

A STUDY ON ARBITRAGE OPPORTUNITY IN FOREX MARKET

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ABSTRACT

This research paper explores arbitrage opportunities in the forex market, with a focus on multi-currency and triangular arbitrage strategies. Utilizing a quantitative approach, the study examines high-frequency trading data from major currency pairs including USD/CHF, USD/JPY, EUR/CHF, EUR/GBP, EUR/JPY, EUR/USD, and GBP/USD. By collecting real-time exchange rate data from multiple trading platforms, the research aims to identify price discrepancies that can be exploited for arbitrage.

In addition to identifying arbitrage opportunities, the study considers execution risks, and regulatory impacts to provide a comprehensive assessment of the feasibility and practicality of these strategies. The findings aim to deepen the understanding of arbitrage dynamics in the forex market and offer actionable insights for traders seeking to capitalize on market inefficiencies.

INTRODUCTION

The foreign exchange market (forex) is the largest and most liquid financial market in the world, with an average daily trading volume exceeding \$6 trillion. It operates 24 hours a day, five days a week in the world's major financial centers. Forex trading makes it easy to exchange one currency for another at an agreed price. Central banks, commercial banks, hedge funds, multinational corporations and individual traders participate in these markets. The prices of currencies in the foreign exchange market are influenced by various economic, political and social factors, which leads to constant fluctuations and arbitrage opportunities. Forex trading involves buying one currency and selling another at the same time. Currencies are traded in pairs, with one currency traded against another. The value of a currency pair is determined by the exchange rate, which indicates the ratio at which one currency can be exchanged for another.

WHAT IS ARBITRAGE?

Arbitrage is a trading strategy used by investors to take advantage of price differences between different markets or instruments. The basic principle of arbitrage is to buy cheap from one market and sell at a higher price in other market and earn profit from the price difference of the transaction.

- EUR/GBP – GBP/USD – EUR/USD
- EUR/USD – USD/JPY – EUR/JPY
- EUR/USD – USD/CHF – EUR/CHF
- EUR/GBP – GBP/USD – USD/JPY – EUR/JPY
- EUR/GBP – GBP/USD – USD/CHF – EUR/CHF

Forex pairs for arbitrage example free

- EUR/USD is trading at 1.20 (Euros per USD) on Platform A.
- EUR/GBP is trading at 0.80 (Euros per GBP) on Platform B.
- GBP/USD is trading at 1.50 (USD per GBP) on Platform C.

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The first roundtrip is EUR/USD, USD/CHF and EUR/CHF, the second is EUR/GBP, GBP/USD and EUR/USD, and the last is EUR/USD, USD/JPY and EUR/JPY. They show that triangular arbitrage opportunities do exist for these particular roundtrips, and that arbitrage profit increases as trading activity decreases.

LITERATURE REVIEW

Kristian Dukov, Eleni Kyriaki, 2014 : Using Fama's Efficient Market Hypothesis (EMH), researchers have attempted to demonstrate market efficiency over the past decade. According to the theory, an investor cannot increase his return without increasing the level of risk. The types of market efficiency can be found according to the information contained in the traded commodity. The statement suggests that "there is no such thing as a free lunch." However, after studying different markets, researchers came to conflicting conclusions, so the topic is still controversial. In general, increasing market volatility has been found to be a sign of market imperfection in emerging markets. Investors are usually quick to spot these market inefficiencies, hoping to exploit them and profit.

Q. Farooq Akrama, Dagfinn Rimea and Lucio Sarnob, 2007 : This article presents the frequency, size and duration of real-time arbitrage opportunities and deviations from the Law of One Price (LOP) in the forex market. Using a unique dataset of three major stock and currency markets covering a period of more than seven months, we examine deviations from the covered interest parity (CIP) condition (also known as "return arbitrage"). and price differences between markets (also known as "one-way arbitrage").

