AN INVESTIGATION INTO THE EXISTENCE OF FOREIGN CURRENCY BORROWER ARBITRAGE IN THE KENYAN COMMERCIAL BANKS

BY

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DECLARATION PAGE

I hereby declare that this research project is my own work and effort and that it has not been submitted anywhere for any award. Where other sources of information have been used, they have been acknowledged.

Signed ………………………………… Date …………………………

HENRY KISSINGER FIGONDO – D63/67895/2011

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This Research Project has been submitted for examination with my approval as the University Supervisor

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I appreciate the efforts made by my supervisor during this project development. I also appreciate the mental and material efforts made by my family members during this proposal development.

DEDICATION

I dedicate this work to my family and class mates

ABSTRACT

An arbitrage trading strategy whereby an investor capitalizes on the interest rate differential between two countries by using a forward contract to cover (eliminate exposure to) exchange rate risk.The study sought to establish the existence or otherwise of foreign exchange rate arbitrage (borrowers' arbitrage) opportunities between Kenya Shilling denominated loans and US dollar denominated loans. The specific objectives of the study were: to establish the existence of individual currency arbitrage on USD, GBP and EUR in the commercial banks in Kenya and to establish the significance of the arbitrage in selected banks in Kenya.

The study used secondary data that were obtained from the Central Bank of Kenya and selected Commercial Banks in Kenya. The banks were selected inform of their profit performance where the researcher went for the best performing banks. Data was then analyzed using descriptive statistics where mean and mode were used to give the central tendency of the forex prices on whether it is uniformly distributed or not uniformly distributed. Inferential statistic was also used where paired t-test was used to give significance of the performance. This helped the researcher obtain reaction level of the financial market.

The study found out that arbitrage existence with some currencies at different banks depending on the time of the year though the gains made by the financial institutions or individuals were not significant in most of the opportunities that existed. the study also found out that that it is not possible to earn positive returns by borrowing domestic assets for lending, in a similar asset, abroad (or vice versa) while covering the exchange rate risk through a forward contract of equal maturity. Domestic and foreign interest-bearing assets can be considered similar if they are of equal maturity and share the same characteristics, such as liquidity and political and default risk. Further, it indicates that it appears that profitable CIP arbitrage when measured, e.g., from the viewpoint of a domestic arbitrageur precludes profitable BA opportunities for a domestic fund raiser while the converse may not be true. If a positive return can be gained in domestic currency by borrowing domestic funds to lend abroad, it will also be relatively dearer to borrow funds abroad (when measured in domestic currency), but the converse may not be the case. The paper then recommends banks and similar financial institutions to be vigilant of traders and arbitrageurs seeking to exploit arbitrage opportunities in the foreign currency denominated assets or liabilities. In turn, very short-term arbitrage opportunities invite traders to exploit them and hence will be quickly eliminated. Traders and other borrowers are encouraged to exploit these opportunities whenever there are opportunities.

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ABBREVIATIONS

APT   -   Arbitrage Pricing Theory

BA   -   Borrower Arbitrage

bps   -   Bits per Second (used to measure change in a financial instrument)

CBK   -   Central Bank of Kenya

CBN   -   Central Bank of Nigeria

CIP   -   Covered Interest Rate Parity

EBS   -   Electronic Broking System

EMH   -   Efficient Market Hypothesis

"FOREX" or "FX"   -   Foreign Exchange

IFEM   -   Inter -Bank Foreign Exchange Market

IRP   -   Interest Rate Parity

LOP   -   Law of One Price

NBFI   -   Non-Bank Financial Institutions

OA   -   Owner Arbitrage

OTC   -   Over the Counter

WDAS   -   Wholesale Dutch Auction System

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Arbitrage is one of the fundamental pillars of financial economics and seems to be generally accepted that financial markets do not offer risk-free arbitrage opportunities, at least when allowance is made for transaction costs (Akram, Rime, & Sarno, 2008). This notion is directly related to the law of one price, which postulates that in well-functioning, efficient financial markets identical securities must have the same price, no matter how they are created. For example, if a derivative instrument can be created using two different sets of underlying securities, then the total price for each derivative instrument would be the same or else an arbitrage opportunity would exist. Arbitrage is the mechanism that should ensure the validity of the law of one price (Agenor, Hoffmaister, & Medeiros, 1997).

While the assumption of no arbitrage is likely to be reasonably mild or valid in several contexts in finance, violations of the law of one price can be rationalized on several grounds. In general terms, the absence of arbitrage opportunities gives rise to the so-called 'arbitrage paradox', first pointed out by(Grossman & Stiglitz, 1980). That is, if arbitrage is never observed, market participants may not have sufficient incentives to watch the market, in which case arbitrage opportunities could arise. A possible resolution to this paradox is for very short-term arbitrage opportunities to arise, inviting traders to exploit them, and hence be quickly eliminated. Also, microstructure theory shows how price differences may occur for identical assets in markets that are less than fully centralized or with an imperfect degree of transparency (Farroq, Dagfinn, & Luciosa, 2006).

Ducan, (2011) indicates that theory often assumes that markets are efficient, meaning that prices fully reflect their fundamental values and it is widely believed that the foreign exchange market is

one of the most efficient markets. In reality, however, there exist frictions, information asymmetry, and non-synchronous trading that cause market inefficiency. The least disputed evidence against market inefficiency may be the existence of arbitrage. (Brown, Ongena, & Yesin, 2009) add that arbitrage is often defined as the simultaneous purchase and sale of an asset in order to profit from a difference in the price. It is a trade that profits by exploiting price differences of identical or similar financial instruments, on different markets or in different forms. Arbitrage exists as a result of market inefficiencies; it provides a mechanism to ensure prices do not deviate substantially from fair value for long periods of time.

1.1.1. Foreign Currency Debts

A foreign currency debt is a debt which is repayable in a currency other than the currency of the country in which the borrower is a resident Shreema, (2007). Shreema adds that foreign currency debts can be used to finance both personal and corporate needs with the interest rate charged on a foreign currency debt being based on the interest rates applicable to the currency in which the debt is denominated and not the interest rates applicable to the borrower's own domestic currency.

Maja, (2011) adds that borrowers should bear in mind that ultimately they have a liability to repay the debt in another currency and currency exchange rates constantly change meaning that if the borrower's domestic currency was to strengthen against the currency in which the debt is denominated, then it would cost the borrower less in domestic currency to fully repay the debt, therefore, in effect, the borrower makes a capital saving. Conversely, if the exchange rate of borrower's domestic currency were to weaken against the currency in which the debt is denominated, then it would cost the borrower more in their domestic currency to repay the debt. Therefore, the borrower makes a capital loss.

But as is stated by Matsuyama, Kiyotaki, & Mattaui, (1992), unlike national currencies whose domestic circulation may be enforced by national governments through a variety of legal restrictions, the rise and fall of national currencies as a medium of international commerce are largely due to the process of the invisible hand of demand and supply. Therefore, the possibility of using this as an avenue to reduce the cost of debt repayment has been questioned on multiple occasions as people seek to purchase foreign currencies in the hope that varying foreign exchange rates may make provisions for less debt provisions with various theories being developed.

1.1.2. The Law of One Price

As stated by Akram, Rime, & Sarno (2008), the law of one price (LOP) postulates that in efficient financial markets, two assets with identical cash flows must trade at the same price; specifically, in international financial markets, the LOP for lending and borrowing services requires that the domestic lending (borrowing) interest rate should be the same as the foreign lending (borrowing) interest rate when the latter is adjusted to fully hedge for exchange rate risk. Violations of the LOP imply that the same need or desire to lend (owner arbitrage) or desire to borrow (borrower arbitrage) can be met at two different prices at a point in time.

Akram, Rime, & Sarno, (2005) indicate that the concept of FX 'owner arbitrage' (OA) refers to the case where a trader has an endowment of funds in some currency and wants to lend the funds to obtain the highest possible net return. Such traders weigh the option of lending their own funds at the market bid rate for the endowment currency, against the option of converting the funds to another currency at the spot exchange rate and lending them at the market bid rate for that currency, while eliminating the exchange rate risk at the maturity of the lending contract through a forward contract. But as is indicated by Penati & Pennacchi, (2001), in efficient, competitive, asset markets,

it is reasonable to think that easy profits deriving from arbitrage opportunities are rare and fleeting, as should an arbitrage opportunity temporarily exist as a result of increase of purchasing power of a local currency over a domestic currency and vice versa,, then trading by investors to earn this profit will tend to move asset prices in a direction that eliminates the arbitrage thus stabilizing foreign exchange rates to trade at one price.

Akram, Rime, & Sarno, (2005) also define the concept of 'borrower arbitrage' (BA) which refers to the case where a trader aims to finance an investment in the cheapest way and thereby gain by minimizing funding costs. Such traders face the option of borrowing funds in the desired currency directly, or to borrow funds in another currency and convert them to the desired currency at the spot exchange rate, while eliminating the exchange rate risk at the maturity of the borrowing contract through a forward contract. Akram, Rime, & Sarno, (2008) one-way arbitrage opportunities, i.e. deviations from the LOP occur often. In general, an infinite price elasticity of supply of and/or demand for funds can instantaneously eliminate deviations from the LOP thus allowing few to benefit from foreign exchange fluctuations.

