

**EFFECT OF INTEREST RATES ON FOREIGN EXCHANGE RATES
IN KENYA: A TEST OF THE FORWARD PREMIUM PUZZLE**

BY

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DECLARATION

I wish to declare that this project report is my original work and that it has not been presented in any other university or institution of higher learning before.

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D63/80940/2015

This project report has been submitted for examination with my approval as the University of Nairobi supervisor.

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Finally, I give gratitude to all the people who in one way or another contributed to the successful completion of this project.

DEDICATION

I dedicate this research project to my family, my loving husband **Mr. Brian Mooka** and daughter **Ninah Mooka**, for their overwhelming support, love and endurance throughout the entire study period.

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LIST OF ABBREVIATIONS

AD	Aggregate Demand
ADF	Augmented Dickey-Fuller Test
ANOVA	Analysis of Variance
AS	Aggregate Supply
CIP	Covered Interest Rate Parity
COPOM	Central Bank of Brazil's Monetary Policy Committee
DF	Dickey-Fuller Test
FOMC	Federal Open Market Committee
FP	Forward Premium
IRR	Interest Rate Parity
KBS	Kenya Bureau of Statistics
PPP	Purchasing Power Parity
RP	Risk Premium
UIP	Uncovered Interest Rate Parity

ABSTRACT

The main objective of this study was to examine the presence of the forward premium puzzle in the foreign exchange market in Kenya. The study used the Kshs/USD exchange rate for the period 1994 to 2016. That data consisted of monthly observations of the exchange rate, monthly observations of the 91-day Kenya government Treasury Bills Rate and the 91-day US government Treasury Bills rate. As a matter of procedure the data were tested for nonstationarity using the ADF test in level forms and in first differences. The result revealed that foreign exchange rates, interest rates and the risk premium are nonstationary. Therefore, this study applied the VECM instead of the classical Granger causality tests to the data. The results show that the coefficient of the forward premium is not only negative but also statistically significant at the 5 percent level. This indicates the presence of the forward premium puzzle in the foreign exchange rate market in Kenya. Moreover, the forward premium contains information that can be used to improve the prediction the foreign exchange rate.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The impact of interest rates on exchange rates has attracted a lot of research in international finance. This has been best captured by the interest rate parity puzzle (IRP). The uncovered interest parity puzzle (UIP) is described as the empirical regularity that high interest rate economies usually have short term deposits earning higher expected returns (Engel, 2016). Another puzzle is that high real interest rate economies have currencies that are stronger than can be accounted for by expected real interest differentials under UIP. The two findings are contradictory when one considers the relationship between the foreign-exchange risk premium and interest-rate differentials (Engel, 2016).

Exchange rates, inflation rates and interest rates influence the performance of the external sector especially exports, imports and the trade balance (Bergén, 2010). The impact of a permanent shock on exchange rates on prices over time is called exchange rate pass through. In the 1970s it was a common argument that international trade flows are the main determinants of exchange rates. This was attributed to tight controls on international flows of financial capital. Thus, appreciating currencies are associated with countries with current trade surpluses while depreciating currencies are associated with countries that have trade deficits (Miller, and Benjamin, 2004)

The Mundell (1963) and Fleming (1962) model and the Dornbusch (1976) model are important models used in international finance. The two models are based on the interest parity. This implies that there are no ex ante excess returns from trading assets denominated in foreign currencies. These models are used to predict the level of the exchange rate. They demonstrate that when domestic interest rates are higher than average relative interest rate, the domestic currency should appreciate against the foreign currency. However, empirical evidence shows that the appreciation of the domestic currency is usually higher than is expected by interest rate parity condition. This means there are higher co-movement or increased volatility in exchange rates. These findings have been attributed to the influence of expected exchange rate risk premiums (Engel, 2016). High interest rates in a country can cause its foreign exchange rate to appreciate

for two reasons. This could be that deposits at the bank pay a higher interest rate and have lower risk (Engel, 2016).

The predictions above about risk contradict one another. This is the case since the domestic economy has both higher expected returns and an appreciating currency in the short term. This first implies that the domestic currency is riskier as implied by the risk-return trade-off. Secondly a stronger currency means that it is less risky.

1.1.1 Interest Rates

Kidwell et al, (2008) defined interest rate as the cost of borrowing someone else's money. When interest rate goes up the cost of money also rises. Fluctuations in interest rates are caused by changes in the inflation rate and monetary policies. Consequently, there is a change in demand and supply of money in the economy (Gagnon, and Ihrig, 2004).

