered to a first-time client.

Question

Which of the following statements is *least likely* accurate?

A. The bid-offer spread is the difference between the offer price and the bid price.
B. The bid-offer spread is wider for larger transactions in the FX market.
C. The offer price is always smaller than the bid price.

Solution

The correct answer is C.

The offer price is always higher than the bid price since the market maker wants to make money for providing liquidity.

LOS 6b: Identify a triangular arbitrage opportunity and calculate the profit, given the bid-offer quotations for three currencies

Every bid-offer quote a dealer displays in the interbank FX market should possess the following properties to avoid the creation of arbitrage opportunity:

1. **The bid should not be higher than the current interbank offer**, **and the offer should not be lower than the current interbank bid**.

   If this rule is broken, an arbitrage opportunity will arise; that is, a market participant will buy from a cheaper source and sell to a more expensive source. This will eventually bring the two prices back in line.

   Example: Assume that the current spot USD/EUR is quoted as 1.3856/1.3858. Further, assume that a dealer's quote is 1.3859/1.361. Market participants in the interbank market will pay for the offer by purchasing EUR at USD 1.3858 and subsequently hit the dealer's bid by selling the EUR to them at 1.3859, making a riskless profit of 1 pip (1.3859 - 1.3858 = 0.0001).

2. **The dealer's cross-rate bids (offers) should be lower (higher) than the implied-rate offers (bids) available in the interbank market**.

   To illustrate this, consider the currency pairs X/Y and Z/Y. If we work out the cross-rate X/Z, it must be consistent with the X/Y and Z/Y rates. If this is not met, the arbitrageur will purchase currency Z from the dealer if its worth is undervalued with respect to the cross rate and sell X. Alternatively, if a dealer overvalues Z with respect to the cross rate, then it will be sold, and consequently, X will be purchased. This is called **triangular arbitrage**.

To identify triangular arbitrage, learning how to calculate the market-implied bid and offer rates is of utmost importance. Consider the examples below.

Example: Calculating the Market-implied Offer Rate

Assume that the bid-offers in a certain interbank for USD/EUR are 1.3850/1.3851, and JPY/USD is 75.66/75.68. The market-implied bid-offer on the JPY/EUR cross rate is *closest* to:

Solution

The relationship between the quotes above is represented as:

$$(\frac{\text{JPY}}{\text{EUR}}) = (\frac{\text{JPY}}{\text{USD}})(\frac{\text{USD}}{\text{EUR}})$$

When calculating the offer rate, the numerators of each term (both left- and right-hand sides of the above equation) are "sold," while the denominators are "bought." For instance, the left-hand side implies "sell JPY, buy EUR." That is, to get the implied cross-rate, we multiply the bid rates of the involved currencies (left-hand side of the above equation).

So,

$$\begin{aligned}(\frac{\text{JPY}}{\text{EUR}})_{\text{offer rate}} &= (\frac{\text{JPY}}{\text{USD}})_{\text{offer rate}}(\frac{\text{USD}}{\text{EUR}})_{\text{offer Rate}} \\ &= 75.68 \times 1.3851 \\ &= 104.824\end{aligned}$$

Example: Calculating the Market-implied Bid Rate

To compute the market-implied bid rate, we adopt a similar approach. However, the numerators of each term (both left-hand and right-hand sides of the cross-rate equation) are "bought" while the denominators are "sold." For instance, the left-hand side implies "Buy JPY, Sell EUR."

Therefore,

$$\begin{aligned}(\frac{\text{JPY}}{\text{EUR}})_{\text{bid rate}} &= (\frac{\text{JPY}}{\text{USD}})_{\text{bid rate}}(\frac{\text{USD}}{\text{EUR}})_{\text{bid rate}} \\ &= 75.66 \times 1.3850 \\ &= 104.789\end{aligned}$$

As expected, the implied cross-rate bid should be less than the offer rate.

Example: Calculating the Market-implied Bid and Offer Rates Via Inversion

Assume that the USD/GBP is 1.5846/1.5848, and the USD/EUR is 1.3850/1.3851. Calculate the implied GBP/EUR cross rate.

Solution

It is easy to see that:

$$\left(\frac{\text{GBP}}{\text{EUR}}\right) \neq \left(\frac{\text{USD}}{\text{GBP}}\right)\left(\frac{\text{USD}}{\text{EUR}}\right)$$

We need to invert the first term on the right-hand side so that:

$$\left(\frac{\text{GBP}}{\text{EUR}}\right) = \left(\frac{1}{\frac{\text{USD}}{\text{GBP}}}\right)\left(\frac{\text{USD}}{\text{EUR}}\right) = \left(\frac{\text{GBP}}{\text{USD}}\right)\left(\frac{\text{USD}}{\text{EUR}}\right)$$

So,

$$\begin{aligned}\left(\frac{\text{GBP}}{\text{EUR}}\right)_{\text{bid rate}} &= \left(\frac{\text{GBP}}{\text{USD}}\right)_{\text{bid rate}}\left(\frac{\text{USD}}{\text{EUR}}\right)_{\text{bid rate}} \\ &= \left(\frac{1}{1.5848}\right)(1.3850) \\ &= 0.8739\end{aligned}$$

And

$$\begin{aligned}\left(\frac{\text{GBP}}{\text{EUR}}\right)_{\text{offer rate}} &= \left(\frac{\text{GBP}}{\text{USD}}\right)_{\text{offer rate}}\left(\frac{\text{USD}}{\text{EUR}}\right)_{\text{offer rate}} \\ &= \left(\frac{1}{1.5846}\right)(1.3851) \\ &= 0.8741\end{aligned}$$

Note that arbitrage constraints on the implied cross-rates also apply to the spot rates. Further, note that any violations of these constraints will cause arbitrage opportunities, which will naturally disappear in a short time.

Example: Identifying a Triangular Arbitrage Opportunity and Calculating the Profit

Consider the following spot rates in an interbank market.

Currency	Quotation
SEK/USD	6.7738/6.7740
JPY/USD	80.86/80.88
CAD/USD	0.9543/0.9545
USD/EUR	1.35458/1.3560

Assume that an inexperienced dealer quotes a bid-offer rate of JPY/CAD as 84.63/84.70. To identify the triangular arbitrage, we need to calculate JPY/CAD:

$$\frac{\text{JPY}}{\text{CAD}} = \frac{\text{JPY}}{\text{USD}} \times \frac{\text{USD}}{\text{CAD}} = \frac{\text{JPY}}{\text{USD}} \times \left(\frac{\text{CAD}}{\text{USD}}\right)^{-1}$$

But,

$$\frac{\text{USD}}{\text{CAD}} = \left(\frac{\text{CAD}}{\text{USD}}\right)^{-1} = \frac{\left(\frac{1}{0.9545}\right)}{\left(\frac{1}{0.9543}\right)} = \frac{1.04767}{1.04789}$$

So that, USD/CAD is quoted as 1.04767/1.04789 and:

$$\left(\frac{\text{JPY}}{\text{CAD}}\right)_{\text{Bid}} = 80.86 \times 1.04767 = 84.71$$
$$\left(\frac{\text{JPY}}{\text{CAD}}\right)_{\text{Offer}} = 80.88 \times 1.04789 = 84.75$$

The implied interbank cross-rate for JPY/CAD is now 84.71/84.75. Going back to the dealer's quote of 84.63/84.70, the dealer is offering to sell CAD at a lower price (below the interbank quoted rate, 84.71). A prudent market participant would utilize this triangular arbitrage by purchasing CAD from the dealer and selling it in the interbank market, making a profit of $84.74 - 84.70 = 0.01$ per CAD involved.