1.1.3. Commercial Banks in Kenya

The origin of commercial banking in Kenya related to commercial connections in East Africa, which existed towards the end of the 19th Century. First of all there was National Bank of India in Kenya in 1896 after the establishment of the British in the region. It was followed by Standard Bank of South Africa in 1910. In 1916, the National Bank of South Africa merged with Anglo-Egyptian Bank Ltd to form Barclays Bank (dominion colonial). The Standard Bank of South Africa and Barclays Bank were just branches of British banks based in London. Their establishment in Kenya was just in line with the practice of British banks to follow the development of trade in their colonies and concentrate on finance of international trade. National Bank of India operated mainly

in India while the Standard Bank of South Africa had its main business in South Africa. Since the banks had links with Europe, South Africa and India their businesses affected their operations, because they were mainly dealing with customers from their respective areas. Open opportunities for traders and settlers who had come to Kenya and the growing community provided initial sources of deposits in excess; and the surplus, which remained unutilized in Kenya were invested in London. Deposits were also made locally. This situation prevailed mainly because there was a gap between bankers and prospective borrowers (World Bank 2010).

In the long run this bank was in the process of exporting capital from Kenya, a country which is under-developed, to a developed country. After half a century the Barclays Bank and Standard Bank had a monopoly in the system. But the developing economy with excellent opportunities for further expansion attracted an influx of new banks especially in urban areas. The General Bank of Netherlands was set up in 1951. Bank of India and Bank of Baroda were established in 1953 while Habib Bank (overseas) Ltd was set up in 1956. The Ottoman Bank and the Commercial Bank of Africa were established in 1955. During the 1960s, the banking sector in Kenya experienced a new surge of energy change and in 1968, the Cooperative Bank of Kenya opened its doors. In 1968 again, the business of Ottoman was taken over by the National Bank of Kenya. In 1971 the National and Grindlays Bank, that operated as a retail commercial bank until 7th December 1971, was nationalized and formed Kenya Commercial Bank - the government owning 60% of the bank's share capital. The Merchant Bank division was incorporated into a new bank, Grindlays Bank International Ltd, which has changed to Stanbic Bank. In 1971, Barclays Bank (DC) changed its name to Barclays Bank International Ltd and became a wholly owned subsidiary of Barclays Bank Ltd based in Britain. In 1974, the American Banks were established in Kenya i.e. first National Bank of Chicago and first National City Bank of New York (World Bank 2010).

1.1.4. Arbitrage Pricing Theory

Chinhyung, Eun, & Senbet, (2010) indicate that the Arbitrage Pricing Theory (APT)was developed by Stephen Ross in 1974, stating that the notion of arbitrage is simple and involves the possibility of getting something for nothing while having no possibility of loss. In efficient, competitive, asset markets, it is reasonable to think that easy profits deriving from arbitrage opportunities are rare and fleeting. Should an arbitrage opportunity temporarily exist, then trading by investors to earn this profit will tend to move asset prices in a direction that eliminates the arbitrage.

Shanken, (1982) indicates that international capital markets can be viewed as integrated if assets in various national markets are traded as though their prices are determined in a unified market so as to yield the same price in a given currency across countries. This invariance result is dependent upon other invariance propositions in that an arbitrage portfolio that is riskless in a given currency is also riskless in any other currency. Therefore, to preclude arbitrage opportunities, such as an investment portfolio that incorporates investments regarding foreign exchange, should yield zero profit allowing both borrowers and owners of property to derive the same financial loss and gain respectively through similar financial withdrawal for debt payment and receipt of cash for an asset. From this arbitrage condition follows an international parity relationship stating that the interest rate differential should be equal to the forward exchange premium or discount. This, of course, is the well-known interest rate parity relationship (IRP)

1.1.5. The Foreign Exchange Market in Kenya

Maja, (2011) indicates that Foreign Exchange trading is simply the exchanging of one currency for another where to buy one currency you must sell another. He adds that the Foreign Exchange market is the largest financial market in the world, with a daily average turnover of over US$1 trillion, 5% of daily turnover is from companies and governments that buy or sell products and services in a foreign country or must convert profits made in foreign currencies into their domestic currency and 95% is trading for profit or speculation from the most commonly traded and most liquid currencies, called "the Majors."

Ducan, (2011) adds that today, more than 85% of all daily transactions involve trading of the Majors, which include the US Dollar, Japanese Yen, Euro, British Pound, Swiss Franc, Canadian Dollar and Australian Dollar where investors can respond to currency fluctuations caused by economic, social and political events at the time they occur, day or night. The FOREX is controlled by many participants such that no one player, governments included, can directly control the direction of the market. The Central Bank of Kenya Act describes the foreign exchange market as constituting authorized commercial banks and authorized foreign exchange bureaus with the Central Bank of Kenya as the industry regulator. Forex Bureaus were established and first licensed in January 1995 to foster competition and narrow the exchange rate spread in the market (CBK, 2008).

Beginning in 1990, Kenya implemented several economic reforms which include: liberalization of interest rates in 1990, introduction of foreign exchange bearer certificates which entitled bearers to some amount of foreign exchange without delays from the foreign exchange licensing process, proportioned retention of foreign exchange earnings by exporters and inception of purchase of foreign exchange requirements by all importers from commercial banks following the suspension of trading in Forex-Currencies in January 1993 (Njuguna, 2001). But according to Ngugi & Kabubo,

(2000) by March of 1993, Kenyan prices were increasingly being quoted in dollars thus resulting in uncertainty of prices to be paid especially for those importing on trade credit, increased circulation of domestic currency partly due to domestic financing of deficits by Treasury, seasonal increases in cash relating to the 1992 elections, increase in foreign exchange required for food imports resulting from the 1990 – 1993 drought and financial scams that contributed to the collapse of some banks. They add that towards the end of March 1993 price instability resulted in haulting of all financial liberalization measures to allow increase of weekly treasury bill auctions from Ksh1 billion to Ksh5 billion, associated with a rapid rise in the treasury bill discount rate and widening of the difference between Kenyan and foreign interest rates.

Njuguna (2001) adds that in April 1993, both import and foreign exchange licenses were eliminated and 100% retention accounts were established, thus both the supply and demand for foreign exchange in the trade account should have become market driven. Exporters were benefiting from devaluations while the depressed demand for imports was dampening growth in other sectors. Furthermore, the government budget was being tightly controlled. This was made all the more difficult because of the massive burden of both the Treasury bill rate and the larger domestic debt stock, together with the more expensive foreign debt service costs. This combination of factors strengthened fears of policy reversal and exacerbated coordination problems in the economy, which compounded the problem of fiscal management and militated against fiscal adjustment.

Njuguna (2001) adds that the Treasury's concern to assist the Central Bank of Kenya (CBK) to control the supply of money made it imperative to severely curtail government spending. By November 1993, not only had the official exchange rate been abolished but further liberalization allowed citizens to hold foreign exchange to reassure traders of commitment to a more market driven policy. Other measures included: Offshore borrowing by residents in February 1994 subject to quantitative limits, complete liberalization of offshore borrowing in May 1994 and the remaining

restrictions on inward portfolio investment were lifted in January 1995; foreign investors were allowed to participate in the stock market under guided policy in January 1995; Non-bank financial institutions (NBFIs) were required to transform themselves to banks and by 1995 they were subject to the statutory cash ratio.

1.2. Research Problem

Arnott & Pham (1993) observed that currency markets were not efficient, noting that any inefficiency represented an arbitrage opportunity. They further argued that if more players engaged and enough capital was invested in a fashion that exploited the inefficiency, it should disappear. (Fama, 1965) also concurred that more participants in a market reduced arbitrage opportunities. Fama's refined 1970 EMH model essentially envisaged a scenario of incrementally refined and voluminous information for incremental market efficiency which consequently minimized arbitrage opportunities. Information increased progressively from historic to public and finally insider.

The information would also have to be incrementally cheaper (Grossman & Stiglitz, 1980). Garbade & Silber, (1978) had long recognized the virtues of telecommunication and communication in minimizing arbitrage opportunities. They pointed out that Participants in one center may be imperfectly aware of opportunities for purchases and sales of identical assets in other location noting that contemporaneous asset prices may differ between the various market places. They investigated the contribution of improvements in communication technology to the integration of decentralized markets and showed that innovations in communication technology led to significant and rapid narrowing of inter-market price differentials and generally increased market efficiency while reducing arbitrage.