The short-term interest rate is a monetary policy tool used to control money demand. To stabilize a depreciating local currency and reduce inflation the central bank increases the interest rate. This helps to stabilize the economy. The most commonly used interest rates in the literature on ID are the rates on government treasury bills of various maturities. The one month TB rates are the most popular in empirical studies and are applied in this study.

1.1.2 Foreign Exchange Rates

The foreign exchange rate is the value at which the domestic currency trades against foreign currencies in the foreign exchange market. It can be measured either as the nominal rate or the real rate. The exchange rate is one of the most important determinants of a country's relative level of economic health. The exchange rate influences a country's level of imports, exports, trade balance and real economic output (Gudmundsson, 2012).

The interest rates strongly influence the foreign exchange rate. However, the nature of the relationships remains puzzling and continues to intrigue researchers in finance and economics (Engle, 2016; Fama, 1984; Williamson, 2001).

1.1.3 Interest Rates and Foreign Exchange Rates

There are two levels for examining the relationship between interest rates and exchange rates. The first is the rate of change. The second is about the magnitude or level of the exchange rates. The two approaches are crucial for illuminating interactions in international financial markets (Engel, 2016).

New models are required to study the above empirical relationships in international finance whether one studies the relationship between the two variables using the rates of change or their levels. Consequently, much of current research has focused on developing more sophisticated models to capture complex investor behavior and interactions in economic variables. However, a scrutiny of the two relationships yields a contradiction. The reasons put forward to explain one relationship cannot be used to explain the other. This is a puzzle (Engel, 2016).

1.1.4 Interest Rates and Foreign Exchange Rate Fluctuations in Kenya

Before the start of Structural Adjustment Program (SAP) in 1983 there was severe repression of the financial sector in Kenya. This was characterized by interest rates controls. There was also direct control of credit by the Central Bank (Willem, 1995).

In the late 1980s and early 1990s economic and financial liberalization began. The interest rate on credit was freed from government control. From 1983 to 1987 the interest rate differentials between commercial banks and NBFIs became narrow. Consequently, there was an increase in the competitiveness of commercial banks. In 1991 there was liberalization of interest rates. Consequently, the difference between loan rates and deposit rates has reduced (Willem, 1995).

The highest lending rates were raised from 10 to 14 % in 1991. Also the interest rate for crop finance rose to 11.25 %. The lowest savings rate was increased to 12.5 %. The interest rate averaged 14.95 percent between 1994 and 2016. The highest rate (84.67 %) was recorded in July of 1993. The lowest interest rate (0.83 %) was witnessed in September of 2003 (KNBS, 2016).

The history of exchange rates in Kenya begins with the operations of the East African Currency Board during the colonial period. This was the fixed exchange rate regime. Since then the

exchange rate regime in Kenya has undergone fundamental changes. In the early 1980s the shilling was pegged to SDR. The major problem then was how to manage exchange rate movements around the peg. This regime was abandoned in 1982 in favor of a basket of foreign currencies of Kenya's main trading partners (Wagacha, 2000).

The objective of the peg was to eliminate the volatilities of foreign currencies in the SDR unrelated to Kenya's trade flows. This was also aimed at bolstering Kenya's competitiveness on the international market. On the other hand the peg retained the technical capability of transmitting and maintaining inflation to Kenya at the levels obtaining in the major trading partners (Wagacha, 2000).

The initial step in liberalizing the foreign exchange market Kenya adopted a dual exchange rate (Wagacha, 2000). In the 1990s there was the official rate alongside the rate available in the market for those who purchased interest-bearing and marketable foreign exchange bearer certificates (the so-called Forex Cs). The Central Bank was therefore in a position to monitor the market performance of the paper and then adjust the official rates accordingly. In 1993, following elimination of controls on imports and most foreign exchange transactions, the exchange rate attained a full float (Wagacha, 2000).

Foreign exchange rate volatility has increased with the liberalization of the financial markets. Consequently, the cost of debt has risen thereby reducing the demand for credit.

1.2 Research Problem

Several theories have been put forward to explain the relationship between interest rates and exchange rates. These theories include Interest Rate Parity Theory, the Mundell-Fleming model (1970) and the Dornbusch (1976) model. The ID is used to analyze the relationship between these two variables. The ID shows that the interest rate differential between two different countries is equal to the forward premium (or discount) on the foreign currency. The Mundell-Fleming model (1970) and the Dornbusch (1976) model of exchange rate behavior are based on interest parity. They demonstrate that when domestic interest rates are higher than average relative interest rate, the domestic currency should appreciate against the foreign currency. However, empirical evidence shows that the appreciation of the domestic currency is usually higher than is expected by interest rate parity condition. This means there are higher co-

movement or increased volatility in exchange rates. These findings have been attributed to the influence of expected exchange rate risk premiums (Engel, 2016). High interest rates in a country can cause its foreign exchange rate to appreciate for two reasons. This could be that deposits at the bank pay a higher return and have lower risk (Engel, 2016).