Takatoshi Ito, Kenta Yamada, Misako Takayasu, Hideki Takayasu, 2012 : Free lunches or risk-free arbitrage opportunities do happen in the forex market, but they usually only last a few seconds. This is detected by "fixed" quotes from EBS (Electronic Broking System) data. Negative spreads in a currency pair and triangular arbitrage relationships involving three currency pairs are examples of "free lunches". The former are much less common than the latter. Such arbitrage opportunities usually arise in active and volatile markets. The number of free lunch opportunities decreased dramatically over the 12-tick data samples,

Takatoshi Ito, Kenta Yamada, Misako Takayasu, Hideki Takayasu, 2020 : Arbitrary winning opportunities can be identified as appearing and disappearing in seconds. Due to the high frequency of fixed quote data on the forex trading platform, these opportunities can appear as a negative bid-ask spread for a currency pair or as triangular events involving three currency pairs. These arbitrage opportunities have become less frequent and longer over time, likely as a result of algorithmic trading.

Zhenyu Cui, Zenhan Qian, Stephen Taylor, Lingjiong Zhu, 2018 : The theoretical and computational framework presented in this paper can be used to detect and detect (triangular) arbitrage opportunities between spot rates in foreign exchange markets. We derive sufficient conditions to eliminate the possibility of triangular arbitrage in markets that may or may not have transaction costs such as market frictions.

INDUSTRY OVERVIEW

The foreign exchange market (forex) is the largest and most liquid financial market in the world, with an average daily trading volume exceeding 6 trillion dollars. Operating continuously five days a week, it facilitates the exchange of currencies at agreed exchange rates in major financial centers around the world. There are various players in this market such as central banks, commercial banks, hedge funds, multinational companies and individual traders. Each of them plays an important role in maintaining liquidity and managing exchange rate fluctuations influenced by various economic, political and social factors. Forex trading strategies range from spot trading to complex derivatives such as futures, options and swaps that allow participants to hedge or speculate on currency movements. Forex arbitrage, including spatial, triangular and multi-currency strategies, exploits price differences between different exchanges or currency pairs to generate risk-free profits.

RESEARCH GAP IN FOREX MARKET ARBITRAGE OPPORTUNITIES

The foreign exchange (forex) market is generally considered efficient, with arbitrage opportunities being rare and fleeting. However, there's always room for interesting research in this area. Here are a few potential research gaps you could explore in your paper on forex arbitrage opportunities:

1. Impact of High-Frequency Trading (HFT) on Retail Arbitrage:

- While traditional arbitrage involves exploiting price discrepancies, HFT algorithms exploit these inefficiencies in milliseconds, making it difficult for retail traders to compete.
- Research the impact of HFT on the frequency and profitability of forex arbitrage opportunities available to retail traders.

2. Triangular Arbitrage in Emerging Markets:

- Triangular arbitrage involves exploiting price discrepancies across three currencies. Existing research suggests these opportunities might be more prevalent in emerging markets with higher volatility.
- Investigate the frequency and profitability of triangular arbitrage opportunities in specific emerging markets compared to developed markets.

RESEARCH METHODOLOGY

Objective of the study

1. To identify and analyze the various types of arbitrage opportunities in the forex market.
2. To investigate the risks associated with forex arbitrage and their management.
3. To explore the tools and platforms essential for successful forex arbitrage.
4. To forecast future trends and opportunities in forex arbitrage.

Research Design

This quantitative study investigates arbitrage opportunities in the forex market, focusing on multi-currency and triangular arbitrage. It utilizes high-frequency trading data from major currency pairs such as USD/CHF, USD/JPY, EUR/CHF, EUR/GBP, EUR/JPY, EUR/USD, and GBP/USD. Real-time exchange rate data from multiple trading platforms will be collected to identify arbitrage discrepancies. The methodology involves constructing arbitrage roundtrips like EUR/GBP – GBP/USD – EUR/USD and EUR/USD – USD/JPY – EUR/JPY, and analyzing their profitability using advanced algorithms and statistical models. The study also considers transaction costs, execution risks, and regulatory impacts to assess the feasibility of these arbitrage strategies, aiming to provide practical insights for traders on exploiting market inefficiencies.