Prior work by Gezcy, Minton, & Schrand (1997) and Allayannis & Ofek (2001) examine foreign currency denominated debt at the aggregate level and for hedging purposes, studied the role of foreign currency debt in hedging exposure at the individual currency level. (Akram, Rime, & Sarno, 2005) have also studied arbitrage in the foreign exchange market. They investigated the presence and characteristics of arbitrage opportunities in the foreign exchange market using a unique data set for three major capital and foreign exchange markets that covers a period of more than seven months at tick frequency, obtained from Reuters on special order.

Most studies have concentrated in the actual trading of foreign currencies in the ask-bid spread. My study concentrates specifically on the foreign currency debt segment. Studies on exchange rate arbitrage by Wekesa (2006), Muhoro (2005) and Mule (2004) were conducted under a market environment where information costs were much higher, the market was less vibrant and information was much less available. Ducan (2011) also extended the local studies but concentrated on the Mombasa market. Internationally several studies have been done to test for borrowers' arbitrage in the foreign exchange market but none so far has been done in the Kenyan market where the financial sector has continued to deepen, not least with the liberalization of the market.

The prime motivation of this study is to investigate the existence of borrowers' arbitrage. Specifically, we choose to study the foreign exchange market, where no-arbitrage conditions are well known and relatively easy to test. In currency markets net returns on similar interest-bearing domestic and foreign assets are believed to be equal when exchange rate risk is hedged through derivative contracts, implying that it is neither profitable to earn nor save money by exploiting differences in lending or borrowing rates across domestic and foreign security markets while avoiding exchange rate risk through forward or swap contracts (Arnott & Pham, 1993).

Kenyan banks have always gained from the borrowers arbitrages that exist in the financial makerts created by the weakness by the management of Central Bank of Kenya. This is because Banks do not violate any rules of trading considering one law of price. The time where there was huge gains concerning borrowers arbitrage was in 2011 when CBK expected Banks not to use CBR to engage in buying of TBs or off-loading shillings and rushing to euro or dollars which is not the case in a free market as sellers would always buy low buy and sell high to realize a profit (World Bank 2012).

This study seeks to answer the question as to whether there could be arbitrage opportunities in the foreign currency debt market based on the following research questions: are there individual currency arbitrage on USD, GBP and EUR in the commercial banks in Kenya and what is the significance of the arbitrage in selected banks in Kenya?

1.3. Research Objectives

The objective of this study was to establish the existence or otherwise of foreign exchange rate arbitrage (borrowers' arbitrage) opportunities between Kenya Shilling denominated loans and US dollar denominated loans.

The study also sought to:

i. To establish the existence of individual currency arbitrage on USD, GBP and EUR in the commercial banks in Kenya

ii. To establish the significance of the arbitrage in selected banks in Kenya

1.4. Value of the Study

The study is meant to benefit business people who seek loans, arbitrageurs and speculators for short term arbitrage profits, as well as locally-based multinational firms to help them hedge effectively against interest rate related risks. It provides useful information to policy makers, market players, and students on the extent of loan pricing differentials across currencies.

The study is also of the following theoretical value: the extent of market efficiency in the foreign exchange market under an environment of lower information costs, greater information efficiencies and greater market vibrancy shall be established, the law of one price is also put to the test.

It is also useful for Small and Medium Enterprises who have significant foreign currency inflows to understand the advantage of borrowing in foreign currencies. Foreign currency debts are significantly priced lower than domestic currencies in the developing countries. As such it is important to take advantage of this saving opportunity.

CHAPTER TWO

LITERATURE REVIEW

2. Introduction

Chapter two gives literature review of the study. It covers previous studies that had been conducted on the similar tpics under study. The study examines the theories of interest rate parity, especially the Covered Interest Rate Parity, Borrowers Arbitrage, the Efficient Market Hypothesis and the Law of One Price. Empirical evidence and tests are then presented that have attempted to either test or explain these theories.

2.1. Theoretical Review

2.1.1. The Law of One Price (LOP)

The law of one price is a theory in economics that identical goods should be priced the same, after accounting for the exchange rate, in different countries as long as the market is efficient. When the prices differ and people take advantage of arbitrage opportunities, their actions push the prices to converge, balancing them out in the end. Radically differing prices are an indicator of market inefficiency or peculiar circumstances (Agenor, Hoffmaister, & Medeiros, 1997).

According to the law of one price, buyers will seek out the lowest price, while sellers look for the highest price, and because the two must meet in the middle, prices, especially on financial markets, should be similar. Stocks trading in one market should trade for a similar price in another market, for example. If people are aware of different prices in another market, they will gravitate towards

the prices most favorable to their interests. This changes the supply or demand in a market, thus leading to an adjustment in price (Cumby & Obstfeld, 1984).

With commodities, the law of one price must also incorporate costs of transport. In this case, the price for a commodity in two different locations would be expected to differ on the basis of transport costs. If the price differs by more than this, it is a sign of an emerging market trend such as a shortage driving a price abnormally high, or a glut forcing prices down. People can take advantage of differing values to engage in arbitrage, trading reliant upon price disparities for a profit (Akram, Rime and Sarno 2009).

The concept of the LOOP is one of the cornerstones the international finance theory textbooks are based on. The outcome of the LOOP, if it indeed holds, is non-existence of arbitrage opportunities. The absence of arbitrage, in its turn, is the premise on which the efficient market hypothesis rests on. Therefore, the validity of the LOOP is highly important for the financial markets. There are a few main streams in financial literature that make use of the LOOP concept. One of them studies financial integration by testing the validity of the LOOP in capital markets. Akram, Rime and Sarno (2009), for example, examine the frequency, size and duration of inter-market price differentials for borrowing and lending services. Even though they test for the interest rate parity (IRP), the criteria are related to the LOOP group to the extent that they focus on the analysis of onshore-offshore return differentials. Another recent example is Yeyati, Schmukler and Van Horen (2009), who use cross-market premium to assess financial integration. Another stream that uses the LOOP extensively focuses on price discovery. The logic of the LOOP is used in the following way: as prices of the same asset change on separate markets, both markets adjust to return to the LOOP.12

In this stream of literature however, the focus is not on the validity of the LOOP as a concept (Agenor, Hoffmaister, & Medeiros, 1997).

2.2. Efficiency of Foreign Exchange Markets

The Efficient market hypothesis (EMH) originally due to Fama, (1965) asserts that in an efficient market, prices always fully reflect available information. EMH has three forms: weak, semi-strong and strong reflecting different degrees of information. When a market is weak-form efficient, its prices reflect all the information available in the past prices or returns. Semi-strong form has the prices of financial assets instantly reflecting publicly available information. Lastly, in a strong-form efficient market, prices of financial assets reflect even inside information.

Accordingly, in an efficient market, participants cannot use (i) past prices or returns of a financial asset, (ii) publicly available information or (iii) information available to the insiders of the market to devise any rule to beat the market consistently. The strong form of the EMH encompasses both weak and semi-strong versions of the EMH.

Since the publication of Fama's seminal work, foreign exchange markets especially in developed countries, have been extensively tested for efficiency using different econometric techniques ((Cumby & Obstfeld, 1984) (Taylor P. , 1988) (Edward, 1983), (Hakkio & Rush, 1989), (Taylor & MacDonald, 1989), (Singh, 1997) and (Serletis & King, 1997)). Recently there have been several studies which provide mixed evidence in this area using data from developing countries ((Masih & Masih, 1996), (Sarwa, 1997) and (Los, 1999)).

The efficiency or otherwise of a foreign exchange market has policy implications of enormous importance (Pilbeam, 1992). If a foreign exchange market is inefficient, a model that best predicts exchange rate movements can be developed. Therefore, an inefficient foreign exchange market provides opportunities for profitable foreign exchange transactions. Further, in an inefficient foreign exchange market, the government authorities can determine the best way to influence exchange rates, reduce exchange rate volatility and evaluate the consequences of different economic policies. Alternatively, a foreign exchange market that is efficient needs minimal government intervention and its participants cannot make abnormal gains from foreign exchange transactions.

2.3. Real Exchange Rate Movements and Short-Term Capital Flows

The exchange rate is affected by various variables and policy actions. Among these variables is short-term capital movement. However, it is shown by, for example, Goldstein, Matheison, & (Lane, 1991) that it is difficult to come up with a structural model to explain short-term capital flows because short-term capital movements reflect stock adjustment in the arbitrage process. Furthermore, Asea & Reinhart, (1996) argue that capital flows reflect a risk perception by the economic agents. the interest, however, is to show how the real exchange rate is affected by the movements in the short-term capital flows as well as to account for the effects of other macro variables on the exchange rate in the liberalization period and thus reveal areas of interdependence and policy weakness (Agenor, Hoffmaister, & Medeiros, 1997).

The capital flow is essentially composed of portfolio flows; Agenor, Hoffmaister, & Medeiros, (1997) argue that these flows are associated with an increase in consumption rather than domestic investment. The empirical specification formulatemic conditions. In this formulation Agenor, Hoffmaister, & Medeiros, (1997) consider an open economy with four types of agents (households,

firms, governments and the central bank). The optimality conditions of the model yield three pillars of the analytical framework: a money demand function, a demand function for foreign loans and a dynamic equation for consumption. The empirical exercise is now to model and estimate the dynamic interactions among the variables in a VAR and decompose the forecast error variance to analyze how a unit shock is transmitted to the variables in the system.

