AN INVESTIGATION ON THE EFFICIENCY OF THE FOREIGN EXCHANGE MARKET IN KENYA: THE RATIONAL EXPECTATIONS APPROACH

BY

WAINAINA PETER WANYOIKE

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DECLARATION

This research project is my original work and has not been presented for award in any other University.

Signature …… Date……

PETER W. WAINAINA

D63/83509/2015

This research project has been submitted for examination with my approval as University supervisor.

Signature: …….. Date……

DR. LISIOLO LISHENGA

Senior Lecturer, Department of Finance and Accounting

School of Business, University of Nairobi

DEDICATION

I dedicate this study material to my dear parents, who brought up all their children in the fear and love of the Lord. They sacrificed their lives to provide for all of our needs to the best of their ability and capacity. They, however did not live long to see and enjoy the fruits of their labour. May their souls continually rest in perfect peace.

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ABREVIATIONS AND ACRONYMS

EMH	Efficient Market Hypothesis
UIP	Uncovered Interest rate Parity
US	United States
ROR	Rate of Return
EMT	Efficient Market Theory
TB	Treasury Bill
CBK	Central Bank of Kenya
SPSS	Statistical Package for Social Sciences

ABSTRACT

The aim of this investigation was to establish whether the forward rate is an unbiased predictor of the future spot exchange rate. The study was guided by three theories namely; Efficient Market Hypothesis, Arbitrage Pricing Theory and the Law of One Price Theory. Descriptive cross-sectional design was adopted for the study. Data was exclusively collected from a secondary source. The research centered on the foreign exchange markets under floating exchange rates beginning July 1999 to June 2016. Historical facts on the monthly (average) spot exchange rate and the three-month forward premiums for the British pound, the Euro, the US Dollar, and the selected currencies of the East African region were sourced from the Central Bank of Kenya. Regression analysis was conducted to determine the significance of the regression coefficients. From the findings, the study concluded that forward rates for all the five currencies (USD, GBP, EURO, UGSH and TZSH) have a positive and significant influence on future spot exchange rates. The study, therefore, concluded that forward rate is an unbiased predictor of the future spot exchange rate. This means therefore that the market is not efficient as per the investigation. From the findings, the study recommended that participants of the FOREX market should know when and when not to take advantage of the inefficiency in the FOREX market to make arbitrage profits. Further, the study recommended the need for scholars and academician to undertake more studies relating to the foreign exchange market. This is because; it is an area that has not been fully researched.

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Market efficiency is usually defined with regards to a particular set of information that market participants use to forecast future prices of assets. Accordingly, three market efficiency forms can be differentiated. There is the weak-form of efficiency in whereby asset prices incorporate all facts obtained from the past. The next is the semi-strong market efficiency form whereby asset prices mirror's all information available in the public. Lastly, there is the strong-form of market efficiency where asset prices impound all facts that are accessible. An efficient foreign exchange market plays two main functions. It ensures risk-sharing among market participants such that they bear only that risk they desire. Next, efficient foreign exchange markets help in the price discovery process. They help determine the fair value of financial assets thereby improving portfolio allocation decisions and better decision making within the firm (Fama, 1991).

To be considered efficient, a foreign exchange market should embody certain characteristics; the forward and the spot rates of exchange should incorporate all relevant information, and in addition to this, they shouldn't be able to predict the spot to be a function of the forward rate or vice versa. In addition to this, the future spot rate should not be predicted by a biased forward rate under the assumptions that the risk is neutral and the risk premium's covariance is stationary. The conventional measures of the foreign exchange market efficiency hypothesis (EMH) are hence derived from a continuous projection of the forward rate on the future spot exchange rate. To bypass the non-stationarity issue related to this estimation model, Froot and Frankel (1989) utilized the forward premium to be the explanatory variable and the exchange rate became the explained variable. As found out by Liu and Maddala (1992), the results of such an adjustment process would lead to inconsistencies in the estimation of the regression coefficient since the forward rate has a correlation with the risk premium. Liu and Maddala made as suggestion to regress the forward premium on the exchange rate differential when the two variables are stationary. The disadvantage of doing this would therefore show a finite sample bias because an endogenous regressor is present. Whether the small sample

bias is large enough to result in rejection of the EMH even when it is true remains to our knowledge an open empirical question.

In its simplest form, market efficiency in foreign exchange markets can be presented as a joint hypothesis that associates in the foreign exchange market are (1) rational and (2) risk-neutral. Empirical studies done on determining how efficient the foreign exchange is across the world shows that the argument does not stand. This has also been shown by Canale and Napolitano (2001) and Atingi and Kaggwa (2003). There has been no agreement in regards to how the foreign markets behave. An example could be that the different markets exhibit different statistical distributions. Many suggestions have been put forward to provide an explanation for the breakdown of the EMH but not one has made it past the empirical tests (Fama, 1991). This also includes those studies conducted to check the efficacy of the foreign exchange market in including Kenya. This study used the rational expectations approach to test the efficacy of foreign exchange markets hypothesis in Kenya.

1.1.1 Market Efficiency

Efficient foreign exchange markets play at least two important roles in the economy. The primary role is that markets are important for risk-sharing. They assist portfolio managers to increase their knowledge on the capacity to hedge the risk of unpredictability of the variability in the exchange rates. They also enable speculators to take positions that align with their forecasts of future foreign exchange rate movements. Second, efficient foreign exchange markets represent the best tool for summing up all market participants' opinions on the future volatility of returns from the market. Therefore, an efficient foreign exchange rate market should enable the use of hedging and speculative activities at minimal costs (sharing of risks and effective pricing), and combine market beliefs on the volatility of returns on assets precisely (information efficiency) (Gradojevic & Gencay, 2010).

The efficiency of markets can be described through three forms with respect to the information zed to forecast future prices. In its weak-form of efficiency, security prices confer all facts contained in past prices. In the semi-strong form of efficiency prices of securities encompass all facts made openly and in the third and strongest form of efficiency, security prices contain all private and public information. Therefore if the weak-form of

market efficiency is absent, then this implies the existence of the other forms of market efficiency. Hence, this study will examine the weak-form of efficiency in the KSh/US dollar spot and forward currency markets in Kenya since the US dollar is the leading world currency (Lyons, 2001).

One implication of market efficiency is that asset returns are random. Therefore, returns on an efficient asset market are normally distributed or Gaussian. However, there is no consensus about the data generating process producing the observed returns on the securities markets. At least two major competing explanations can be identified in the literature. The first group argues that returns are generated by a stationary, non-Gaussian distribution that belongs to the Stable Paretian family of distributions. For example, Mandelbrot (1967) and Fama (1970) adduced proof that favors of the Stable Paretian distribution. The second group argues that returns are generated by the Gaussian distribution with time-varying parameters. However, comparing the performance of the candidate data generating processes has been hampered by the fact that they are not nested. This study contributes towards this debate by applying extreme value theory to the distribution of extreme returns and extreme volatility in the foreign exchange market. This approach has an advantage over previous methods used in the literature since the various data generating processes need not be nested for comparison purposes.

The analysis of foreign exchange market efficiency provides an opportunity to contribute to two different lines of research. First, the investigation on the effectiveness of risk sharing of the foreign exchange market raises issues of the presence of arbitrage opportunities, the strongest contradiction of market efficiency. Second, starting from Hodrick and Srivastava (1984), many studies have measured informational effectiveness of foreign exchange markets by testing the unbiasedness of the forward rate to predict future spot rate. The common finding has been that the forward rate is a biased predictor of the future spot rate. This has been accredited to either the existence of the risk premium or to irrationality of market participants. Thus, there is no consensus about which of these two competing explanations is superior to the other.

However, there is an emerging consensus that developing economies deserve a different approach to testing the UIP condition compared to developed economies (Aliper et al., 2009). In particular, emerging economies are characterized by: relatively volatile economic conditions and ongoing structural changes; the peso problem; the fear of floating by monetary authorities that drive them to over-stabilize their currencies causing a stronger simultaneity bias; and incomplete institutional reforms (Alper, et al., 2009). These factors introduce other risks like currency risk, default risk and political risks that may cause failure of the UIP condition. Therefore, applying the same tools for testing UIP in developed countries to developing economies may invariably lead to rejection of the UIP hypothesis.

1.1.2 Rational Expectations

Muth (1961) explains that economic agents make presuppositions on future happenings. The presuppositions made are considered to be rational since they are a combination of all accessible facts and thereby do not lead systematic forecasting errors. This hypothesis implies that policies are only effective if they bring about unexpected events. In simple terms, this is impossible because rational economic agents will eventually ascertain any policy rule and will hence not be confounded. Another term for this is the 'irrelevance hypothesis. This analysis has been vastly applied to several policy instruments, particularly - monetary policy; but may also be useful to other policies such as fiscal policy and taxation. Rationality can be defined in two ways: The first way is on if the forecasted exchange rate is an unbiased predictor of the future spot exchange rate also referred to as unbiasedness and the second way is whether all accessible facts are included in the expected exchange also known as orthogonality. The rational expectations tests available in past literature are also based on these two criteria.