ANALYSIS AND INTERPRETATION OF DATA

The Foreign Exchange Market

The FX market is a market for trading currencies which is globally dispersed, i.e. it determines the values of different currencies. In order to keep this market globally decentralized financial centres, that purposes as anchors, connect a wide range of different buyers and sellers. The main participants in forex market are larger international banks (The Economist 2005).

1. Types of Arbitrage in Forex Market

There are different types of arbitrage strategies that can be applied in the forex market:

- **Spatial Arbitrage:** This refers to taking advantage of price differences between different forex brokers or exchanges. Traders can exploit discrepancies in currency prices by simultaneously buying at a lower price from one source and selling at a higher price to another.
- **Triangular Arbitrage:** Triangular arbitrage is a more complex strategy that involves taking advantage of discrepancies between currency exchange rates involving three different currency pairs. This strategy exploits the cross-rates relationship to identify and execute profitable trades, ensuring that the triangular arbitrage condition is met.
- **Temporal Arbitrage:** Temporal arbitrage, also known as time arbitrage, involves capitalizing on temporary

price discrepancies of the same currency pair over time. Traders monitor currency prices closely and execute trades to take advantage of short-lived discrepancies before they are corrected.

2. Identifying and Analyzing Arbitrage Opportunities

Arbitrage is termed as finding a good deal. In the Forex market, where currencies are traded, it means spotting when the price of a currency is different in different markets. You can then buy it where it's cheaper and sell it where it's more expensive to make a profit. It's a smart way to make money without taking much risk.

2.1. Identifying Arbitrage Opportunities

- Monitoring Currency Prices
- Spotting Currency Mispricing
- Analyzing Market Liquidity

2.2. Analyzing Arbitrage Opportunities

- Calculating Transaction Costs
- Assessing Market Risk
- Evaluating Regulatory and Legal Factors

Executing and Managing Arbitrage Trades in Forex Market

Steps for Executing Arbitrage Trades

1. Identify Potential Opportunities
2. Analyze and Confirm Discrepancies
3. Execute Trades Swiftly
4. Manage Risk and Monitor Positions
5. Settlement and Profit Realization

Example of Triangular Arbitrage

Suppose we're working with three currencies: USD, EUR, and GBP. The key to triangular arbitrage is exploiting discrepancies in the currency exchange rates.

Step 1: Identify the exchange rate discrepancy

Let's say the current market exchange rates are as follows:

- USD/EUR = 0.85
- EUR/GBP = 0.70
- GBP/USD = 2.00

These currency rates mean that 1 USD equals 0.85 EUR, 1 EUR equals 0.70 GBP, and 1 GBP equals 1.50 USD.

Step 2: Calculate the implied cross exchange rates

- Implied USD/GBP = USD/EUR x EUR/GBP = $0.85 \times 0.70 = 0.595$

Based on the above, 1 USD should be exchangeable for 0.595 GBP for an arbitrage opportunity.

Step 3: Compare with the actual exchange rate

The actual exchange rate for GBP/USD is 2.00, which is equal to a USD/GBP rate of $1/2.00 = 0.5$. This is lower than the implied rate of 0.595. Thus, there is the potential for triangular arbitrage.

Step 4: Execute the arbitrage

Let's say the trader has 100,000 USD. The execution of the trades would be as follows:

- Buy EUR with 100,000 USD at the 0.85 rate:

$$100,000 \times 0.85 = 85,000 \text{ EUR}$$

- Use the 85,000 EUR proceeds to buy GBP at the 0.70 rate.

$$85,000 \times 0.70 = 59,500 \text{ GBP}$$

- With the 59,500 GBP, purchase USD at the 2.00 rate.

$$59,500 \times 2.0 = 119,000 \text{ USD.}$$

Step 5: Calculate the profit

The trader began with 100,000 USD and ended with 119,000 USD. Thus the profit is $119,000 - 100,000 = 19,000$.