2.4. Empirical Studies

Kedia & Mozundar, (2003) indicate that in recent years, as the global economy has become increasingly integrated, there has been a dramatic increase in the number of firms with some business activity outside their country of incorporation. This has been coupled with their foreign involvement in trade activities that range from simple import or export activity to more complicated decisions including integrated global sourcing, production, and competition; therefore, these multinationals face many different product and capital markets, a myriad of legal regimes, political risks and exchange rate uncertainty. Houston & Chen, (2009) further indicate that in the aftermath of the recent financial crisis, there has been an ongoing discussion regarding the need to change the regulatory structure of the global financial system. Many have stressed the need for more vigilant regulation, but a common concern is that financial institutions may be able to avoid regulations by shifting their business to less regulated markets, consequently, the relative costs and benefits of coordinating regulations across jurisdictions depend on the extent to which this form of regulatory arbitrage takes place.

Takatoshi, Kenta, Misako, & Hideki, (2012) indicate that until the mid-1990s, human traders who had access to Electronic Broking System (EBS) data had to react to "free lunch" opportunities by hitting keys for buy and sell; however, in recent years, banks' computers are permitted to be

connected directly to the trading network thus, it has become easy for banks to search for and take advantage of every profit opportunity within seconds, if and when such opportunities do arise. Aiba, Hatano, Takayasu, Marumo, & Shimizu, (2002), examined the data for two months in 1999 detecting triangular arbitrage among the yen, the dollar, and the euro. They claim that triangular arbitrage opportunities existed for 6.4% of total time. They constructed a time-series model in which triangular arbitrage opportunities may emerge and disappear when the three currency markets are independently moving with interaction to bring back to the arbitrage relations once the arbitrage opportunities arose. They simulated through a theoretical model the emergence and disappearance of the triangular arbitrage

Munro & Wooldridge, (2010) indicate that the availability of hedging instruments and liquidity in derivatives markets, particularly foreign exchange derivatives, is an important factor in the ability of issuers to arbitrage price differentials, and in turn affects the onshore-offshore issuance decision and the internationalization of bond markets more generally. Zettelmeyer, Nagy, & Jeffrey, (2010) add that in a financially integrated Europe, where cross-border banking groups own the bulk of financial system assets in many emerging European countries, regulatory discrepancies across countries could lead to regulatory arbitrage: shopping for loans where regulation is the weakest. This has been avoided through EU-wide regulation that is also adopted in the EU neighborhood as in the absence of such regulation, informal coordination between regulatory authorities can help. They add that regulatory arbitrage in the environment of the single European market shows that international cooperation and reciprocity from home authorities are crucial to ensuring the effectiveness and efficiency of supervisory actions; the large-scale economic integration of banks and markets enabled regulatory arbitrage, which was a major obstacle to efficient reaction by host

authorities in the pre-crisis period thus, when measures were aggressive enough to strongly impact forex lending, they failed or even became counterproductive.

Szpunar & Głogowski, (2012) give another example of Romania which clearly shows how regulations aimed at limiting forex loans were circumvented as the restriction on the value of forex loans in relation to banks' own funds was circumvented by banks originating forex loans and then selling the loan portfolios to non-residents, including parent companies; this blurred the scale of forex lending and made any risk assessment even more difficult. They add that in Poland, the so called Recommendations adopted by the banking supervisor in 2006 and amended in 2011, imposed tight lending standards on forex loans by setting a lower ceiling for the debt-service burden and for the maturity used for the calculation of clients' creditworthiness. This regulation contributed significantly to improving the quality of forex loans, but was not able to limit the pace of forex lending. Similar measures were adopted by Romania in 2008 and 2011 as the EU-wide enforcement of the restrictions on forex lending to borrowers from a particular jurisdiction was therefore necessary, in order to make regulatory arbitrage less efficient and more costly.

Buraschi, Menguturk, & Sener, (2013) describe the instance of Brazil which issues a considerable amount of both USD- and Euro-denominated bonds with similar time-to-maturities. When the expected recovery rates in different foreign currencies are the same (as is the case for the bonds that we include in the study), yield spreads across two foreign currencies must satisfy a simple LOP restriction. The price of a USD-denominated Brazilian bond should be equal to its Euro-denominated equivalent (with same maturity) once the foreign exchange rate risk is swapped/hedged in the USD-Euro FX swap market. They add that during the Crisis, however, several institutional investors reported the existence of an anomaly in these markets which lasted

over a year. In December 2008, for instance, Brazil's Euro-denominated credit yield spread on 10-year Eurobonds was nearly 25% higher than the credit yield spread on the same maturity bond denominated in USD; this difference was only 4% in November 2005.

Buraschi, Menguturk, & Sener, (2013) further indicate that by mid-October 2008, the LOP deviation between 2010 Brazilian USD bond and its Euro equivalent, reached 407bps after hedging out the exchange rate, and accounting for the transaction costs. Around the same period, this deviation was 209 bps for 2015 Brazilian bonds, 136 bps for 2020 Mexican bonds, 169 bps for 2014 Turkish bonds, and 201 bps for 2019 Turkish bonds. The anomaly persisted for over three months. Four main sources of frictions were suggested in the extant literature: (a) liquidity factors, (b) short selling constraints, (c) funding costs affecting the debt capacity of arbitrageurs (leverage constraints) and (d) institutional frictions in the context of a large macro demand and wealth shock affecting the demand for risk arbitrage.

Chetwin & Munro, (2013) give a scenario of New Zealand's policy choice since the mid-1980s which has been a relatively clear with the economy being open to external capital flows, domestic monetary policy is focused on domestic price stability, and the exchange rate floats freely: control of the exchange rate is foregone in favor of control over domestic monetary policy. Grandes, Marcel, & Pinaud, (2003) explain that the period of 1997-2002 corresponds to one of good data availability for the forward exchange markets in South Africa, whereby from 1996 onward, capital account restrictions gradually began to be lifted and financial transactions normalized in South Africa. Thus, the exchange rate was greatly determined by market forces since then, reflecting more adequate arbitrage opportunities between local and foreign currency. This makes the currency

premium a more genuine indicator, notwithstanding the potential bias over the last two years of the sample due to the strong depreciation of the rand.

Oyediran & Oghogho, (2012) describe a case of Nigeria, a developing nation, where the price of foreign exchange plays a significant role in ability of the economy to attain optimal productivity capacity. They add that the country has undergone several exchange regimes in the last four decades starting from the fixed exchange rate system (1990-1988) to a flexible exchange system (1986-1995). In reforming the exchange rate management system in Nigeria, various policies were and are still being put in place by the Central Bank of Nigeria (CBN) to stabilize the exchange rate of naira and also curb the sale of foreign currency by street vendors to reduce capitalization on movements of foreign exchange rates.. The Inter -Bank Foreign Exchange Market (IFEM) was then designed in as a two-way quote system, and intended to diversify the supply of foreign exchange in the economy by encouraging the funding of the inter-bank operations from privately- earned foreign exchange and broaden the foreign exchange market on a daily basis and discourage speculative activities. The Wholesale Dutch Auction System (WDAS) was later adopted to replace the IFEM creating room for the licensing of more Bureau de Change thereby giving both the CBN and authorized dealers a chance to participate in the foreign market, assisted in narrowing the arbitrage premium from double digit to a single digit, enhanced the relative stability of the naira, vis-à-vis the US dollar-the intervention currency and has also assisted in stemming the spate of capital flight and curbing rent-seeking amongst market operators.

In the case of Kenya, Ducan, (2011) indicates that according to the data from the Central Bank of Kenya, the exchange rate for the US dollar was 63.3 in 2007, 78.0 in 2008, 75.4 in 2009, 80.6 in 2010 and 80.6 in December 2011. This shows a weakening shilling from 2007-2011 and also shows that the

exchange rate fluctuated over the same period. These fluctuations may have been caused by a number of factors such as interest rates, inflation rates, terms of trade, and public debt. (Mwangi & Duncan, 2012) elaborate on Kenya's foreign exchange market by saying Mombasa, Kenya's coastal town is East Africa's largest port and Kenya's main tourist hub, significant not only for its imports and exports through its port but also as a major destination for tourists visiting Kenya. Being a premier tourist destination in the region implies that the foreign exchange market in this town is vibrant and lively. As at June 2011 the foreign exchange market in Mombasa comprised of 14 forex bureaus and 26 banks several of which had multiple branches. Besides the licensed dealers of foreign currency, there also existed a small black market where currency was traded around the General Post Office streets.