Irrational behavior can be explained through a range of decision making practices also referred to as biases, the results of which affect processing of information by individuals, and ultimately how they use the information in coming up with financial decisions that they perceive to be comfortable in. As illustrated by Shefrin (2000), behavioral psychology has demonstrated how imperfect people are in processing information since they are clouded by errors, biases and other perceptual illusions. Based on cognitive psychology

behavioral biases occur when people arrive at decisions based on their beliefs and preferences. These biases include overconfidence, anchoring, representativeness, loss aversion mental accounting among others.

According to Oslen (1998), in the presence of new information, investors fail to act logically, as a result, end up being overconfident and revert their choices in the presence of superficial financial information. Financial psychology has shown how irrational human beings can be when making investment decisions in the stock market. This has been emphasized by the fact that indeed psychological factors, noted by (Decourt et al., 2005), do have an effect on the investors' rationality in stock market investment decisions.

1.1.3 Market Efficiency and Rational Expectations

Market efficiency has a close link to the rational expectations property introduced by Muth (1961) and required equilibrium of asset prices by (Lucas, 1978). Indeed, Lucas demonstrates how the rational expectations hypothesis is equal to the notion that prices fully reflect all available information. In this model, asset prices are a function of current production, whose dispersion over a period of time is known to investors. Consumers make investment decision, partly based on what they expect in future in terms of prices. In this context, rational expectations demands that the price function implied by the consumer behavior (the true price function) should be equal to the price function on which decisions are based (the perceived price function). Under these assumptions, equilibrium asset prices satisfy Fama's definition of market efficiency.

Efficient markets hypothesis (EMH) does not imply the rational expectations hypothesis (REH). The EMH notes that the prices of assets would be constant if everyone had rational expectations. The strong form EMH also holds that every individual possesses complete information. The semi-strong form, like the REH implies that expected values are conditioned to public information. The EMH does not make any assumptions about individual portfolios. The assumption that each investor has an efficient portfolio is not assumed neither is it implied. Contrary to this, the rational expectations hypothesis indicates that the expected value of expectation errors conditional on public information is zero. As used it definitely amounts to much more the assumption that observable

aggregates have the values they would have if everyone had rational expectation (Fama & French, 1989).

1.1.4 Foreign Exchange Market in Kenya

The major participants of the FOREX market in Kenya are commercial Banks and foreign exchange bureaus. Other stakeholders for example corporations, institutional investors and individual investors have to conduct banks and/or brokers to obtain foreign currency. Deregulation of Kenya's foreign exchange market started with a fixed exchange rate era that lasted to the year 1982, followed by the crawling peg from 1983 till 1992. In 1992, Kenya introduced the foreign exchange bearer certificates commonly known as forex Cs, which marked the beginning of the foreign exchange market. These forex Cs were purchased at the established exchange rate from the central Bank in a "no question asked basis". These certificates which bore an interest rate were then marketable as any other paper. This meant that Kenya effectively had a two-fold exchange rate era:- the official exchange rate and a market rate. In January 1993, the forex Cs were suspended by the government meaning that the only existing exchange rate was the official one. However retaining of proportions of foreign exchange earnings by exporters was allowed, while importers were required to purchase their foreign exchange from commercial Banks.

Ngungi (1999) further notes that following the recall of the forex Cs, speculation within the market grew. The resultant effect was, the official exchange rate was devalued three times in the first half of 1993. This persuaded the government to eliminate foreign exchange regulation hence liberalizing the FOREX market. This gave birth to the floating exchange rate regime implying that the exchange value of currencies was determined by market pressures of demand and supply. The adoption of the floating exchange rate system was expected to harbor benefits for Kenya. The first benefit was that the change would permit a continual alteration of the exchange following modifications in demand and supply of foreign exchange. Secondly, it would equate the demand for and supply of foreign exchange by bringing about a shift in the nominal exchange rate as opposed to the levels of reserves. Third, Kenya would be free to adopt a monetary policy suitable for it without being concerned about the consequences on the balance of payments and therefore have an independent monetary policy consistent to variations in the exchange rates.

Under the floating system, the exchange rate movements would incorporate external imbalances as opposed to reserve movements. However, the floating exchange rate was allowed in environments that experienced excess liquidity, high depreciation and a rising inflation. The mopping up process pushed increased the Treasury bill rate and since it is the base rate for other interest rates, all the other rates escalated so high up hence causing a weakening of the exchange rate.

After 1993 an appreciation of the exchange rate was experienced caused by an interim inflow of capital in response to elevated levels of interest on the Treasury bill rate. The people relying on trade credit at that time were faced with uncertainty as to what prices they would be expected to repay for the foreign exchange in the event that letters of credit issued to them were recalled and therefore they included the foreign exchange redemption premium into their prices. This led to a massive increase in the level of inflation. A shift to a standardized floating exchange rate regime from a fixed system has been the cause of the increase in uncertainty and volatility.

1.2 Research problem

Efficiency of the forex market depends on how fast the market adjusts to new information. Participants in one location of the market might be not be perfect by having knowledge of purchases opportunities and undistinguishable selling of assets in different place noticing asset variation in prices in the market places from various places (Grossman & Stiglitz, 1980). Currency market is not efficient due to existence of arbitrage opportunities. If more players participated in the forex market the short term arbitrage opportunities would be exploited (Arnott & Pham, 1993). In the actual market place, investors have been discovered to exhibit irrational characteristics when making investment choices. The standard finance models have been unable to explicitly explain market anomalies (Atingi & Kaggwa, 2003). As explained by Thaler (1980) people are often willing to gain a higher payoff in order to relinquish an object than they are actually actually willing to part with so as to acquire the same – a pattern he referred to as endowment effect.

The forex market has experienced rapid growth since it was first established and amount of operating bureaus have risen from 48 in 1998 to 149 as at December 2016. This rapid

growth has to do with units in the market and also the volume of their trading. Despite the upsurge of commercial banks and foreign exchange bureaus in Kenya volatility of the exchange rate has increased. Thus, transaction and information costs have increased hence the liquidity of the foreign exchange markets has significantly declined. Commercial banks have also recorded abnormal profits from currency trade in Kenya and thus there is need to carry a study on the efficiency of the forex market in Kenya.

In the Local scenario, studies on efficiency of the FOREX market in Kenya have considered efficiency from the basis of profitability of simple trading rules. Ndunda (2002) did an examination that sought to determine if future spot rates in Kenya could be forecasted by the use of forward exchange rates. The study was centered on the market under a floating exchange rate system from October 1993 to December 2002. She established that being a forecaster of the future spot rate, the forward rate doesn't stand as a good basis of determination hence the conclusion that there is inefficiency in Kenya's foreign exchange market since the rate of return to speculation is not equal to zero. Kurgat (1998) did an empirical investigation on the efficiency of the spot markets on the FOREX bureaus in Kenya and he concluded that the sole cause of inefficiency experienced in the FOREX market could be elucidated by the presence arbitrage opportunities. He demonstrated that there were avenues of making spontaneous riskless risk profits by using local arbitrage. The research concluded that Kenya's foreign exchange market is inefficient.

After several years, Muhoro (2005) did a study similar to that by making use of locational and triangular arbitrage models. Second-rate data was derived from the daily closing counter foreign exchange rates of the Kenya shilling counter to the Euro and US dollar for 6 banks and 57 bureaus in the year 2003. The researcher used the Chi-square as a test of goodness of fit and descriptive statistics in her data analysis. The findings of the study were that the FOREX market was inefficient and the reason for this was the existence of many arbitrage opportunities that were in occurrence at the market. He argued that greater profits would be achieved by both banks and forex bureaus by conducting a triangular arbitrage as opposed to conducting a locational arbitrage transaction. This showed that the pricing of currencies against one another was not efficient. The above local studies considered how

efficient Kenya's foreign exchange market is from the arbitrage perspective i.e. profitability of simple trading rules. This is just one of the ways through which efficacy of the foreign exchange market can be tested. Presence of risk premium, rationality of participants' behavior, presence of over/under reaction in the market, inefficient information processing can also be used to test EMH. The study looked at efficiency of foreign exchange market in Kenya from the rational. The following research question guided the study: Is the expected forward rate an unbiased predictor of the future spot exchange rate?

1.3 Objectives of the study

The aim of the investigation was to establish whether the forward rate is an unbiased predictor of the future spot exchange rate

1.4 Value of the study

The current study will benefit participants of the FOREX market by advising them on whether or not they can take advantage of the inefficiency in the FOREX market to make arbitrage profits.