Thus, the trader received a triangular arbitrage of 19,000.

Top Currency Pair

1. Major Currency Pairs

1.1. EUR/USD (Euro/US Dollar)

Description: The EUR/USD pair represents the exchange rate between the euro, the currency of the Eurozone, and the US dollar, the currency of the United States. This pair is the most traded in the world.

Factors Affecting the Pair:

1. Economic Data: GDP growth, unemployment rates, inflation, and other economic indicators from both the Eurozone and the US.
2. Monetary Policy: Decisions and statements from the European Central Bank (ECB) and the Federal Reserve (Fed) regarding interest rates and other monetary policies.
3. Political Events: Elections, political stability, and policy changes within the Eurozone and the US.
4. Market Sentiment: General risk sentiment can drive demand for either the safe-haven US dollar or the euro.

1.2. USD/JPY (US Dollar/Japanese Yen)

Description: The USD/JPY pair represents the exchange rate between the US dollar and the Japanese yen.

Factors Affecting the Pair:

1. Economic Data: Key economic indicators from the US and Japan, such as GDP, industrial production, and employment figures.
2. Monetary Policy: Actions and statements from the Bank of Japan (BoJ) and the Federal Reserve.
3. Geopolitical Events: Regional tensions in Asia can impact the yen as a safe-haven currency.
4. Market Sentiment: Risk-on/risk-off sentiment strongly influences the demand for the yen.

1.3. GBP/USD (British Pound/US Dollar)

Description: The GBP/USD pair, often referred to as "Cable," represents the exchange rate between the British pound sterling and the US dollar.

Factors Affecting the Pair:

1. Economic Data: Indicators from the UK and the US, such as retail sales, inflation, and housing data.
2. Monetary Policy: Interest rate decisions and monetary policy from the Bank of England (BoE) and the Federal Reserve.
3. Political Events: Brexit developments, UK elections, and other political events.
4. Market Sentiment: Influenced by global economic conditions and investor sentiment.

1.4. USD/CHF (US Dollar/Swiss Franc)

Description: The USD/CHF pair represents the exchange rate between the US dollar and the Swiss franc.

Factors Affecting the Pair:

1. Economic Data: Economic indicators from the US and Switzerland.
2. Monetary Policy: Actions from the Swiss National Bank (SNB) and the Federal Reserve.
3. Safe-Haven Demand: The Swiss franc is considered a safe-haven currency, attracting demand during times of market uncertainty.
4. Geopolitical Events: Global risk factors and geopolitical tensions.

1.5. AUD/USD (Australian Dollar/US Dollar)

Description: The AUD/USD pair represents the exchange rate between the Australian dollar and the US dollar.

Factors Affecting the Pair:

1. Economic Data: Economic indicators from Australia and the US.
2. Commodity Prices: Australia's economy is heavily dependent on commodities like gold and iron ore, so commodity prices impact the AUD.
3. Monetary Policy: Decisions from the Reserve Bank of Australia (RBA) and the Federal Reserve.
4. Market Sentiment: Risk sentiment and global economic conditions.

1.6. USD/CAD (US Dollar/Canadian Dollar)

Description: The USD/CAD pair represents the exchange rate between the US dollar and the Canadian dollar.

Factors Affecting the Pair:

1. Economic Data: Key economic indicators from the US and Canada.
2. Oil Prices: Canada is a major oil exporter, so oil prices significantly impact the CAD.
3. Monetary Policy: Actions from the Bank of Canada (BoC) and the Federal Reserve.
4. Trade Relations: US-Canada trade relations and agreements.