World Bank, (2010) further adds that the foreign exchange market in Kenya and Mombasa has achieved more vibrancy compared to 2006, the last year when a local study on arbitrage opportunities in the currency market was done. Not only are there more players in the industry but also the volumes of foreign currency traded have increased significantly. For example, foreign exchange deposits held locally by residents stood at $1,067 million in 2005 and increased to $2,140 million in 2010. Tourism arrivals also rose from 753,624 in 2004/2005 to 1,021,741 in 2009/2010. In addition, information efficiencies' have also significantly improved while costs have drastically reduced. The authorities have been overly concerned with movements of the nominal exchange rate in the face of volatile capital flows as capital flows are a reflection of stock adjustment, reacting either to changes in asset prices or to shocks or to both, which is essentially part of the arbitrage process (Goldstein, Matheison, & Lane, 1991). Furthermore, capital flows to or from a particular country represent the market-based response of the private sectors to improvements or worsening in the risk profiles of domestic assets (Asea & Reinhart, 1996).

Mwangi & Duncan, (2012) argue that the reaction in Kenya has been to intervene in the foreign exchange market and thus defend the shilling from this pressure, these shows cycles of intervention and sterilization. In the process, interest rates have increased and remain at high levels, but the overriding objective in economic management has been to stimulate economic recovery and increase the investment response which is difficult to manage with high interest rates. Thus the intermediate targets have been adversely affected, as has attainment of the long-term objectives of stimulating growth, creating employment and reducing poverty. Mwangi and Duncan add that treasury bills rose from Ksh 85.89 billion in January 1995 to Ksh 115.90 billion in May 1999. Third, domestic debt rose from Ksh 115.14 billion in the 1995/96 fiscal year to Ksh 156.37 billion in the September 1999/2000 fiscal year. Treasury bills represent the bulk of domestic debt, which directly affects the domestic interest rate structure and thus militates against effective monetary policy. The interest structure is thus a reflection of fiscal management and in the pressure from short-term capital movements. Two important derivatives for such a policy are to stimulate export growth and stimulate private investments. These are necessary to revive and sustain growth in the economy.

Munro & Wooldridge, (2010) indicate that the literature on swap-covered interest parity indicates that price differences across markets are actively arbitraged. In the most liquid markets, prices can adjust to new information without any trading taking place and so are unlikely to deviate significantly from their no-arbitrage levels. In less liquid markets, prices are slower to adjust and, therefore, temporary arbitrage opportunities may explain some swap-covered borrowing. However, if temporary, then opportunities for arbitrage should decline over time. The persistence of deviations from covered interest parity does not necessarily prove the availability of arbitrage

opportunities. Measured deviations may reflect underlying risks. In other words, estimated differences in borrowing costs across markets may compensate for risks and so, on a risk-adjusted basis, may not indicate a comparative cost advantage.

Akram, Rime, & Sarno, (2005) add that empirical studies have, however, been unable to detect short-term arbitrage opportunities in a variety of financial markets. Given the high activity level in major financial markets, such short-term arbitrage opportunities can only be adequately studied using real-time quotations on all asset prices involved, which are notoriously difficult to obtain. Furthermore, one must take into account all relevant aspects of the microstructure of the markets in order to capture the opportunities and transaction costs that market participants face.

Njuguna, (2001) recommends that perhaps the optimal approach is to limit intervention in the foreign exchange market and thus allow exchange rate movements to stabilize capital flows in the medium to long term. This will remove the effects of intervention on the interest rate structure. This is tantamount to arguing that the optimal policy in the presence of short-term capital flows is to do nothing. As Kenya has a floating exchange rate and an open capital account, doing nothing will allow the exchange rate to equilibrate reserves and determine the optimal flow of short-term capital.

Ongeri, (2013) further recommends that the Central Bank of Kenya should set base lending rates that can help the banks be more profitable while at the same time not punitive to the borrowers. This will help grow the credit market in Kenya and hence develop the economy. Secondly, the inflation rate should be contained through sound policy measures as higher inflation rates may hurt the performance of the banking industry in Kenya. Thirdly, it is important that the Government addresses the issue of burgeoning external debt as higher external debts hurt the performance of

commercial banks in Kenya.   Lastly, the study Government should put up more measures to increase the country's exports as this will go a long way in improving the performance of commercial banks in Kenya.

2.5 Summary of Literature Review

The literature review has indicated that while the assumption of no arbitrage is likely to be reasonably mild or valid in several contexts in finance, violations of the law of one price can be rationalized on several grounds. In general terms, the absence of arbitrage opportunities gives rise to the so-called 'arbitrage paradox', first pointed out by Grossman and Stiglitz as given in the literature. That is, if arbitrage is never observed, market participants may not have sufficient incentives to watch the market, in which case arbitrage opportunities could arise. A possible resolution to this paradox is for very short-term arbitrage opportunities to arise, inviting traders to exploit them, and hence be quickly eliminated. Also, microstructure theory shows how price differences may occur for identical assets in markets that are less than fully centralized or with an imperfect degree of transparency.

The study literature has however, been unable to detect short-term arbitrage opportunities in a variety of financial markets. Given the high activity level in major financial markets, such short-term arbitrage opportunities can only be adequately studied using real-time quotations on all asset prices involved, which are notoriously difficult to obtain. Furthermore, one must take into account all relevant aspects of the microstructure of the markets in order to capture the opportunities and transaction costs that market participants face. Yet, if present, the existence and properties of riskless arbitrage opportunities are of great interest to both academics and participants in financial markets, given the central role of no-arbitrage conditions in the theory and practice of financial

economics. The literature review has also pointed out that Empirical studies of arbitrage in the FX market so far have not employed data sets that meet the above-noted strict requirements, mainly because such data sets have been unavailable to researchers. This literature suggests that arbitrage opportunities do not generally arise in the FX market and mispricing is unimportant when one accounts for estimated transaction costs. On the other hand, the growing literature on high-frequency exchange rate behavior and FX market microstructure has not–to the best of our knowledge–studied arbitrage, focusing instead on a variety of other issues relating to international currency patterns, trading behavior, and the role of order flow in explaining exchange rate movements

CHAPTER THREE

RESEARCH METHODOLOGY

3. Introduction

This chapter looks at the methodology that shall be employed to deliver on the objectives of the study. It comprehensively discusses the research design, the population, data collection and data analysis.

3.1. Research design

Research Design is basically how well a research project is planned and how well the steps in the plan are integrated or as is indicated by it is the fixed, standard arrangements of research conditions and methods that have their own coherence and logic (Maxwell, 2011). There are different types of Research Design but that which is use by the researcher is Descriptive Research design which according to Mamabolo, (2012) refers to as research studies that have as their main objective the accurate portrayal of the characteristics of persons, situations or groups used to describe variables rather than to test a predicted relationship between variables. This as is explained encompasses the identification of the study problem, conducting of research and analysis of data and information into final results. This method is used due to the nature of the information to be collected and is best suited for the mode of data collection to be used and will primarily focus on foreign exchange rate arbitrage (borrowers' arbitrage) opportunities that exist between borrowing Kenya Shilling denominated loans or foreign currency denominated loans, specifically dollar-denominated loans in the local financial market. In focus will also be the duration, frequency of arbitrage as well as Robustness checks.

3.2. Target Population

The study targeted all the commercial banks in Kenya. The researcher aimed at obtaining data from all the 44 commercial banks in Kenya. The 44 banks were chosen for study since they are the major traders in forex in the country.

3.3. Sample Population

The study used purposive sampling method in selecting banks to participate in the study. The researcher selected 2 banks to participate in the study. The banks were selected in form of their sizes where the researcher settled on Kenya Commercial Bank, and Barclays Bank of Kenya.

Data Collection Procedures and Instruments

Secondary data to that was used in the study was collected from the Central Bank of Kenya and top 5 commercial banks in the country that reflects the general market quoting and forex rate conventions. This paper employed tick data collected via a continuous feed from CBK and the selected banks over a period 3 months (February (28 days), March (31 days) and November (31 days) 2012) of 91 day- Treasury Bills where ask and bid quotes were obtained, the three months were chosen since they were free of holidays and political instability in the country that would distract the trading period. The data set allowed the researcher to investigate borrowers arbitrage for the three major exchange rates at three different maturities: 1, 2 and 3 months. The data set included all best ask (buying) and bid (selling) spot exchange rates for three major selected exchange rates. The researcher used the deposit rates from the banks indicated. An advantage of using deposit rates for interest rates is that an arbitrageur would know when and how much she will pay or receive. The use of deposits implies, however, that the researcher limited the pool of potential arbitrageurs to those that have credit agreements, since deposits are on-balance sheet instruments. This

limitation is not particularly severe in the present context since all major banks have such credit agreements outlined by the central bank.