Few investigations have been conducted in Kenya on the efficacy of the foreign exchange market, and thus this study is of importance to Kenyan scholars and academician for the knowledge it adds in the area. It would benefit other academicians who may want to pursue studies relating to the foreign exchange market.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the theoretical framework applied in the study and reviews previous studies done on efficiency of forex market. It contains the theoretical review, determinants of firm's efficiency, empirical review, summary of literature review and conceptual framework.

2.2 Theoretical Review

This section highlighted on the fundamental forex market efficiency theories and how they inform on the study. These theories included: Efficient market hypothesis theory Arbitrage pricing theory and Law of one price theory.

2.2.1 Efficient Market Hypothesis

Fama (1970) explained the concept of efficient markets and described it as a market whereby security prices fully incorporate the entire accessible facts in such a way that unexpected gains cannot be obtained through this information set (informational efficiency); puts available funds to their best possible uses (allocative efficiency) and undertakes transactions at least avoidable cost (operational efficiency).

An economist's definition of market efficiency is that: the appropriation of resources derived by the market is considered efficient (Pareto optimal) if a substitute feasible appropriation of resources that can render an individual better off without doing the opposite to another does not in exist (Stiglitz, 1981). According to literature in finance however, the meaning is not the same. According to Reilly and Brown (2007) an efficient capital market is a market in which prices of securities adjust instantaneously to one in which security prices adjust rapidly as new information is presented to the market and hence current prices are a true reflection of all information regarding the security. This is called an informational efficient market meaning that it is impossible for one to steadily acquire superior gains over and above average market returns on a risk adjusted basis, given that all the facts about the investment have been laid out to the public at the time of making the investment. The two most applicable definitions of informational efficiency, are as

follows. “A capital market is efficient if all the information set is fully reflected in securities price” (Fama, 1970). As reported by (Jensen, 1978), a market is considered to be efficient informationally if there exists no possibility of making an economic profit on the basis of information set. Economic profit is taken to mean gains that have been adjusted for risks and netted of all costs.

Stiglitz (1981) mentioned that, market efficiency (informational efficiency) that has been put to use by financial economists is considered to be a section of overall market efficiency. A key requirement from the market is that it should enable sufficient information gathering, Market prices should incorporate the full information availed to the divergent traders and firms should be able to share out information on their future expected gains other investors (Stiglitz, 1981). The key aspect concerning the theory is that investors will only have the ability to gain more returns by accepting additional risk since rising interests would drive the expected ROR upwards. Fama and French (2004) argue that only the risk that cannot be diversified away can be compensated. Efficient market theory implies that prices are inclusive of all information. It is hence said that in a perfectly efficient market it is not possible to outperform the market. Price settlements by investors are taken to be “fair”. The meaning of this is that the only worry for investors is the choice of the risk and return trade-off that they are willing to take.

2.2.2 Arbitrage Pricing Theory

Arbitrage pricing theory advanced by Ross (1976), argued that APT occurs when simultaneous trading of currencies in markets that are different is done aiming in taking advantage of differing prices. Ross argued that stock’s price on foreign exchange is undervalued has been equated to local exchange price, therefore a trader uses this difference to make profit from this without incurring any risk. He asserted that arbitrage opportunities need rapid identification and should involve low transaction costs because in highly competitive markets mispricing is quickly corrected.

The theory assumed that the investors of the forex market are risk adverse utility maximizers although it is presumed not to prevail if there is no opportunity of arbitrage. This theory predicts the relationship between the triangular arbitrage and the forex market performance through linear combination of many independent macroeconomic variables: Interest rate, balance of payment and inflation rate. According to Azhar Bin Zakaria (2006) states that the APT model is used by arbitrageurs to gain yield by taking benefit of mispriced currency rates because the actual exchange rate will have a price which is different from the model prediction hypothetical currency rate. APT theory helps the arbitrageurs determine the overvalued and undervalued currencies and through this profit is gained. The theory is related to this study in that it explains the conditions necessary for triangular arbitrage to take place.

2.2.3 The Law of One Price Theory

The one price law argued that similar assets price should be the same in different markets in the presence of transaction costs. If the prices differ the arbitrageurs will stabilize the price by moving it toward equilibrium through buying in the market that are cheaper and selling in market of dealers to benefit from the arbitrage profits (Akram, Rime & Sarno, 2008). According to Parikh(2010),the LOP is based on assumptions that there aren't transactions costs association through trading of items/currencies in several markets hence assuming absence of mobility expenses related with the exportation and importation of goods in order for LOP to be valid.

According to Krugman and Obstfeld (2002) argues out that free conveyance costs and official barriers identical goods in competitive markets sold in different locations having their prices stated in terms of the same currency need to sell for the same price. LOP theory doesn't always hold in practice because of the transaction costs and trade barriers that are present in the real world. Therefore, if price discrepancies occur people take advantage of them in order to profit from the arbitrage gain associated with the different currency rates in the forex market. This theory is related to this study as it explains how triangular arbitrage is not feasible in an efficient market.

2.3 Determinants of Foreign Exchange Market Efficiency

Numerous empirical studies, (Fama (1970), Clendenning (1970) and Aliber (1973)) have been carried out on the efficiency of international FOREX markets. Such studies came about with the establishment of floating exchange rates in most countries of the world. Levich (1979) argued that it is not easy to establish whether investors' efficiency set and the real spot exchange rate is equivalent to its equilibrium value unless there exists a consensus on what the equilibrium value is. According to Fama (1970), equity markets and foreign exchange markets differ as firms might be represented based on their consistency in terms of products, directors, financial strategy and customers. He suggests that for firms operating in a stable environment with mature products, investors can learn the risk/return properties of equities.

Poole (1967) and Booth (1977) carried out empirical studies to assess the efficiency of the FOREX market. They tested the null hypothesis that under a freely floating exchange rate regime, changes in spot exchange rates should be serially correlated. They made the conclusion that there are compelling recessions from random behaviour under floating exchange rates and therefore the spot market was inefficient. Poole (1967) further analysed the investment strategies that use filter rules as guides for picking speculative positions. A filter rule is a mathematical rule that can be applied mechanically to produce buy and sell signals. An x per cent filter rule indicates; "buy a currency whenever it rises x per cent above its most recent trough; sell the currency whenever it falls x percent below its most recent peak."

2.4 Empirical Review

Fama (1965) stated that an efficient market consists of many competitive profit maximizers who interact in the market and put into use all facts that are made available in a rational manner. A characteristic of an efficient market is that all accessible facts are entirely incorporated in prices in such a way that provides no opportunities for arbitrage. In an efficient currency market, spot or forward exchange rates should also contain all relevant facts and should not forecast one as being a function of the other. Also, the future spot rate should be predicted by the forward rate in absence of a bias under the assumptions of the

risk being neutral and risk premium that is a covariance-stationary (i.e. if markets are efficient forward rate should predict future rate).

While Baillie and Bollerslev (1989), Diebold et al., (1994) and MacDonald and Taylor (1989), argued that co-integration among exchange rates in diverse currencies implies that the market efficiency has failed, Dwyer and Wallace(1992) and Engel (1996) have shown how no connection exists between co-integration of spot rates and inefficiency of the market. Levin and Lin (1992), Wu and Chen(1998) demonstrated that the more enhanced statistical power of unit root tests obtainable from the use of pooled data as opposed to using individual series greatly reinforces the market efficiency hypothesis. Alexakis and Apergis (1996) also demonstrate the existence of the efficient FOREX market hypothesis by modeling conditional heteroskedasticity through ARCH models.

As demonstrated in the survey by Froot and Thaler (1990), the accustomed test for efficacy makes the assumption that the forward exchange rate is an unbiased estimate of the future spot rate. Several investigations have pointed out that use of expectations survey data to augment the efficacy test, in the event that biases are still present and can be observed by the tests. Therefore, Elliot and Ito (1995) use micro survey data to investigate how efficiency the forward yen/dollar market is and find that the survey data counts as a key source of additional facts explaining how markets behave.

Dooley and Shafer (1976) examined the variation in the dollar spot rates from March 13, 1973 to September 5, 1975 using the martingale model for 9 selected countries. The results led to rejection of the martingale model for spot exchange rates for four out of the nine countries at the ninety five percent confidence level implying that exchange markets for many currencies may not have been efficient in the use of price information.

Cummins et al., (1976) examined the US against the Canadian dollar exchange rate using the martingale model in the 1970-74 period. They concluded that the spot market seems to behave efficiently and hence it does a random walk. However, their test indicated that the forward rate against the Canadian dollar does not do a random walk hence the respective forward market did not pass the usual weak form test of efficiency.

Levich (1978) examined equation (9) for nine countries during the period 1967-75. For the three-month horizon, the error w(t+l) was not indicatively divergent from zero in France and Italy; but the errors seemed to be significantly different from zero in Canada, the United Kingdom, Belgium, Germany, the Netherlands, Switzerland and Japan. Only in two out of nine countries was the martingale hypothesis consistent with the data.

