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Triangular Arbitrage Process in FOREX Market in Different Countries: A Case Study of German DM and French FF

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Abstract

The topic of investigation for this research paper is triangular arbitrage for brief and irregular periods of time. The purpose of using import and export trade activity in a triangle arbitrage strategy is to hedge risk and make a profit for arbitrageurs operating in international foreign exchange markets. This study utilizes a purely quantitative methodology and technique to analyze and contrast the spot exchange rates of three (triangular) currencies in two geographically distinct nations in Europe over the course of a predetermined amount of time. Arbitrageurs, importers, exporters, academics, and researchers who are interested in understanding the logics, route, and techniques of calculating triangular arbitrage would find this study beneficial. Based on the findings, it seemed that there is a good arbitrage opportunity between currencies and their respective locations, as described by the route diagram of triangular arbitrage.

Keywords: FOREX, spot market, arbitrage, triangular arbitrage

Introduction

(Barunik, Kočenda, & Vácha, 2017) ^[4] state in their research regarding both positive and negative spillover in FOREX in the nations of Europe. According to their analysis, there are a number of economic variables that interact with one another and have a big impact in the volatility of currencies that spill over into the European FOREX market. In addition of that (Geromichalos & Jung, 2018) ^[7] state that FOREX market is usually a over the counter market where arbitrageurs take advantages of deviation in bid and ask prices of different currencies. They also predict model how the volume of international trade affects the overall currency market worldwide. Further (Ito & Yabu, 2007) ^[9] in their paper support time series historical data of Japanese foreign exchange market behavior as a cost minimizing factor in international trade. (Moore & Roche, 2002) ^[15] in their very interesting study the economy methodology of currencies' forward rates compared with currencies' spot rates. In the model they predict covariance between the spot prices as well forward prices of different currencies. In their study they also demonstrate relationship between interest rate factors with forward rates of currencies taken. (Kaltwasser, 2010) ^[10] present heterogeneous model of foreign exchange market where they discuss various models of exchange rate behavior. They further conclude that determination of exchange rates is governed by fundamentalist traders operating in FOREX market.

Hypothesis Formulation

H1: FOREX market has significant impact on international trade

H1^a: International trade is positively related with triangular arbitrage

Literature Review

(Fenn, Howison, McDonald, Williams, & Johnson, 2009) ^[5] investigate the many repercussions of using triangle arbitrage, but confine your research to the spot markets of the different currencies. They investigate the many different occurrences that arbitrageurs take advantage of in order to make enormous profits in the FOREX market throughout the globe. In addition of Fenn *et al* (Aiba & Hatano, 2004) ^[1] in their interesting study explore the features of triangular arbitrage over regular arbitrage by depicting correlation between various spot rates of currency. (Moosa, 2001) ^[16] describes in his paper about similarities and difference between triangular arbitrage in spot rates and in the interest rates of various currencies in various foreign exchange markets. (Mavrides, 1992) ^[14] The demand and supply of currencies in the markets that are now in existence, according to what is stated in book on foreign currency, are what decide whether or not triangular arbitrage is possible. (Aiba *et al.*, 2003) ^[3] in their significant study describe the significance of triangular arbitrage and its impact on economy keeping various macro-economic factors in mind.

In their model they successfully analyzed correlation among difference currencies.(Gębarowski, Oświęcimka, Wątopek, & Drożdż, 2019) [6] in their paper write and discuss major correlation between eight major currencies of the world depending upon their transactions and contribution towards economic development. The study done by (Goldstein, 1964) [8] though very old but very significance in this paper as he argues the effects of economy towards fluctuations in currencies value in home country as well as foreign country. Not only (Reynolds, Sögner, & Wagner, 2021) [19] do place an emphasis on the relevance of the arbitrage process, but it also results in hedging against the risk exposures that are associated with the trading industry. They do nothing more than construct a time frame model in which the prices of various currencies on the FOREX market exhibit the greatest amount of volatility possible. (Aiba, Hatano, & Applications, 2006) [2] addresses these concerns once again in their analysis of the implementation of triangle arbitrage in spot market. They did a research that contradicted their own in 2003, and in that study, they took into account a number of different microeconomic variables that impact the spot exchange rates of currencies. (Wang, Li, Liang, & Li, 2008) [20] in their unique study give insights of currency forecasting on the basis of their spot prices. They consider forecasting of currencies could develop more robust decision making in order to hedge against risk exposures in doing international trade. (Kühl, 2018) [13] in his paper discusses the co movements of European currencies with respect to US dollar. Furthermore he describes role of other macro-economic factors affecting the fluctuations among currencies. (Kisaka, Rose, Ganesh, & Gituro, 2008) [11] discuss in their Kenyan focused research paper about the historical currency rates and applied Box-Jenkins approach of forecasting the future of its domestic currency. More of support of previous studies (Nakamura & Small, 2007) [17] analyze correlation among top rated foreign currencies from S&P 500 index and accordingly rate them.(Nan & Kaizoji, 2020) [18] in their research make emphasis on hedging against risk on the basis of bitcoin spot rates prevailing in the international market. (Kozhan & Tham, 2008) [12] in their study point out pros and cons of arbitrage and its types in international FOREX market. They predict model of assumptions and evidence having their experiences of arbitrage whether done to hedge or making profits.

Hypothesis Formulation

- H1^a:** Triangular arbitrage is positively related with spot prices of currencies.
- H2^b:** Triangular arbitrage is negatively related with spot prices of currencies.
- H3^b:** Triangular arbitrage is neutral with spot prices of currencies.