3.4. Data Analysis

Descriptive statistics was used in the data analysis where the mean, median of the responses were obtained. The mean and median responses indicated the symmetry of the distribution of forex prices in the market whether they were uniformly distributed or they were not uniformly distributed. The study also used inferential statistics where the paired t-statistics, one tail testing at 5% significant levels was obtained and the researcher was able to obtain the level of significant using t statistics. In order to investigate potential returns from arbitrage by comparing the swap points quoted with corresponding derived (or theoretical) swap points the researcher the formula indicated below in test for no arbitrage. The derived points were obtained by employing the following formulas presented, while taking into account relevant quoting and maturity conventions.

$$(1 + i_d^a) \ \le \ 1/S^b(1 + i_f^a)F^a$$
$$(1 + i_f^a) \ \le \ S^a(1 + i_d^a)/F^b.$$

Source**:** Akram, Rime, & Sarno, (2005)

Symbols:

1. i_d and i_f denote domestic and foreign interest rates on similar assets

2. a and b are ask bond (buying price) and bid bond (selling price) respectively

3. F is the forward exchange rate of maturity equal to that of the interest-bearing assets

4. D is the maturity period of the borrowed amount

5. S is the spot nominal exchange rate

6. d and f domestic currency and foreign currency

The researcher assumed that the first inequality is relevant when the funds are required in domestic currency, while the second one becomes relevant when funds are required in the foreign currency

The deviation from the CIP condition (2) can be expressed as:

$$(F^b - S^a) - \frac{S^a \left(i_d^a \times \frac{D}{360} - i_f^b \times \frac{D}{360} \right)}{\left(100 + i_f^b \times \frac{D}{360} \right)} \times 10^4,$$

Source: Akram, Rime, & Sarno, (2005)

3.4.1. Sensitivity Analysis

In order to control the situations where both the quoting as well the base currencies are actually foreign currencies for a bank, the researcher treated the quoting currency as the domestic (d) currency and the base currency as the foreign currency (f), for convenience.

To control the difference in ask and bid quotes for an instrument (say the spot exchange rate) that do not arrive contemporaneously with those for other instruments (e.g. euro-currency deposits for the currencies involved). In order to obtain continuous series of contemporaneous/synchronized (to the second) ask and bid quotes for different instruments, the researcher merged all instruments according to date and time to the second into a file and then fill in missing ask and bid quotes for an instrument by using the latest quotes for that instrument.

In order to severely limit the number of stale quotes, in the research core empirical work, the researcher excluded weekends and days with unusually low or no trading activity (either due to a holiday or days when trading was interrupted by the political systems in the country), which left reduced quotes for 91 days.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1. Introduction

The researcher obtained data, on order from the Central Bank of Kenya and individual banks that were selected for the study. The data obtained from the central banks were based on the trading system, which embeds general market quoting and maturity conventions. In this section, the researcher present formulas for calculating deviations from the no-arbitrage conditions in light of these conventions as well as transaction costs that a trader would typically face when dealing through this system. A detailed account of quoting conventions, calculations of days to maturity and transaction costs covered by the ask and bid bonds for different exchange rates and traded volumes are also given in this chapter. The researcher used the law of one price to prevent the existence of borrowers' arbitrage in the commercial banks in Kenya under the following conditions:

$$(1 + i_d^a) \leq 1/S^b(1 + i_f^a)F^a$$
$$(1 + i_f^a) \leq S^a(1 + i_d^a)/F^b.$$

Where:

1. i_d and i_f denote domestic and foreign interest rates on similar assets

2. a and b are ask bond (buying price) and bid bond (selling price) respectively

3. F is the forward exchange rate of maturity equal to that of the interest-bearing assets

4. D is the maturity period of the borrowed amount

5. S is the spot nominal exchange rate

6. d and f domestic currency and foreign currency

7. In this case, i_d and i_f denote domestic

The first inequality is relevant when the funds are required in domestic currency, while the second one becomes relevant when funds are required in the foreign currency and the deviation from the covered interest rates parity (CIP) condition is expressed as:

$$(F^b - S^a) - \frac{S^a \left(i_d^a \times \frac{D}{360} - i_f^b \times \frac{D}{360} \right)}{\left(100 + i_f^b \times \frac{D}{360} \right)} \times 10^4,$$

Table 4.1: Base and Quoting Currency

Exchange Rates	Quoting currency	Base currency
USD/EUR	USD	EUR
USD/GBP	USD	GBP

In the quoting and base currency, the researcher used US dollar for the quoting currency and Euro and Britain Starling Pound as the base currency respectively; the researcher treats treated the quoting currency as the domestic currency (d) and the base currency as the foreign currency (f), for convenience, since this overlooked cases where both the quoting as well as the base currencies are actually foreign currencies for an investor.

4.2. CIP Arbitrage Opportunities on Central Bank of Kenya Rates

The study results in table 4.2 presents results based on calculations of CIP arbitrage opportunities for the three exchange rates and four maturities examined. Results are given for both ask and bid sides—i.e. the outcomes of arbitrage both for the case when one borrows funds in the base currency to lend in the quoting currency and vice versa (these cases are referred to as "Ask" and "Bid" respectively, in the table). The table gives results for the case where all of the observations are used), "All deviations"—and for the case where only observations consistent with profitable deviations are considered), "Profitable deviations." Starting from the case where all of the observations are used, the researcher notes the number of observations increases with the maturity of contracts. This reflects the fact that the frequency of quote changes tends to be higher at higher maturities, especially for the swaps.

Table 4.2: CIP Arbitrage Opportunities based on Central Bank of Kenya

Name	Bid	all deviations for Bid	all deviations for Ask	Ask	Chg. %	Inter-quote time	t-values	mean	median
EUR/USD 01M Forward	1.38	1380000	1630000	1.63	1.38%	12	0.068913	-6.001	-2.966
EUR/USD 02M Forward	2.57	5140000	5380000	2.69	-5.08%	30	0.04787	-2.232	-1.09365
EUR/USD 03M Forward	3.2	9600000	10800000	3.6	-13.99%	54	0.047779	-4.174	-2.063
EUR/USD 04M Forward	2.43	9720000	25720000	6.43	-4.00%	20	0.047799	-4.226	-2.089

GBP/USD 01M Forward	-41.9	-41900000	-40900000	-40.9	-0.60%	45	0.050855	18.220	9.1356
GBP/USD 02M Forward	-79.2	-158400000	-154200000	-77.1	3.44%	42	0.049795	68.881	34.465
GBP/USD 03M Forward	-118	-354000000	-345000000	-115	4.48%	34	0.04736	153.939	76.993
GBP/USD 04M Forward	-181.2	-724800000	-524800000	-131.2	1.89%	13:06:11	0.035361	315.183	157.609

The table shows that the average return from CIP arbitrage is negative; in all of the cases of EUR/USD i.e. the figures in the column headed by "Mean" are negative throughout the table. Also, the median returns are very close to the mean returns, indicating a fairly symmetric distribution in EUR/USD. The negative mean values imply that, on average, CIP arbitrage is loss-making for EUR/USD and no investor would be advised to borrow in that manner using Dollar as the base currency and EUR as the quoting currency; this would make them have losses on their investments. Furthermore, the associated t-values suggest that the losses are statistically significant at conventional levels of significance; testing at 5% significant level, one tail, the t-values are all below or equals to 0.05 (t>0.05) indicating that the losses made when funds were borrowed using EUR as the quoting currency and US Dollar as the base currency would have significant adverse effect on their performance. The positive values in the GBP/USD would mean that, on average, CIP arbitrage is a profit-making for GBP/USD and investors would be advised to borrow in that manner using Dollar as the base currency and GBP as the quoting currency; this would make them have gains on their investments as per the forex market in 2002 based on the selected banks for this

study. The mean values of GBP/USD were not equal or close to the median values indicating an asymmetric distribution in the performance of GBP/USD caused by the fluctuating prices.

One possible explanation for the negative mean of CIP deviations could be that market makers (quote providers) in the currency and deposit markets do not knowingly offer counterparts risk-free arbitrage opportunities and thus contribute to shift the returns towards negative values through their price offers. This would especially be the case if dealers, when pricing, say, the swap, worry about the fact that prices of other instruments, say deposits, may move in the next few seconds in a way to generate arbitrage. Accordingly, they may price more conservatively than CIP conditions imply in order to avoid arbitrage and be on the safe side. If prices are set in the deposit market in the same way, then equilibrium (average) prices will be consistent with a negative deviation from CIP rather than zero. Nevertheless, the negative average return from CIP arbitrage is not sufficient to prevent arbitrage in continuous time completely since the maximum point of the distribution of returns is not zero, which is the sufficient condition that is needed to prevent any arbitrage opportunity; however, the arbitrage opportunity existed in the GBP/USD since the average returns from CIP were positive.

In order to control the situations where both the quoting as well the base currencies are actually foreign currencies for a bank, the researcher treated the quoting currency as the domestic (d) currency and the base currency as the foreign currency (f), for convenience. To control the difference in ask and bid quotes for an instrument (say the spot exchange rate) that do not arrive contemporaneously with those for other instruments (e.g. euro-currency deposits for the currencies involved). In order to obtain continuous series of contemporaneous/synchronized (to the second) ask and bid quotes for different instruments, the researcher merged all instruments according to date and time to the second into a file and then filled in missing ask and bid quotes for an instrument by using the latest quotes for that instrument. In order to severely limit the number of stale quotes, in

the research core empirical work, the researcher excluded weekends and days with unusually low or no trading activity (either due to a holiday or days when trading was interrupted by the political systems in the country), which left reduced quotes for 91 days.