1.7. NZD/USD (New Zealand Dollar/US Dollar)

Description: The NZD/USD pair represents the exchange rate between the New Zealand dollar and the US dollar.

Factors Affecting the Pair:

1. Economic Data: Economic indicators from New Zealand and the US.
2. Commodity Prices: New Zealand's economy relies on commodities like dairy products.
3. Monetary Policy: Decisions from the Reserve Bank of New Zealand (RBNZ) and the Federal Reserve.
4. Market Sentiment: Influenced by global risk sentiment and economic conditions.

2. Minor Currency Pairs

Minor pairs, or cross-currency pairs, do not include the US dollar but involve other major currencies.

Examples include:

- EUR/GBP: Euro/British Pound
- EUR/JPY: Euro/Japanese Yen
- GBP/JPY: British Pound/Japanese Yen

These pairs can offer good trading opportunities but usually have higher spreads compared to major pairs due to lower liquidity.

3. Exotic Currency Pairs

Exotic pairs consist of one major currency and one currency from a smaller or emerging economy.

Examples include:

- USD/TRY: US Dollar/Turkish Lira
- USD/SEK: US Dollar/Swedish Krona

These pairs can be highly volatile and have wider spreads, making them riskier to trade but potentially more rewarding for experienced traders.

Comparison between Forex and Indian share market

1. Liquidity and Market Size:

Forex Market:

- Liquidity: The Forex market is the largest financial market globally, with a daily trading volume exceeding \$6.6 trillion. This immense liquidity ensures that trades can be executed swiftly without significantly impacting prices.
- Market Size: With its vast size, the Forex market offers ample opportunities for traders to enter and exit positions at any time during trading hours.

Indian Stock Market:

- Liquidity: The Indian stock market has a total market capitalization of over \$3 trillion, making it one of the largest stock markets in the world. Liquidity can vary between large-cap and small-cap stocks, with large-cap stocks generally offering higher liquidity.
- Market Size: While substantial, the Indian stock market's size is smaller compared to the Forex market. However, it still provides significant trading opportunities, especially in major indices and blue-chip stocks.

2. Leverage:

Forex Market:

- Leverage: Forex trading typically offers high leverage, allowing traders to control large positions with a relatively small amount of capital. Leverage ratios can vary from 50:1 to 100:1 or even higher, depending on the broker and jurisdiction.

- Impact: While leverage amplifies potential returns, it also magnifies the risks. Traders must exercise caution and implement proper risk management strategies to mitigate potential losses.

Indian Stock Market:

- Leverage: In the Indian stock market, leverage is available through margin trading, though it's generally lower compared to the Forex market. Retail investors typically have access to leverage ratios of up to 2:1, while margin accounts for institutions may offer higher leverage.

- Regulation: Leverage in the Indian stock market is subject to regulatory oversight from authorities like SEBI (Securities and Exchange Board of India), ensuring prudent use and risk management by market participants.

3. Factors Influencing Performance:

Forex Market:

- Economic Indicators: Interest rates, employment data, GDP growth, and inflation figures impact currency values.

- Geopolitical Events: Political instability, trade tensions, and conflicts can affect market sentiment and currency prices.

- Central Bank Policies: Monetary policy decisions, such as interest rate changes and quantitative easing, influence currency valuations.

Indian Stock Market:

- Economic Indicators: GDP growth, inflation rates, and industrial production figures influence stock market performance.

- Policy Reforms: Government policies, reforms, and regulatory changes can impact investor sentiment and market outlook.

- Global Factors: International economic conditions, trade dynamics, and geopolitical events can affect capital flows and market sentiment.

4. Risk and Volatility:

Forex Market:

- Risk: High leverage in the Forex market increases both potential returns and risks. Traders can experience significant losses if proper risk management is not implemented.

- Volatility: Currency pairs can experience substantial price movements, especially during periods of market uncertainty and economic turbulence.