Case Statement

As per research hypothesis formed a case has been formed from Europe on February 23, 2023, the price of one German Mark in the FOREX market in Berlin was listed at \$0.5428/DM, while the price of one German Mark in the FOREX market in Paris was given at FF 3.3538/DM and FF 6.1787/USD on the same day. In addition to this, it is anticipated that international traders based in Germany will be involved in the importing and exportation of goods and services, as well as the receipt of and payment of dues to counter parties involved in either making profits or hedging based on the spot rates of currencies that are prevalent on the

same date in two different markets. This activity will take place in both domestic and international markets.

Assumptions

- Transaction costs ignored
- Taxation policies and aspects ignored
- Free trade and no trade barriers between different FOREX markets in Europe

Hypothetical Model of Triangular Arbitrage

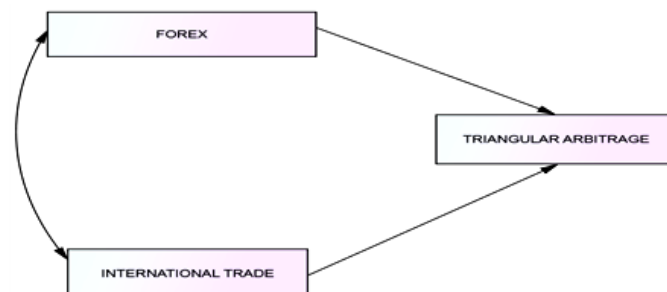


Fig 1: Hypothetical Model of Triangular Arbitrage

Research Methodology

This study is based on understanding triangular arbitrage, which is comprised of currencies taken as a part of a case study to understand the arbitrage process as German Mark (DM), French Franc (FF), and their pegged currency USD on two FOREX spot markets in Berlin (Germany) and Paris (France) as of February 23, 2023. This study was conducted in Germany and France. The German Mark and the French Franc were chosen after the erratic exchange rate fluctuations of their respective histories were analyzed and considered.

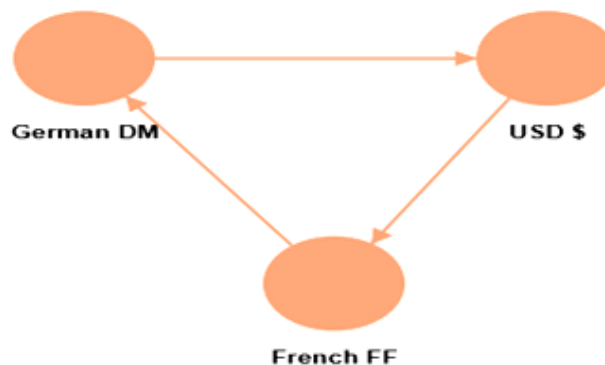


Fig 2: Path diagram case: Triangular Arbitrage Process

Analysis and Discussion

Dated 23 Feb; 2023, source: currency converter

- 1 German DM= USD 0.5428 (Berlin FOREX Market)
- 1 German DM= FF 3.2538 (Paris FOREX Market)
- 1 USD = FF 6.1787 (Paris FOREX Market)

Case: Identify chances of hedging and profits by the triangular arbitrage process (short time) on the basis of their spot prices in various FOREX markets in Europe,
 $\$/DM = \0.5428 ------(i)
 $FF/DM = FF 3.3538$ ------(ii)
 $FF/\$ = 6.1787$ ------(iii)
 Verifying if case of triangular arbitrage leads to chances of profits from one FOREX market to another.
 $\$/DM = \0.5428
 Changing into DM against USD (\$) $DM/\$ = 1/05428$

DM/\$ = DM 1.8422.....(iv)

Further

FF/DM = FF 3.2538(v.)

DM/FF = 1/3.2538

DM/FF = 0.3073(vi)

FF/\$ = FF 6.1787(vii)

Change equation vi and vii as per equation iv i.e. changing (vi) and (vii) into DM/\$ as mentioned below

DM/FF* FF/\$ = 0.3073*6.1787

DM/\$ = DM 1.8987.....(viii)

Upon comparing equation (iv) and equation (viii) the result of spot rates are compared as

DM 1.8422 and DM 1.8987 thus proves that trader can acquire (buy) DM in Berlin and convert (sell) in another market (Paris) thus to get advantage of triangular arbitrage. Because of this, on the basis of the study goals and hypotheses, it was determined that participation in the FOREX market may lead to international commerce depending on the types of firms involved. There may be a positive correlation between the FOREX market and international commerce, and vice versa. The scenario that was chosen to illustrate the topic of this article clearly depicts the nature of trade as arbitraging and the obvious worldwide exposure that it has on two nations called France and Germany. It was also discovered, as was specified in the framed hypothesis, that an international triangular arbitrage has a positive relationship with spot prices of respective currencies and has a considerable influence on these prices; this led to the acceptance of the alternative hypothesis.

Further Scope of Study

Arbitrage is a delicate procedure that is used to hedge against the many different sorts of risks that are associated with managing foreign currency. Currency derivatives, which include forward contracts, future contracts, and options derivatives, are the many profit-making and risk-reducing strategies that traders and arbitragers have at their disposal. This case study was centered on triangle arbitrage between three distinct currencies in two spot markets; hence, it leaves room for future research into accepting bid and ask rates in spot markets and forward markets.

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