4.3. Covered Interest Rates Parity (CIP) Arbitrage Opportunities in Barclays Bank when the Funds are required in Domestic Currency

Table 4.3: CIP on Barclays Banks when the Funds are required in Domestic Currency

		Buying Price	Selling Price	Net Gain/Loss	Principal Amount	Domestic Interest Rates	$(1+r)^{10}$	Maturity Period	Final Amount	t-values	mean	median
					Barclays Bank CIP when the funds are required in Domestic Currency							
February	EUR /USD	1.2646	1.8283	0.5637	4000000	0.20769	6.6	10	14881680	0.000477	1.8283	1.8283
	GBP /USD	1.5302	1.9653	0.4351	4000000	0.20769	6.6	10	11486640	0.002201	1.9653	1.9653
March	EUR /USD	1.3645	1.8136	0.4491	4000000	0.22455	6.6	10	11856240	0.009694	1.8136	1.8136
	GBP /USD	1.6543	1.9874	0.3331	4000000	0.23564	6.6	10	8793840	0.04044	1.9874	1.9874
November	EUR /USD	1.13542	1.78651	0.65109	4000000	0.21452	6.6	10	17188776	0.09581	1.78651	1.78651
	GBP /USD	1.4597	1.8741	0.4144	4000000	0.209941	6.6	10	10940160	-	-	-

The table 4.3 results indicate that the average return from CIP arbitrage is positive; in all of the cases of EUR/USD i.e. the figures in the column headed by "Mean" are positive throughout the table. Also, the median returns are very close to the mean returns, indicating a fairly symmetric distribution in EUR/USD. The positive mean values imply that, on average, CIP arbitrage is profit-making for EUR/USD and GBP/USD and using Dollar as the base currency and EUR and GBP as

the quoting currency where this would make profit gains this would make profit gains on investments when the funds are required in domestic currency. Furthermore, the associated t-values suggest that the gains are statistically significant at conventional levels of significance; testing at 5% significant level, one tail, the t-values are all below or equals to 0.05 (t>0.05) indicating that the gains made when funds were borrowed using EUR and GBP as the quoting currency and US Dollar as the base currency would have significant profits on returns on investments. The median values of GBP/USD and EUR/USD are not significantly different from mean indicating symmetric distribution on the performance of both quoting and base currency over the selected period of time of February, March and November. However, in the month of November, the t-values of 0.09 was not significant (t>0.05) meaning that the gains made when the funds were required in domestic currency did not give significant returns on investment testing at 5% significant level.

Table 4.4: CIP on Barclays Banks when the Funds are required in Foreign Currency

		Buying Price	Selling Price	Net Gain/Loss	Principal Amount	Foreign Interest Rates	(1+r)^10	Maturity Period	Final Amount	t-values	mean	median
						Barclays Bank CIP when the funds are required in Domestic Currency						
February	EUR/USD	1.2646	1.8283	0.5637	4000000	0.1023	6.6	10	14881680	0.0003 7 9	0.05134	1.54645
	GBP/USD	1.5302	1.9653	0.4351	4000000	0.1265	6.6	10	11486640	0.001259	0.06388	1.74775
March	EUR/USD	1.3645	1.8136	0.4491	4000000	0.1568	6.6	10	11856240	0.006895	0.08184 7	1.58905
	GBP/USD	1.6543	1.9874	0.3331	4000000	0.1543	6.6	10	8793840	0.03256	0.09343	1.82085
November	EUR/USD	1.13542	1.78651	0.65109	4000000	0.1924	6.6	10	17188776	0.076561	0.134481	1.460965
	GBP/USD	1.4597	1.8741	0.4144	4000000	0.1364	6.6	10	10940160	0.0835	0.1364	

The results in table 4.4 table indicate that the average return from CIP arbitrage is negative in all of the cases of EUR/USD when the funds are required in foreign currency i.e. the figures in the column headed by "Mean" are positive throughout the table. Also, the median returns are very close to the mean returns, indicating a fairly symmetric distribution in EUR/USD and GBP/USD. The positive mean values imply that, on average, CIP arbitrage is profit-making for EUR/USD and GBP/USD and using Dollar as the base currency and EUR and GBP as the quoting currency where this would make profit gains this would make profit gains on investments. Furthermore, the associated t-values suggest that the gains are statistically significant at conventional levels of significance; testing at 5% significant level, one tail, the t-values are all below or equals to 0.05 (t>0.05) indicating that the gains made when funds were borrowed using EUR and GBP as the quoting currency and US Dollar as the base currency would have significant profits on returns on investments. The median values of GBP/USD and EUR/USD are not significantly different from mean indicating uniform distribution on the performance of both quoting and base currency over the selected period of time of February, March and November. However, the t-values of 0.07 and 0.08 for the month of November for both the EUR/USD and GBP/USD was not significant (t>0.05) meaning that the gains made when the funds were required in foreign currency did not give significant returns on investment testing at 5% significant level.

4.4. Covered Interest Rates Parity (CIP) Arbitrage Opportunities in Kenya Commercial Bank when the Funds are required in Domestic Currency

Table 4.5: CIP on Kenya Commercial Bank when the Funds are required in Foreign Currency

		Buying Price	Selling Price	Net Gain/Loss	Principal Amount	Foreign Interest Rates	(1+r)^10	Maturity Period	Final Amount	t-values	mean	median
February	EUR/USD	1.3452	1.9564	0.6112	4000000	0.1023	6.6	10	16135680	0.000946	-0.051623	1.6508
	GBP/USD	1.6421	1.9653	0.3232	4000000	0.1265	6.6	10	8532480	0.002139	-0.064319	1.8037
March	EUR/USD	1.4235	1.8865	0.463	4000000	0.1568	6.6	10	12223200	0.005851	-0.081325	1.655
	GBP/USD	1.4265	1.9947	0.5682	4000000	0.1543	6.6	10	15000480	0.029543	-0.091921	1.7106
November	EUR/USD	1.2354	1.7986	0.5632	4000000	0.1924	6.6	10	14868480	0.123331	-0.015786	1.517
	GBP/USD	1.4731	1.7654	0.2923	4000000	0.1364	6.6	10	7716720		-0.0136	

The table shows that the average return from CIP arbitrage is negative; in all of the cases of EUR/USD i.e. the figures in the column headed by "Mean" are negative throughout the table. Also, the median returns are not close to the mean returns, indicating asymmetric distribution in EUR/USD meaning that the currency performance was not uniform. The negative mean values

imply that, on average, CIP arbitrage is loss-making for both GBP/USD and EUR/USD when the funds are required in foreign currency at Kenya Commercial Bank therefore investors would be advised not to borrow in that manner using Dollar as the base currency and EUR as the quoting currency; this would make them have losses on their investments. Furthermore, the associated t-values suggest that the losses are not statistically significant at t value below conventional levels of significance; testing at 5% significant level, one tail, the t-values are all below or equals to 0.05 ($t<0.05$) except for the month of November when the losses were statistically significant at t-values ($t<0.05$).

Table 4.5: CIP on Kenya Commercial Bank when the Funds are required in Domestic Currency

		Kenya Commercial Bank CIP when the funds are required in Domestic Currency										
		Buying Price	Selling Price	Net Gain/Loss	Principal Amount	Foreign Interest Rates	$(1+r)^{10}$	Maturity Period	Final Amount	t-values	mean	median
February	EUR/USD	1.3452	1.9564	0.6112	4000000	0.1126	6.6	10	16135680	0.409705	0.261152	1.6508
	GBP/USD	1.6421	1.9653	0.3232	4000000	0.1139	6.6	10	8532480	0.130798	0.122349	1.8037
March	EUR/USD	1.4235	1.8865	0.463	4000000	0.5642	6.6	10	12223200	0.032585	0.298393	1.655
	GBP/USD	1.4265	1.9947	0.5682	4000000	0.8741	6.6	10	15000480	0.05355	0.463825	1.7106
November	EUR/USD	1.2354	1.7986	0.5632	4000000	0.9754	6.6	10	14868480	0.183715	0.579557	1.517
	GBP/USD	1.4731	1.7654	0.2923	4000000	0.3794	6.6	10	7716720	0.9633	0.3794	

The study results 4.5 in table indicate that the average return from CIP arbitrage is positive; in all of the cases of EUR/USD and GBP/USD i.e. the figures in the column headed by "Mean" are positive throughout the table when the funds are required in foreign currency. Also, the median returns are not close to the mean returns, indicating asymmetric distribution in EUR/USD and GBP/USD meaning that the currency performance was not uniform. The positive mean values imply that, on average, CIP arbitrage is profit-making for both GBP/USD and EUR/USD when the funds are required in foreign currency at Kenya Commercial Bank therefore investors would be advised not to borrow in that manner using Dollar as the base currency and EUR as the quoting currency; this would make them have losses on their investments. Furthermore, the associated t-values suggest that the gains are not statistically significant at t value above the conventional levels of significance; testing at 5% significant level, one tail, the t-values are all below or equals to 0.05 (t<0.05) except for the month of March where the investors would make significant gains at t<0.05 testing at 5% significant level using a 1 tail test.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

Chapter five gives the summary, recommendations of the study based on the study findings. The chapter presents brief overview of the study findings in comparison with the findings in the literature review. The contrary or similarity between the study findings and the findings in the literature is then given.