Indian Stock Market:

- Risk: While the Indian stock market offers lower leverage compared to Forex trading, it still carries inherent risks. Market volatility, sector-specific risks, and regulatory changes can impact investment portfolios.

- Volatility: Stock prices can fluctuate widely in response to corporate earnings, economic indicators, and market sentiment.

Scope of Future Arbitrage Opportunities in the Forex Market

1. Technological Advances- High Frequency Trading (HFT)
2. Blockchain and Cryptocurrency- Decentralized Exchanges
3. Market Integration and Globalization- Emerging Markets
4. Economic and Geopolitical Factors- Geopolitical Events

FINDINGS

Triangular Arbitrage: Triangular arbitrage opportunities exist in the forex market, particularly in situations where discrepancies arise in the quoted cross rates of three currency pairs. These opportunities, although often short-lived, can provide risk-free profit potential.

Market Volatility: Increased market volatility often leads to more arbitrage opportunities as price discrepancies become more pronounced. During periods of high volatility, traders can find more frequent opportunities to execute arbitrage strategies.

High-Frequency Trading (HFT): HFT significantly enhances the ability to detect and exploit arbitrage opportunities. The use of advanced algorithms and high-speed trading platforms allows for the rapid execution of trades, minimizing latency and maximizing profit potential.

Diversification Benefits: Diversifying across different types of arbitrage strategies (e.g., triangular, spatial, and multi-currency) can help spread risk and increase the chances of finding profitable trades.

CONCLUSION

The foreign exchange market, being the largest and most liquid financial market globally, presents a dynamic environment for a wide range of participants including central banks, commercial banks, hedge funds, multinational corporations, and individual traders. This market's 24-hour operation across global financial centers facilitates continuous opportunities for various trading strategies, notably arbitrage. Arbitrage in the forex market involves taking advantage of price differences in different markets to make a profit. Despite the potential for profit, forex arbitrage carries significant risks. Market fluctuations can erode anticipated gains, while execution delays can result in missed opportunities. Additionally, transaction costs, such as spreads and fees, can diminish returns. Effective risk management strategies are crucial to mitigate these risks. This includes using automated trading systems that can execute trades swiftly and accurately, as well as maintaining a robust understanding of market conditions and liquidity. The success of forex arbitrage heavily depends on the tools and platforms available to traders. Advanced software applications can quickly identify arbitrage opportunities and execute trades within milliseconds, a necessity in the fast-paced forex market. High-speed internet connections ensure rapid access to market data and execution capabilities. Reliable brokers, who offer low latency and tight spreads, further enhance the potential for profitable arbitrage trading. Additionally, platforms that provide comprehensive market analysis and back-testing capabilities can help traders refine their strategies and manage risks more effectively. Looking forward, the future of forex arbitrage is promising, driven by ongoing technological advancements and increasing market access. Innovations in artificial intelligence and machine learning are expected to enhance the ability to predict and exploit arbitrage opportunities. Additionally, the global expansion of forex markets and the growing interconnectivity of financial systems are likely to create more frequent and diverse arbitrage possibilities. Traders who stay abreast of these technological trends and continuously adapt their strategies will be well-positioned to capitalize on future opportunities in forex arbitrage.

LIMITATIONS OF THE STUDY

- **Historical Data Availability:** The study may rely on historical data, which might not capture real-time market conditions accurately. Limited availability of historical high-frequency data can impact the comprehensiveness of the analysis.

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- **Rapid Market Changes:** The forex market is highly volatile and can change rapidly due to economic news, geopolitical events, and other factors. These sudden changes can make it difficult to predict and capitalize on arbitrage opportunities.
- **Technical Failures:** Technical failures, such as system crashes or connectivity issues, can disrupt trading activities and result in missed opportunities or losses.
- **Transaction Costs:** Forex trades incur costs like spreads (difference between buy and sell prices) and commissions. These costs eat into potential profits, especially for small arbitrage opportunities.