The predictions above about risk contradict one another. This is the case since the domestic economy has both a higher expected returns and an appreciating currency in the short term. This first implies that the domestic currency is riskier as implied by the risk-return trade-off. Secondly a stronger currency means that it is less risky.

There are so many empirical studies that have been carried out on the UIP puzzle. However, much of this research has been conducted in developed countries. Seminal and pioneer studies on the UIP puzzle are Bilson (1981) and Fama (1984). A survey of related literature is provided by Engel (1996, 2014). As correctly argued by Engel (2016: 437), to properly account for this puzzle the short-term interest rates in the high-interest rate economy are riskier (according to the risk-return trade-off), and therefore have an expected excess return which is compensation for exposure to higher risk. This expected risk premium is not constant and it varies with the interest differential.

The interest parity research is struggling to explain the common empirical finding that $cov (E_t \rho_{t+1}, r_t^* - r_t) > 0$ (Engel, 2016). Where, ρ_{t+1} is the differential return between period t and $t+1$ on a foreign and the domestic short-term deposits; $r_t^* - r_t$ is the difference in the ex-ante real interest rate in the foreign economy and the domestic economy. The asterisk * denotes the foreign country. The “cov” refers to the unconditional covariance, and $E_t \rho_{t+1}$ is the conditional expectation of ρ_{t+1} . This means that there is a positive relationship between the ex-ante excess return on the foreign deposit and the foreign less domestic economy interest differential. Both the risk premium and the interest rate differential are known at time t .

Studies conducted in Kenya in relation to the effects of interest rates, inflation rates and how they affect exchange rates have yielded minimal significant results. This is the main reason for undertaking this study in Kenya. Hence the research question is: What is the effect of the interest rate on Kshs/US\$ exchange rate in Kenya?

1.3 Research Objectives

The objective of this study is to establish the effect of the interest rates on exchange rates in Kenya.

1.4 Value of the Study

The results, recommendations and conclusions of the study can help investors, regulators and policy makers to make better decisions.

This study contributes to the theory of international finance by illuminating the relationship between interest rates and foreign exchange rates in a developing country context. The research setting considers the imperfections such as interest controls on the dynamic relationship between interest rates and foreign exchange rates.

The study also makes a contribution toward business policy and practice. Specifically, the existence of the forward premium puzzle provides an opportunity to businesses to proactively and profitably manage the foreign exchange rate risk and the interest rate risk.

To the academia, this study extends the frontiers of knowledge by illuminating the forward premium puzzle in the developing country context. Most extant literature is about developed countries.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter covers theoretical literature, empirical literature, determinants of exchange rate and summary of literature review. Section 2.2 discusses the theoretical literature which highlights the different theories that explain the relationship between interest rate and exchange rate. Section 2.3 presents the empirical literature and Section 2.4 covers the determinants of exchange rates and interrelation with interest rate. The factors which determine exchange rate are inflation, current account deficit, terms of trade and interest rate. Finally, section 2.5 is the summary.

2.2 Theoretical Literature Review

This section reviews the theories of exchange rate determination. Each theory identifies its own determinants of the exchange rate. This study was based mainly on the Interest Rate Parity Theory (IRP), because it focuses on spot rates and forward rates of currencies and how it is affected by the fluctuations in the interest rates.

2.2.1 Interest Rate Parity (IRP) Theory

IRP is the main theory that underpins this study. It states that the forward premium (or discount) is equal to the interest rate differentials between two different currencies in an efficient market (Bleaney, and Fielding, 2002; Engel, 2016; Mishkin, Frederic, 2006). The IRP is represented algebraically as:

$$i_t^* - i_t = \Delta_k s_{t+k}^e \tag{2.1}$$

Where the LHS is the interest rate differential and the RHS is the forward premium.

The IRP theory makes two main assumptions. First, capital is highly mobile. Second, assets can be substituted perfectly based on their level of risk and liquidity. Under these two assumptions investors hold only those currencies which offer higher returns (Levi, 2007).

The IRP theory is arguably one the best theories to explain the behavior of foreign exchange rates. In this theory currency is treated as an asset. This is known as the asset approach, or the interest rate parity model (Levi, 2007).

The implication of IRP theory is that there is no arbitrage opportunity in the currency market. Consequently, the failure of the IRP implies the existence of arbitrage opportunities that can be profitably exploited by arbitrageurs (Levi, 2007).