5.2 Summary

This paper investigates empirically the existence of arbitrage using a microstructure perspective. Specifically, we study the foreign exchange (FX) market in the selected commercial banks in Kenya (KCB and Barclays Bank of Kenya), for which the no-arbitrage condition is well known and relatively easy to test. This condition is covered interest rate parity (CIP), which states that net returns on an investment that borrows at home and lends abroad (or vice versa) in similar interest-bearing assets will be zero when exchange rate risk is hedged through forward or swap contracts. The CIP condition is the cornerstone riskless no-arbitrage condition in the FX market. The study findings suggest that CIP arbitrage opportunities do not generally arise in the FX market and mispricing is negligible when one accounts for estimated transaction costs.

The study found out that trading aimed at exploiting no-arbitrage conditions is, on average, not profit-making. However, the study has documented numerous short-lived profitable deviations from CIP based on whether the funds were required in foreign currency or they were required in domestic currency. The study has also revealed that the size of the profitable deviations can be

economically significant and is comparable across different maturities of the interest rates examined. Their duration is, on average, high enough to allow agents to exploit these opportunities, but low enough to explain why such CIP violations have gone undetected in much previous research using data at lower frequencies; this finding is also supported by the study done by Ongena & Yesin (2009) where they indicated that the profit gains from currency deviations do not form adequate profit for investors. The study also found little evidence in favor of the fact that prices for spot and forward rates and for money market instruments are set directly from the formulas of no-arbitrage conditions in real time; this is also inline by the findings by Ize & Levy-Yeyati, (2003) that the frequency, size and duration of apparent arbitrage opportunities decline with the pace of markets and increase with market volatility.

Overall, the evidence is consistent with the Grossman–Stiglitz (1980) view of financial markets, where efficiency is not interpreted as a statement about prices being correct at each point in time but the notion that in efficiently-functioning financial markets very short-term arbitrage opportunities can arise and invite traders to exploit them, which makes it worthwhile to watch the relevant markets. This is the arbitrage mechanism that restores the arbitrage-free prices that was observed by the study on average. Nevertheless, the lack of predictability of arbitrage and the fast speed at which arbitrage opportunities are exploited and eliminated imply that a typical researcher in international macro-finance using data at the daily or lower frequency can safely assume that CIP holds which is not the case in this kind of study.

5.3 Conclusions of the Study

The reaction in Kenya has been to intervene in the foreign exchange market and thus defend the shilling from this pressure, these shows cycles of intervention and sterilization. In the process, interest rates have increased and remain at high levels, but the overriding objective in economic

management has been to stimulate economic recovery and increase the investment response which is difficult to manage with high interest rates. Thus the intermediate targets have been adversely affected, as has attainment of the long-term objectives of stimulating growth, creating employment and reducing poverty.

The study concludes that it is not possible to earn positive returns by borrowing domestic assets for lending, in a similar asset, abroad (or vice versa) while covering the exchange rate risk through a forward contract of equal maturity. Domestic and foreign interest-bearing assets can be considered similar if they are of equal maturity and share the same characteristics, such as liquidity and political and default risk. Further, it indicates that it appears that profitable CIP arbitrage when measured, e.g., from the viewpoint of a domestic arbitrageur precludes profitable BA opportunities for a domestic fund raiser while the converse may not be true. If a positive return can be gained in domestic currency by borrowing domestic funds to lend abroad, it will also be relatively dearer to borrow funds abroad (when measured in domestic currency), but the converse may not be the case. However, profitable CIP arbitrage when measured in domestic currency implies that it will be profitable for a foreign investor to borrow domestic currency funds, convert them to the foreign currency at the spot rate, while covering the exchange rate risk at maturity through a forward contract. In other words, profitable CIP arbitrage from the viewpoint of a domestic (foreign) dealer implies BA from the viewpoint of a foreign (domestic) dealer.

5.4 Recommendations

The study recommends arbitrage to be observed by all the banks since if it was never observed; market participants would not have sufficient incentives to watch the market, in which case arbitrage opportunities could arise. In turn, very short-term arbitrage opportunities invite traders to exploit them and hence will be quickly eliminated.

The study also recommends that size of arbitrage opportunities is economically significant for the three exchange rates and across all of the different maturities of the instruments involved in arbitrage since the duration of arbitrage opportunities is, on average, high enough to allow agents to exploit deviations from the law of one price. However, duration is low enough to suggest that markets exploit arbitrage opportunities rapidly.

5.5 Limitation of the Study

The study was limited by the number of banks as participants since only two 5 out of the 42 selected banks were chosen for the study. The study was also limited on the generalization of its findings since the researcher assumed that the study findings generalized the entire banking sector. The study also chose study three months (February, Mach and November) rather than studying the entire 12 months period in the year 2012. Finally, the study was limited by the currency in which it evaluated the existence of borrower's arbitrage since it concentrated on only their currencies.

5.6 Suggestion for Further Research

The study recommends further studies on the explanation of dealers acting as market makers that may deliberately provide relatively lower ask quotes and bid quotes if they want to reduce their inventories, or provide relatively higher ask and bid quotes if they want to increase their inventories. Since this this explanation of the apparent mispricing is not implausible given in the study and was not captured by the study objectives yet is substantial in the trading of financial markets, and especially in the inter-dealer markets that is aimed at controlling inventories

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Appendix 1: Forward Exchange Rates EUR/USD

Name	Bid	Ask	Net chg.	Chg. %	High	Low	Last Time
EUR/USD 01M Forward	1.3800	1.6300	+0.0200	+1.38%	1.6000	0.7550	13:05:13
EUR/USD 01W Forward	0.2900	0.3700	-0.0150	-4.34%	0.7350	0.1700	13:00:00
EUR/USD 02M Forward	2.5700	2.6900	-0.1450	-5.08%	3.0000	2.0000	13:01:30
EUR/USD 02W Forward	0.6200	0.6800	-0.0150	-2.26%	1.1950	0.3250	13:01:28
EUR/USD 02Y Forward	27.3500	57.3500	-4.5550	-9.76%	52.0000	41.5000	13:06:01
EUR/USD 03M Forward	3.2000	3.6000	-0.5450	-13.99%	4.0000	3.0000	13:05:54
EUR/USD 03W Forward	0.9200	0.9800	-0.0250	-2.53%	1.2400	0.4850	13:01:28
EUR/USD 04M Forward	2.4300	6.4300	-0.1850	-4.00%	5.5050	4.3750	13:00:20

Appendix 2: Forward Exchange Rates GBP/USD

Name	Bid	Ask	Net chg.	Chg. %	High	Low	Last Time
GBP/USD 01M Forward	-41.9000	-40.9000	0.2500	-0.60%	NaN	-41.7500	13:06:45
GBP/USD 01W Forward	-9.6000	-8.8000	0.0000	0.00%	-5.8000	-9.4000	13:06:47
GBP/USD 02M Forward	-79.2000	-77.1000	-2.6000	3.44%	-50.1000	-78.7500	13:05:42
GBP/USD 02W Forward	-18.7000	-17.7000	-0.1500	0.83%	-11.5000	-18.6000	13:05:50
GBP/USD 02Y Forward	-1,000.0000	-900.0000	-48.9000	5.43%	-815.0000	-986.4000	13:07:11
GBP/USD 03M Forward	-118.0000	-115.0000	-5.0000	4.48%	-75.9000	-118.0000	13:05:34
GBP/USD 03W Forward	-27.6000	-26.6000	-0.5500	2.07%	-25.8500	-27.5000	13:06:35
GBP/USD 04M Forward	-181.2000	-131.2000	-2.9000	1.89%	-102.0000	-157.9000	13:06:11

Appendix 3: 91 Day Treasury Bonds

Month, Year	Issue No	ISIN Number	Tenure	Face Value	Issue Reopen date	Maturity date	Coupon Rate	Redemption Yield
Nov, 2012	IFB1/2011/12 (Tap 1)	KE2000002242	12	328.8	11/7/2012	9/18/2023	12	16.64
Mar, 2012	FXD3/2012/1	KE2000002291	1	15	3/26/2012	3/25/2013	16.432	16.432
Feb, 2012	FXD2/2012/1	KE2000002291	1	10	2/27/2012	2/25/2013	18.03	18.03