Kaserman (1973) examined the U.S.-Canadian dollar from the period of between July 1955 and March 1961 for the relation between the subsequent spot price P(t+1), where the unit of time is one quarter, and the forward price Qt+i(t) at time t. He studied equation (10) and concluded that the forward rate under-predicted the spot rate in periods of a rising spot rate and over-predicted it when the spot rate was falling.

Locally, Ndunda (2002) conducted an investigation on determining whether future spot rates in the Kenyan foreign exchange market were forecasted by the forward exchange rates by making use of the Hansen & Hodrick (1980) model. She mainly concentrate on efficiency of Kenya's foreign exchange market in a floating exchange rate system and she selected the period from October 1993 to December 2002. Weekly spot exchange rate data was collected together with three-month forward exchange premium for the United States dollar, British pound Euro, Swiss Franc, the Euro, and the Yen. An estimation of the regressed errors of the local currency was made on a constant two lagged errors using weekly data and a three-month forward rate. The regression model was put to test on the basis of the assumption that the coefficients of the regression were equal to zero. The investigative results showed a firm confirmation of simple efficiency hypothesis for a total of four out of the five currencies. She found out that Interest rates in Kenya have been relatively high but changes in the foreign exchange rates have been as high. Therefore, the quoted forward rates became greater than the future spot rates; which implied that the forward rate did not stand as a good forecaster of future spot rate. She hence made the conclusion that the FOREX market in Kenya is characterized by inefficiency as the rate of return to speculation is not equal to zero. The limitations to the study however were that the researcher did not account for the normality and constant variance assumptions in the study model (Ndunda, 2002). Available evidence shows that exchange rates are better characterized by ARCH models (Engle, 1982; Hsieh, 1989). Besides using the rational

expectations approach, this study will also go further to fill this gap by testing for constant variance, normality distribution of error terms, as well as the stationarity associated with the time series data to be used.

In the period before1995, Kenya placed restrictions on foreign currency transactions. However, Kurgat (1998) mentions that Kenya's FOREX market became more active after the Exchange Control Act in 1995 was revoked and forex bureaus were given licenses. The licensing of foreign bureaus in Kenya improved the efficiency with which the Kenyan shilling would be exchanged for other foreign currencies (Kurgat, 1998). He investigated the efficiency of spot markets in Kenya's forex bureaus and showed how inefficient the Kenyan foreign exchange market and attributed this to the presence of arbitrage opportunities. He demonstrated how possible it was to generate instant riskless returns through local arbitrage. The study established that the FOREX markets in Kenya face inefficiency.

After several years, Muhoro (2005) conducted a similar investigation by making use of locational and triangular arbitrage models. Second-rate data was obtained in the form of daily closing counter foreign exchange rates of the Kenya shilling against two currencies; the Euro and US dollar for a total of 57 forex bureaus and 6 banks for 2003. The researcher used the Chi-square as a test of goodness of fit and descriptive statistics in her data analysis. The findings of the study were that the FOREX market was inefficient and the reason for this was the existence of many arbitrage opportunities that were in occurrence at the market. Muhoro (2005) argued that greater profits would be achieved by conducting a triangular arbitrage transaction as opposed to a locational arbitrage transaction in both banks and bureaus. This showed that the pricing of currencies against each other is considered inefficient.

2.5 Conceptual Framework

This is the understanding of the relationship among conceptual different variables in a certain study. According to McGaghie (2001) he argued that the conceptual model sets the stage for the presentation of the particular research question that drives the investigation being reported based on the problem statement. The objective of the research was: to establish whether the forward rate is an unbiased predictor of the future spot exchange rate. The two main variables from the objective were forward rate (Independent variable) and future spot rate (Dependent variable).

The conceptual framework below was used to show the relationship between forward rate and future spot rate on the Kenyan forex market. The independent variable was forward rate which was measured by US monthly averages for the 91-Day T-BILL rates and the three-month forward premiums for the Euro, the Sterling Pound, the US Dollar, and the two East African currencies were obtained from the Central Bank of Kenya. Future spot rate was the dependent variable which the study sought to explain and it was measured by monthly (average) spot exchange rate.

Figure 2.1: The Conceptual Model

Source: Researcher (2017)

2.6 Summary of Literature Review

Local studies carried out on efficiency of the FOREX market in Kenya i.e. Ndunda (2002), Kurgat (1998) and Muhoro (2005) looked at efficiency from the basis of profitability of simple trading rules (arbitrage). This study will instead look at efficiency of the FOREX market in Kenya from the rational expectations approach. The results of the above local studies could also be questionable since in all the studies, the assumptions of regression models such as normally distributed errors terms, constant variance, and stationarity of time series data were not tested. Also prior research on the efficiency of the foreign exchange markets shows proof that spot rates and forward rates are non-stationary and follow unit root processes (Meese and Singleton, 1982; Baillie and Bollerslev, 1989; Hakkio and Rush, 1989; Barnhart and Szakmary, 1991; Liu and Maddala, 1992; Naka and Whitney, 1995; Lin and Chen, 1998; and Lin et al., 2002). This study seeks to close this gap by testing for rational expectations, constant variance, normality distribution of error terms, as well as the stationarity of the time series data to be used.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter described methods of research applied to objectively establish the efficiency of the FOREX market in Kenya. It also showed the population of study, research design, a test of reliability and validity, the criteria with which data was collected and analyzed.

3.2 Research Design

Research design is defined as a blue print of those procedures, which are adopted by a researcher for testing the relationship between dependent variables and independent variables (Khan, 2008). Descriptive cross-sectional design was adopted for the study. A descriptive study involves a description of all the elements of the population. It allows estimates of a part of a population that has these attributes. Identifying relationships among various variables is possible, to establish whether the variables are independent or dependent. Cross-sectional study methods are done once and they represent summary at a given timeframe (Cooper & Schindler, 2008).

3.3 Data Collection

Data was exclusively collected from a secondary source. The research centered on the foreign exchange markets under floating exchange rates beginning July 1999 to June 2016. Historical facts on the monthly (average) spot exchange rate and the three-month forward premiums for the British pound, the Euro, the US Dollar, and the selected currencies of the East African region were sourced from the Central Bank of Kenya. The premium was added to the spot exchange rates to obtain the three-month or 13-week forward exchange rate. The US monthly averages for the 91-Day T-BILL rates were obtained through a search query at the website link to the US treasury department. This assisted in computing the forward rate.

3.4 Diagnostic Tests

Linearity show that two variables X and Y are related by a mathematical equation Y=bX where b is a constant number. The linearity test was obtained through the F-statistic in ANOVA. Stationarity test is a process where the statistical properties such as mean,

variance and autocorrelation structure do not change with time. Stationary tests were applied by using the Augmented Dickey-Fuller (ADF) test to indicate whether there was stationarity or non-stationarity in the variables. Normality is a test for the assumption that the residual of the response variable are normally distributed around the mean. This was determined by Kolmogorov-Smirnov test.

Autocorrelation is the measurement of the similarity between a certain time series and a lagged value of the same time series over successive time intervals. It was tested using Durbin-Watson statistic (Khan, 2008).

Multicollinearity is said to occur when there is a nearly exact or exact linear relation among two or more of the independent variables. This was tested by the determinant of the correlation matrices, which varies from zero to one. Orthogonal independent variable is an indication that the determinant is one while it is zero if there is a complete linear dependence between them and as it approaches to zero then the multicollinearity becomes more intense. Variance Inflation Factors (VIF) and tolerance levels were carried out to show the degree of multicollinearity (Burns & Burns, 2008).

3.5 Data Analysis

The data was sorted, classified, coded and then tabulated for easy analysis. Collected data was analyzed using both descriptive and inferential statistics. Analysis of the data was made by using the Statistical Package for Social Sciences (SPSS) version 21 computer software because it's more user-friendly. The data was inputted into the SPSS and examined using descriptive, correlation and regression analyses.

3.5.1 Analytical Model

Using the collected data, the researcher conducted a regression analysis to establish the efficiency of the FOREX market in Kenya. The study applied the following regression model:

$$\Delta S_{t+k} = \beta_0 + \beta_1(F_t^{(k)} - S_t) + \varepsilon_{t+k} \quad \text{.......................................} (1)$$

Where: $S_{t,}$ denotes the spot exchange rate at time t,

$\Delta S_{t+k} = S_{t+k} - S_t$

α = y intercept of the regression equation.

$\beta_0$and β_1 =are the regression constants

$F_t^{(k)}$ = Level of k-period forward exchange rate determined at time t;

ε =an error term with $\varepsilon_t(\varepsilon_{t+k}) = 0$

If market participants are risk-neutral and have rational expectations it is expected that β to be equal to unity and ε_{t+k} to be uncorrelated with information available at time t. The forward rates were computed by applying equation (2) below:

$F = S_t * (1+i_h / 1+i_0)$……. (2)

Where;

I_h is the local interest rate

i_0 is the foreign interest rate

S_t is the spot rate at time t

The monthly averages for the US 91-Day T-BILL rates for July 1999 to June 2016 were applied in equation (2) as the proxy for foreign interest rates.