2.2.2 Time-Varying Risk Premium or Irrational Expectations

The failure of the IRP hypothesis is attributed to risk-averse and irrational behavior of market participants. Risk aversion makes traders to demand a premium as compensation for exposure to more risk. Therefore, the risk premium, p_t , is added to the interest rate differential as compensation for bearing the foreign currency risk. This result is summarized algebraically below.

$$i_t - i_t^* = \Delta_k s_{t+k}^e + p_t \quad (2.2)$$

Equivalently, using the covered interest rate parity condition (2.2) in (2.1), the forward premium may be thought of as composed of two parts – the expected depreciation and p_t .

$$f_t^{(k)} - s_t = \Delta_k s_{t+k}^e + p_t \quad (2.3)$$

The presence of a risk premium has significant implications for the regression in equation (2.7), which were first noted by Fama (1984) who also considered a similar regression of the excess return from taking an open forward position, $f_t^{(k)} - s_{t+k}$ onto the forward premium,

$$f_t^{(k)} - s_{t+k} = Y + \delta(f_t^{(k)} - s_t) + v_{t+k} \quad (2.4)$$

where v_{t+k} is the regression error.

2.3 Empirical Literature Review

This section discusses how different scholars have explained the effects of interest rates on exchange rate determination both locally and internationally. Different scholars have different perspectives on this matter. Some provide negative relationships while others view the positive side of the relationship.

2.3.1 Uncovered Interest Parity

The interest parity research is struggling to explain the common empirical finding that $cov(E_t \rho_{t+1}, r_t^* - r_t) > 0$ (Engel, 2016). The asterisk * denotes the foreign economy. The “cov” refers to the unconditional covariance, and $E_t \rho_{t+1}$ is the conditional expectation of ρ_{t+1} . This means that there is a positive relationship between the ex-ante excess return on the foreign economy deposit and the foreign less domestic economy interest differential. Both the risk premium and the interest rate differential are known at time t .

There are so many empirical studies that have been carried out on the forward premium (FP) puzzle. However, much of this research has been conducted in developed countries. Seminal and pioneer studies on the FP puzzle are Bilson (1981) and Fama (1984). A survey of related literature is provided by Engel (2016). As correctly argued by Engel (2016: 437), to properly account for this puzzle the short-term deposits in the domestic economy are relatively riskier and have an expected higher return which is compensation for exposure to higher risk. This expected risk premium is not constant as it varies with the interest differential.

Thus under the assumption of covered interest rate parity (CIP) the UIP condition is empirically examined by the regression model:

$$\Delta_k s_{t+k} = \alpha + \beta(f_t^{(k)} - s_t) + \eta_{t+k} \quad (2.7)$$

where η_{t+k} is the disturbance term. The coefficient β is equal to one. The error term is expected to be white noise.

In general, the results obtained from (2.7) provide evidence that rejects the EMH (Frankel, 1980; Fama 1984; Bekaert and Hodrick, 1993). Generally β closer to -1 than +1 (Froot and Thaler, 1990).

Clarida and Taylor (1997) exploited the Engle and Granger (1987) framework and, employing a VECM in spot and forward rates provide evidence suggesting that the forward premium improves the exchange rate the prediction.

Hadzi-Vaskov and Kool (2006) further examined the source of the bias in the coefficient of the forward premium. They found that volatility in the interest rate could explain part of the bias in the forward premium.

This study is similar to those studies that attempt to explain the UIP condition. The earlier studies applied the CAPM to exchange rates (Frankel and Engel, 1984). Other studies employed statistical models of currency premiums (Hansen and Hodrick, 1983; Domowitz and Hakkio, 1985; Cumby, 1988). Subsequent studies applied the behavioral science approach (Froot and Thaler, 1990; Eichenbaum and Evans, 1995; Mankiw and Reis, 2002).

The latest studies have focused on the skewness of returns (Brunnermeir, Nagel, and Pedersen, 2009; Chen and Gwati, 2013; Jurek and Xu, 2014; Farhi, Fraiberger, Gabaix, Ranciere, and Verdelan, 2015). Other studies have examined overconfidence (Burnside, Han, Hirshleifer, and Wang, 2011), habit formation (Verdelan, 2010), rare disaster (Farhi and Gabaix, 2014), long-run risks (Bansal and Shaliastovich, 2013), country size (Hassen, 2013), and infrequent portfolio decisions (Bacheta and Wincoop, 2010). There are more studies that are exploiting portfolio analysis to seek for risk factors that can illuminate the foreign exchange rate premiums (Lustig and Verdelan, 2007; Lustig, Rousanov, and Verdelan, 2011; Merkhoff, Sarno, Schmeling, Schrimpf, 2012).