3.5.2 Tests of Significance

To test the statistical significance the autocorrelation test, the F- test and the p values were used at 95% confidence level. The F statistic was utilized to establish a statistical significance of regression equation while the p value was used to test statistical significance of study coefficients. Auto-correlation test is known for its reliability as a reasonable measure for testing of either dependence or independence of random variables in a series.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1: Introduction

This chapter deals with the analysis of data. The aim of this investigation was to establish whether the forward rate is an unbiased predictor of the future spot exchange rate. The data analysis is in harmony with the objective where patterns were investigated through descriptive analysis, trend and inferential analysis which were then interpreted and inferences drawn on them.

4.2 Characteristics

The study used monthly time series data for the period July 1999-June 2016. The sources of data included World Bank Indicators and Kenya National Bureau of Statistics annual reports. Data was collected for the variables forward rates and future spot rates for various currencies namely; USD, GBP, EURO, UG SH and TZ SH. Analysis results are presented as per the above currencies.

Table 4.1 below describes the basic features of the real data for the variables. Descriptive statistics give summaries about the sample and they form a fundamental basis for every quantitative data analysis.

Table 4.1: Descriptive Statistics

	Observations	**Mean**	**Max**	**Min**
Spot Rates (USD)	204	80.33572	105.2930	62.02900
Forward Rates (USD)	204	85.5051	123.4434	63.8040
Spot Rates (GBP)	204	131.4278	160.3090	110.8450
Forward Rates (GBP)	204	139.5880	188.6865	115.5684
Spot Rates (EURO)	204	97.81326	139.6210	66.69300
Forward Rates (EURO)	204	104.0605	159.6367	69.1114
Spot Rates (UGSH)	204	26.27620	35.18800	19.50500
Forward Rates (UGSH)	204	27.9563	42.4655	21.0547
Spot Rates (TZSH)	204	16.24033	21.73000	10.08100

Forward Rates (TZSH)	204	17.2628	25.9437	10.4466

From the above the results, the mean for Spot and forward rates (USD) over the estimated period were 80.33572 and 85.5051 respectively, with values ranging from a minimum of 62.02900 and 63.8040 to a maximum of 105.2930 and 123.4434 respectively. The mean for Spot and forward rates (GBP) over the estimated period were 131.4278 and 139.5880 respectively, with values ranging from a minimum of 110.8450 and 115.5684 to a maximum of 160.3090 and 188.6865 respectively.

The mean for Spot and forward rates (EURO) over the estimated period were 97.81326 and 104.0605 respectively, with values ranging from a minimum of 66.69300 and 69.1114 to a maximum of 139.6210 and 159.6367respectively. The mean for Spot and forward rates (UGSH) over the estimated period were 26.27620 and 27.9563 respectively, with values ranging from a minimum of 19.50500 and 21.0547 to a maximum of 35.18800 and 42.4655respectively.

The mean for Spot and forward rates (TZSH) over the estimated period were 16.24033 and 17.2628 respectively, with values ranging from a minimum of 10.08100 and 10.4466 to a maximum of 21.73000and 25.9437respectively.

4.3 Trends Analysis

Figure 4.1 below shows the trend pattern for forward rates and spot rates in USD. The results indicate an upward trend of both the forward and spot rates over the study period. This implies that both the forward and spot rates in USD have been increasing over time.

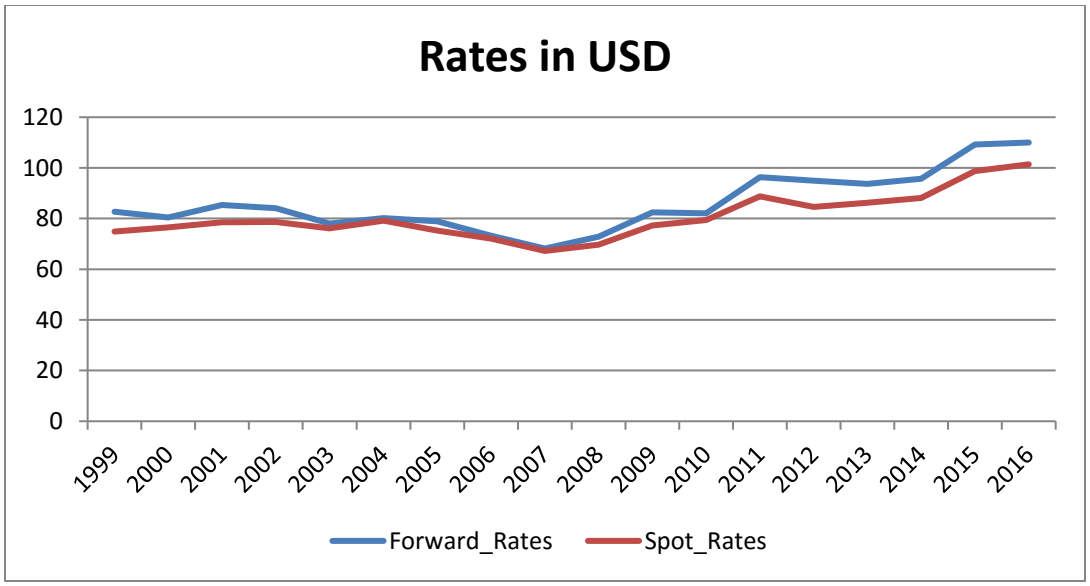

Figure 4.1: Trend Analysis for forward and Spot Rates in USD

Figure 4.2 below shows the trend pattern for forward rates and spot rates in GBP. The results indicate an upward trend of both the forward and spot rates over the study period. This implies that both the forward and spot rates in GBP have been increasing over time.

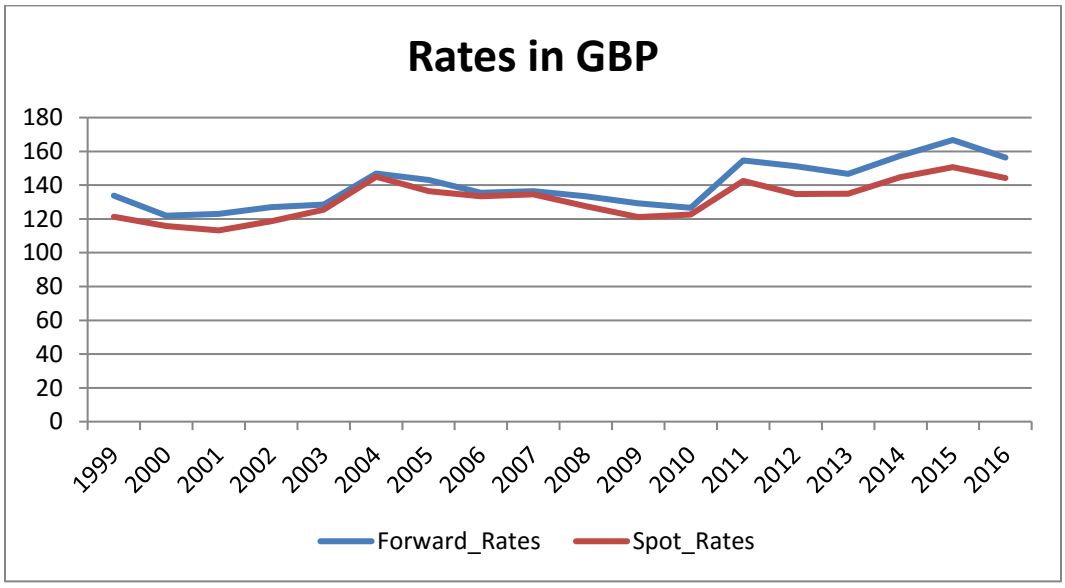

Figure 4.2: Trend Analysis for Forward and Spot Rates in GBP

Figure 4.3 below shows the trend pattern for forward rates and spot rates in EURO. The results indicate an upward trend of both the forward and spot rates over the study period. This implies that both the forward and spot rates in EURO have been increasing over time.

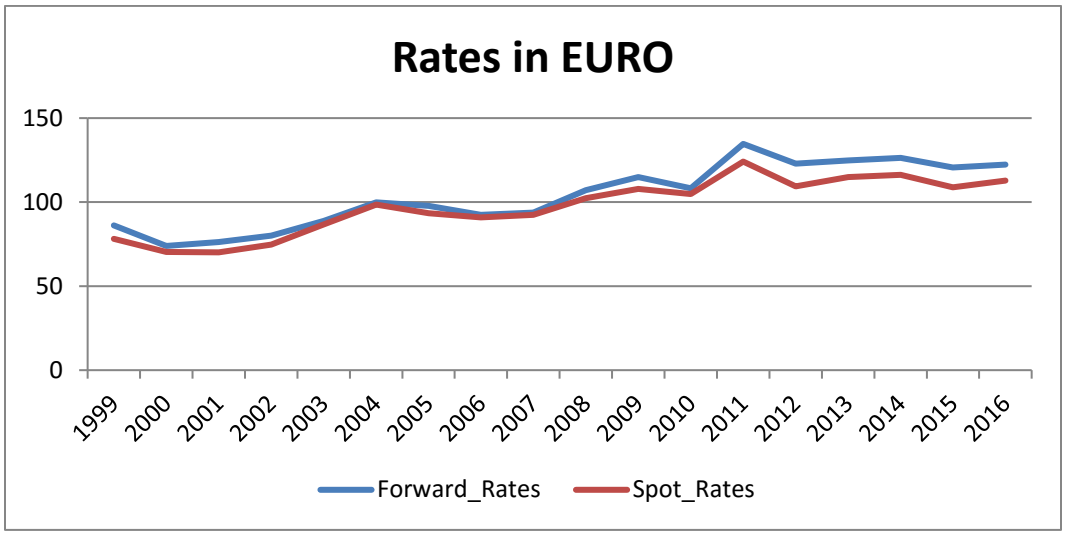

Figure 4.3: Trend Analysis for Forward and Spot Rates in EURO

Figure 4.4 below shows the trend pattern for forward rates and spot rates in UG SH. The results indicate an upward trend of both the forward and spot rates over the study period. This implies that both the forward and spot rates in UG SH have been increasing over time.

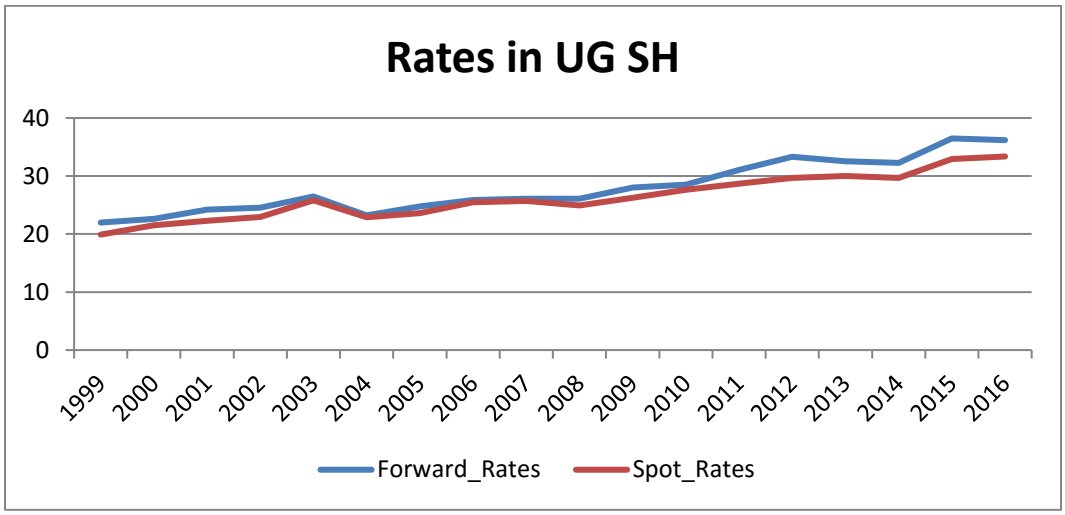

Figure 4.4: Trend Analysis for Forward and Spot Rates in UG SH

Figure 4.5 below shows the trend pattern for forward rates and spot rates in TZ SH. The results indicate an upward trend of both the forward and spot rates over the study period. This implies that both the forward and spot rates in TZ SH have been increasing over time.

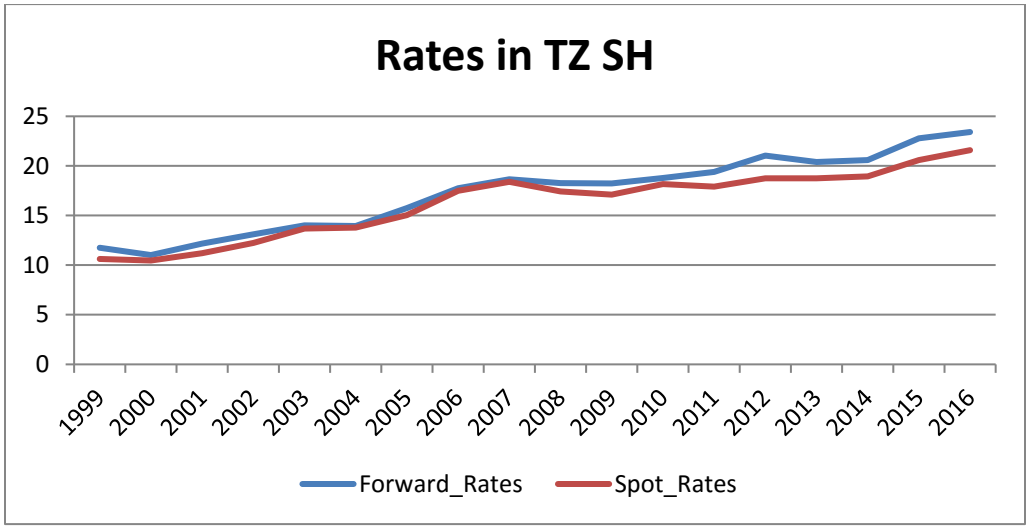

Figure 4.5: Trend Analysis for Forward and Spot Rates in TZ SH

4.4 Diagnostic Tests

4.4.1 Linearity Test

Linearity show that the relation between two variables two variables X and Y can be explained by a mathematical equation Y=bX where b is a constant number. The linearity test was obtained through the F-statistic in ANOVA.

Table 4.2: Linearity Test using ANOVA

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14907.1	1	14907.1	3383.03	.000b
	Residual	890.1	202	4.406		
	Total	15797.2	203			

a Dependent Variable: Spot Rates (USD)

b Predictors: (Constant), Forward Rates (USD)

Results presented in table 4.2 above reveal that the F statistic is significant at 0.05 significance level; hence we conclude that there exists a profound linear relationship between the dependent variable (Spot Rates) and the independent variable (Forward Rates) in USD.

Table 4.3: Linearity Test using ANOVA

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25799.9	1	25799.9	1254.7	.000b
	Residual	4153.63	202	20.563		
	Total	29953.5	203			
a Dependent Variable: Spot Rates (GBP)						
b Predictors: (Constant), Forward Rates (GBP)						

Results presented in table 4.3 above reveal that the F statistic is significant at 0.05 significance level; hence we conclude that there exists a profound linear relationship between the dependent variable (Spot Rates) and the independent variable (Forward Rates) in GBP.

Table 4.4: Linearity Test using ANOVA

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	53194.6	1	53194.6	4516.04	.000b
	Residual	2379.37	202	11.779		
	Total	55574	203			
a Dependent Variable: Spot Rates (EURO)						
b Predictors: (Constant), Forward Rates (EURO)						

Results presented in table 4.4 above reveal that the F statistic is significant at 0.05 significance level; hence we conclude that there exists a profound linear relationship between the dependent variable (Spot Rates) and the independent variable (Forward Rates) in EURO.

Table 4.5: Linearity Test using ANOVA

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2500.04	1	2500.04	3453.05	.000b
	Residual	146.25	202	0.724		
	Total	2646.29	203			

a Dependent Variable: Spot Rates (UG SH)
b Predictors: (Constant), Forward Rates (UG SH)

Results presented in table 4.5 above reveal that the F statistic is significant at 0.05 significance level; hence we conclude that there exists a profound linear relationship between the dependent variable (Spot Rates) and the independent variable (Forward Rates) in UG SH.

Table 4.6: Linearity Test using ANOVA

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2051.82	1	2051.82	5355	.000b
	Residual	77.398	202	0.383		
	Total	2129.22	203			

a Dependent Variable: Spot Rates (TZ SH)
b Predictors: (Constant), Forward Rates (TZ SH)

Results presented in table 4.6 above reveal that the F statistic is significant at 0.05 significance level; hence we conclude that there exists a profound linear relationship between the dependent variable (Spot Rates) and the independent variable (Forward Rates) in TZ SH.

4.4.2 Stationarity Test

Most time series data is usually non-stationary in nature, thus, prior to running a regression analysis, stationary tests were made by utilizing the Augmented Dickey-Fuller (ADF) test to indicate stationarity or non-stationarity in the variables. The intent of this is to avoid obtaining spurious regression results by utilizing non-stationary series.

Table 4.7: Stationarity Tests at First Difference

Variable name	ADF test	1% Level	5% Level	10% Level	Comment
Spot Rates (USD)	-11.78478	-3.463067	-2.875825	-2.574462	Stationary
Forward Rates (USD)	-6.488998	-3.463405	-2.875972	-2.574541	Stationary
Spot Rates (GBP)	-13.56905	-3.462737	-2.875680	-2.574385	Stationary
Forward Rates (GBP)	-13.34905	3.462737	-2.875680	-2.574385	Stationary
Spot Rates (EURO)	-13.74067	-3.463067	-2.875825	-2.574462	Stationary
Forward Rates (EURO)	-13.22144	-3.463067	-2.875825	-2.574462	Stationary
Spot Rates (UGSH)	-12.85185	-3.463235	-2.875898	-2.574501	Stationary
Forward Rates (UGSH)	-12.82310	-3.463235	-2.875898	-2.574501	Stationary
Spot Rates (TZSH)	-11.47054	-3.462901	-2.875752	-2.574423	Stationary
Forward Rates (TZSH)	-11.44714	-3.462901	-2.875752	-2.574423	Stationary

Table 4.7 displays the stationary tests at first differencing. The results reveal that all the variables are stationary.

4.4.3 Normality Test

Normality test was determined using the Kolmogorov-Smirnov test.

Table 4.8: Normality Test

Tests of Normality						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Spot Rates (USD)	0.131	204	0.000	0.941	204	0.000
Spot Rates (GBP)	0.054	204	.200*	0.976	204	0.001

Spot Rates (EURO)	0.081	204	0.003	0.964	204	0.000
Spot Rates (UG SH)	0.078	204	0.004	0.978	204	0.002
Spot Rates (TZ SH)	0.146	204	0.000	0.921	204	0.000

a Lilliefors Significance Correction

Results presented in table 4.8 above reveal that data for the dependent variable (spot rates) for all the currencies was not normally distributed. This is because the significance value for the Kolmogorov-Smirnov test was less than the conventional significance value of 0.05. However, normality was assumed since the number of observations was large.

4.4.4 Autocorrelation

Figure 4.9 shows results for autocorrelation test using Durbin-Watson statistic. The Durbin Watson test reports a test statistics, with a value from 0 to 4, where: 2 denotes no autocorrelation; 0 to 2<2 denotes a positive autocorrelation; while >2 denotes a negative autocorrelation. The decision rule is that test statistic values in the range of 1.5 to 2.5 are relatively normal. Values outside this range could cause concern (Field, 2009).

Table 4.9: Autocorrelation Test

Durbin-Watson Test for autocorrelation					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.971a	0.944	0.943	2.09915	0.255
2	.928a	0.861	0.861	4.53459	0.147
3	.978a	0.957	0.957	3.43206	0.148
4	.972a	0.945	0.944	0.85089	0.169
5	.982a	0.964	0.963	0.619	0.141

a Predictors: (Constant), Forward Rates
b Dependent Variable: Spot Rates

Results presented in table 4.9 above reveal that the null hypothesis of no autocorrelation is

accepted and that residuals are not auto correlated for all the models except 5.

4.4.5 Multicollinearity Test

Multicollinearity test was assessed using the variance inflation factors (VIF). Field (2009) mentioned that VIF values above 10 indicate that multicollinearity is present.

Table 4.10: Multicollinearity Results using VIF

Variables	Tolerance	VIF
Forward Rates (USD)	1	1
Forward Rates (GBP)	1	1
Forward Rates (EURO)	1	1
Forward Rates (UG SH)	1	1
Forward Rates (TZ SH)		
Average VIF		**1**

The results in Table 4.10 above present variance inflation factor results which were found to be 1. This is less than 10 and thus according to Field (2009) multicollinearity does not exist.

4.5 Inferential Statistics

4.5.1 Correlation Analysis

Table 4.11 below presents the results of the correlation analysis for model 1.

Table 4.11: Correlation Results (Model 1)

		Spot Rates	Forward Rates
Spot Rates	Pearson Correlation	1.000	
	Sig. (2-tailed)		
Forward Rates	Pearson Correlation	.971**	1.000
	Sig. (2-tailed)	0.000	

** Correlation is significant at the 0.01 level (2-tailed).

The results revealed that forward rates and spot rates (USD) are positively and significantly associated (r=0.971, p=0.000). The results implied that forward rates and spot rates change

in the same direction. The correlation value of 0.971 also indicated a strong association between the two variables.

Table 4.12: Correlation Results (Model 2)

		Spot Rates	Forward Rates
Spot Rates	Pearson Correlation	1.000	
	Sig. (2-tailed)		
Forward Rates	Pearson Correlation	.928**	1.000
	Sig. (2-tailed)	0.000	
** Correlation is significant at the 0.01 level (2-tailed).			

The results presented in table 4.12 above revealed that forward rates and spot rates (GBP) show a positive and profound association (r=0.928, p=0.000). The results implied that forward rates and spot rates change in the same direction. The correlation value of 0.928 also indicated a strong association between the two variables.

Table 4.13: Correlation Results (Model 3)

		Spot Rates	Forward Rates
Spot Rates	Pearson Correlation	1	
	Sig. (2-tailed)		
Forward Rates	Pearson Correlation	.978**	1
	Sig. (2-tailed)	0	
** Correlation is significant at the 0.01 level (2-tailed).			

The results presented in table 4.13 above revealed that forward rates and spot rates (EURO) show a positive and profound association (r=0.978, p=0.000). The results implied that forward rates and spot rates change in the same direction. The correlation value of 0.978 also indicated a strong association between the two variables.

Table 4.14: Correlation Results (Model 4)

		Spot Rates	Forward Rates
Spot Rates	Pearson Correlation	1.000	
	Sig. (2-tailed)		
Forward Rates	Pearson Correlation	.972**	1.000
	Sig. (2-tailed)	0.000	
** Correlation is significant at the 0.01 level (2-tailed).			

The results presented in table 4.14 above revealed that forward rates and spot rates (UG SH) show a positive and profound association (r=0.972, p=0.000). The results implied that forward rates and spot rates change in the same direction. The correlation value of 0.972 also indicated a strong association between the two variables.

Table 4.15: Correlation Results (Model 5)

		Spot Rates	Forward Rates
Spot Rates	Pearson Correlation	1.000	
	Sig. (2-tailed)		
Forward Rates	Pearson Correlation	.982**	1.000
	Sig. (2-tailed)	0.000	
** Correlation is significant at the 0.01 level (2-tailed).			

The results presented in table 4.15 above revealed that forward rates and spot rates (TZ SH) show a positive and profound association (0.982, p=0.000). The results implied that forward rates and spot rates change in the same direction. The correlation value of 0.982 also indicated a strong association between the two variables.

4.5.2 Regression Results

Regression analysis is a statistical tool used to indicate the relation between variables. Normally, researcher seeks to maintain the casual effect of on variable upon another. Regression analysis enables a researcher to model, examine and explore spatial relationship, and can assist in the explanation of the factors behind observed spatial patterns. Prediction is also made using regression analysis.

4.5.2.1 Regression Results for Model 1

The study sought to examine the relationship between forward rates and spot rates in USD. The results of the model summary are given in Table 4.16.

Table 4.16: Model Fitness

Indicator	Coefficient
R	0.971
R Square	**0.944**
Adjusted R Square	0.943
Std. Error of the Estimate	2.09915

The findings revealed that forward rates explained 94.4% of the total variations in spot rates.

Table 4.17 below provides the results on the analysis of variance (ANOVA).

Table 4.17: Analysis of Variance

Indicator	Sum of Squares	Df	Mean Square	F	Sig.
Regression	14907.08	1	14907.08	3383.025	.000b
Residual	890.1	202	4.406		
Total	15797.18	203			

The results show that the overall model was statistically significant as supported by a p value of 0.000. This was supported by an F statistic of 3383.025 and the reported p value (0.000) which was lower than 0.05 significance level. The results show that forward rates are good predictors of future spot rates.

Table 4.18 presents the regression of coefficients results

Table 4.18: Regression of Coefficients

	B	Std. Error	t	Sig.
(Constant)	17.323	1.092	15.862	0.000
Forward Rates	0.737	0.013	58.164	0.000

The findings show that there is a positive and significant relationship between forward rates and spot rates in USD as supported by a p value of 0.000 and a beta coefficient of (0.737). This implies that an increase in forward rates by 1 unit would raise spot rates by 0.737 units.

The specific model;

Spot Rates=17.323+0.737 Forward Rates

4.5.2.2 Regression Results for Model 2

The study sought to establish the relationship between forward rates and spot rates in GBP. The results of the model summary are given in Table 4.19.

Table 4.19: Model Fitness

Indicator	Coefficient
R	0.928
R Square	**0.861**
Adjusted R Square	0.861
Std. Error of the Estimate	4.53459

The findings revealed that forward rates explained 86.1 % of the total variations in spot rates.

Table 4.20 below provides the results on the analysis of variance (ANOVA).

Table 4.20: Analysis of Variance

Indicator	Sum of Squares	Df	Mean Square	F	Sig.
Regression	25799.87	1	25799.87	1254.703	.000b
Residual	4153.631	202	20.563		
Total	29953.51	203			

The results indicate that the overall model was statistically significant as supported by a p value of 0.000. This was supported by an F statistic of 1254.703 and the reported p value (0.000) which was lower than 0.05 significance level. The results imply that forward rates are good predictors of future spot rates.

Table 4.21 presents the regression of coefficients results

Table 4.21: Regression of Coefficients

	B	Std. Error	t	Sig.
(Constant)	24.576	3.033	8.102	0.000
Forward Rates	0.765	0.022	35.422	0.000

The findings show that there is a positive and significant relationship between forward rates and spot rates in GBP as supported by a p value of 0.000 and a beta coefficient of (0.765). This implies that an increase in forward rates by 1 unit would raise spot rates by 0.765 units.

The specific model;

Spot Rates=24.576+0.765Forward Rates

4.5.2.3 Regression Results for Model 3

The study sought to establish the relationship between forward rates and spot rates in EURO. The results of the model summary are given in Table 4.22.

Table 4.22: Model Fitness

Indicator	Coefficient
R	0.978
R Square	**0.957**
Adjusted R Square	0.957
Std. Error of the Estimate	3.43206

The findings revealed that forward rates explained 95.7 % of the total variations in spot rates.

Table 4.23 below provides the results on the analysis of variance (ANOVA).

Table 4.23: Analysis of Variance

Indicator	Sum of Squares	Df	Mean Square	F	Sig.
Regression	53194.6	1	53194.6	4516.04	.000b
Residual	2379.37	202	11.779		
Total	55574	203			

The results indicate that the overall model was statistically significant as supported by a p value of 0.000. This was supported by an F statistic of 4516.04 and the reported p value (0.000) which was lower than 0.05 significance level. The results imply that forward rates are good predictors of future spot rates.

Table 4.24 presents the regression of coefficients results

Table 4.24: Regression of Coefficients

	B	Std. Error	t	Sig.
(Constant)	10.32	1.323	7.803	0.000
Forward Rates	0.841	0.013	67.201	0.000

The findings show that there is a positive and significant relationship between forward rates and spot rates in EURO as supported by a p value of 0.000 and a beta coefficient of (0.841). This implies that an increase in forward rates by 1 unit would raise spot rates by 0.841 units.

The specific model;

Spot Rates=10.32+0.841Forward Rates

4.5.2.4 Regression Results for Model 4

The study sought to establish the relationship between forward rates and spot rates in UGSH. The results of the model summary are given in Table 4.25.

Table 4.25: Model Fitness

Indicator	Coefficient
R	0.972
R Square	**0.945**
Adjusted R Square	0.944
Std. Error of the Estimate	0.85089

The findings revealed that forward rates explained 94.5 % of the total variations in spot rates.

Table 4.26 below provides the results on the analysis of variance (ANOVA).

Table 4.26: Analysis of Variance

Indicator	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2500.04	1	2500.04	3453.05	.000b
Residual	146.25	202	0.724		
Total	2646.29	203			

The results indicate that the overall model was statistically significant as supported by a p value of 0.000. This was supported by an F statistic of 3453.05 and the reported p value (0.000) which was less than the conventional probability of 0.05 significance level. The results imply that forward rates are good predictors of future spot rates.

Table 4.27 presents the regression of coefficients results

Table 4.27: Regression of Coefficients

	B	Std. Error	t	Sig.
(Constant)	3.955	0.385	10.286	0.000
Forward Rates (UGSH)	0.799	0.014	58.763	0.000

The findings show that there is a positive and significant relationship between forward rates and spot rates in UGSH as supported by a p value of 0.000 and a beta coefficient of (0.799). This implies that an increase in forward rates by 1 unit would raise spot rates by 0.799 units.

The specific model;

Spot Rates=3.955+0.799Forward Rates

4.5.2.5 Regression Results for Model 5

The study sought to establish the relationship between forward rates and spot rates in TZSH. The results of the model summary are given in Table 4.28.

Table 4.28: Model Fitness

Indicator	Coefficient
R	0.982
R Square	**0.964**
Adjusted R Square	0.963
Std. Error of the Estimate	0.619

The findings revealed that forward rates explained 96.4 % of the total variations in spot rates.

Table 4.29 below provides the results on the analysis of variance (ANOVA).

Table 4.29: Analysis of Variance

Indicator	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2051.82	1	2051.82	5355	.000b
Residual	77.398	202	0.383		
Total	2129.22	203			

The results indicate that the overall model was statistically significant as supported by a p value of 0.000. This was supported by an F statistic of 5355 and the reported p value (0.000) which was lower than 0.05 significance level. The results imply that forward rates are good predictors of future spot rates.

Table 4.30 presents the regression of coefficients results

Table 4.30: Regression of Coefficients

	B	Std. Error	t	Sig.
(Constant)	1.195	0.21	5.688	0.000
Forward Rates (TZSH)	0.872	0.012	73.178	0.000

The findings show that there is a positive and significant relationship between forward rates and spot rates in TZSH as supported by a p value of 0.000 and a beta coefficient of (0.872). This implies that an increase in forward rates by 1 unit would raise spot rates by 0.872 units.

The specific model;

Spot Rates=1.195+0.872Forward Rates

4.6 Discussion of Results

The aim of this investigation was to establish whether the forward rate is an unbiased predictor of the future spot exchange rate.

In the first model, the coefficient of forward rates (USD) was 0.737, which was positive and significant at 5% level of significance. This implies that forward rates (USD) have a positive significant influence on future spot exchange rate.

In the second model, the coefficient of forward rates (GBP) was 0.765, which was positive and significant at 5% level of significance. This implies that forward rates (GBP) have a positive significant influence on future spot exchange rate.

In the third model, the coefficient of forward rates (EURO) was 0.841, which was positive and significant at 5% level of significance. This implies that forward rates (EURO) have a positive significant influence on future spot exchange rate.

In the fourth model, the coefficient of forward rates (UGSH) was 0.799, which was positive and significant at 5% level of significance. This implies that forward rates (UGSH) have a positive significant influence on future spot exchange rate.

In the fifth model, the coefficient of forward rates (TZSH) was 0.872, which was positive and significant at 5% level of significance. This implies that forward rates (TZSH) have a positive significant influence on future spot exchange rate.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of the study findings and the study conclusions based on the results. The policy recommendations from the findings and areas for further research are also presented.

5.2 Summary

The aim of this investigation was to establish whether the forward rate is an unbiased predictor of the future spot exchange rate.

In the first model, the correlation results show a positive and profound association between forward rates and spot rates (USD). Further, the regression results indicated that forward rates and spot rates ate positively and significantly related. This implied that a rise in forward rates would cause future spot exchange rate to rise and vice versa.

In the second model, the correlation results show a positive and profound association between forward rates and spot rates (GBP). Further, the regression results indicated that forward rates and spot rates ate positively and significantly related. This implied that a rise in forward rates would cause future spot exchange rate to rise and vice versa.

In the third model, the correlation results show a positive and profound association between forward rates and spot rates (EURO). Further, the regression results indicated that forward rates and spot rates ate positively and significantly related. This implied that a rise in forward rates would cause future spot exchange rate to rise and vice versa.

In the fourth model, the correlation results show a positive and profound association between forward rates and spot rates (UGSH). Further, the regression results indicated that forward rates and spot rates ate positively and significantly related. This implied that a rise in forward rates would cause future spot exchange rate to rise and vice versa.

In the fifth model, the correlation results show a positive and profound association between forward rates and spot rates (TZSH). Further, the regression results indicated that forward rates and spot rates ate positively and significantly related. This implied that a rise in forward rates would cause future spot exchange rate to rise and vice versa.

5.3 Conclusion

From the findings, the study concluded that forward rates for all the five currencies (USD, GBP, EURO, UGSH and TZSH) have a positive and significant influence on future spot exchange rates. The study, therefore, concluded that forward rate is an unbiased predictor of the future spot exchange rate.

5.4 Recommendations

From the findings, the study recommended that participants of the FOREX market should know when and when not to take advantage of the inefficiency in the FOREX market to make arbitrage profits.

Further, the study recommended the need for scholars and academician to undertake more studies relating to the foreign exchange market. This is because; it is an area that has not been fully researched.

5.5 Limitations of the study

The researcher faced various hindrances while conducting the study. For instance, much reliance was placed on the use of secondary data sources. Secondary data can, however, not be relied upon since they were intended for other purposes. To curb this, the study sought data from trusted sources such as the Central Bank of Kenya. Further, this study focused only on forward rates as a predictor of spot rates, there could be other factors that influence spot rates. Thus, establishing the relationship between the two variables might be erroneous. The study tested the significance of the relationship established to mitigate this.

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APPENDICES

Appendix I: Data Collection Form

Year	Month	Spot exchange rate	Forward premium	US Treasury bill rate	Home interest rates