In summary, the increasing sophistication in the econometric techniques employed has generated increasingly strong evidence against the UIP hypothesis. Several explanations of the forward premium anomaly have been presented in the literature. For instance, this anomaly has been attributed to a time varying risk premium (Hodrick, 1997; Hai, Mark and Wu, 1997); the peso problem (Lewis, 1995); nonlinearity (Mehl and Cappiello, 2007) and irrationality and heterogeneity of market participants (Frankel and Froot, 1987a). Engel (2016) provides a survey of the current literature on the forward premium puzzle.

2.3.2 Review of Local Research

There several studies that have been conducted on the efficiency of the foreign exchange market in Kenya (Kurgat, 1998; Ngugi, 1999; Ndunda, 2002; Muhoro, 2005; Kiptoo, 2007; Kisaka, et al., 2008). The study by Kurgat (1998) tested the efficiency of the forex bureaus currency market. Its focus was on whether arbitrage opportunities exist in currency trade in Kenya. Kurgat

(1998) found that the forex bureaus market is far from efficient. There were significant arbitrage opportunities that could be exploited.

In her study Ndunda (2002) tested the uncovered interest parity in the forward market. She regressed the forward premium on the lagged forward premium for each of the following currencies: US dollar, Sterling Pound, Swiss Franc, Euro and Japanese Yen. Her findings were that the foreign exchange market is not efficient.

Another study by Muhoro (2005) analyzed locational and triangular arbitrage in the currency market. She also found that the foreign exchange market is not efficient. Two years later Kimani (2007) re-examined this issue. She tested the rationality of market participants' expectations. She found that forward rates are biased predictors of the future spot rates and market participants were not rational.

Studies done by Ndung'u (2010), found that exchange rate volatility was caused by excess liquidity in the economy and the consequent high inflation rate. Citing data and methodological flaws in the previous studies Kisaka (2008) revisited the issue of the foreign exchange market efficiency in Kenya. He found that this market is not efficient.

2.4. Determinants of Foreign Exchange Rates

The exchange rate depends on the demand and supply of a currency. The main determinants of exchange rates include inflation rates and interest rates.

An appreciating domestic currency is expected to reduce the country's deficit and vice versa. This is because an appreciating domestic currency makes a country's exports more expensive thereby reducing inflows of revenue. Also imports will be cheaper thereby increasing the outflow of cash. While a depreciating domestic currency makes a country's exports cheaper thereby increasing revenue inflow and its imports more expensive thereby reducing revenue outflow.

2.4.1 Interest Rate

There is a direct relationship between inflation and interest rates. Therefore, high inflation leads to high interest rates. Thus, the interest rate is a key variable in explaining exchange rate. The

central bank can use short term interest rates to manipulate the exchange rate (Bowe and Saltvedt, 2004).

There is still an ongoing debate between economists on the interaction between the interest rate and exchange rate. The Mundell-Fleming model predicts that interest rate should increase in order to stabilize the exchange rate. Otherwise, the home currency will depreciate causing a rise in inflation (Calvo & Reinhart, 2000).

2.4.2 Inflation Rate

Foreign exchange rates are strongly influenced by inflation. Generally, low inflation rate causes the domestic currency to appreciate against foreign currencies (Duarte, & Stockman, 2002).

Fluctuations in the foreign exchange rate can also cause changes in the inflation rate. Engle (2002) argues that exchange rate fluctuations influence the inflation rate through changes in the aggregate demand (AD) and aggregate supply (AS). Depreciation of the domestic currency causes an increase in the price of imports.

2.5 Conceptual Framework

This section presents the conceptual model and the discussion of the key variables in the study.

2.5.1 Conceptual Model

This study is based on the conceptual model below.



Figure 1 Conceptual Model

2.5.2 Interest Rates

The interest rate is the price of money. Money is a normal good thus as the interest rate rises the demand for money declines. Consequently, this lowers the value of money locally and

internationally. Therefore, fluctuation in the interest rate causes a change in the foreign exchange rate of the local currency.

Interest rates can be either nominal or real. The nominal interest rate is one that has not been adjusted for changes in the inflation rate. The real interest rate is calculated as the nominal interest rate minus the inflation rate.

The most commonly used interest rates in empirical studies are the interest rates on government securities. There are government securities of different maturities – 91 days, 182 days and 364 days.

2.5.3 Foreign Exchange Rates

The foreign exchange rate is the price of the local currency on the international currency market.

The foreign exchange rate is usually quoted as the price of one unit of the foreign currency in terms of the local currency. There are several internationally traded currencies but the most traded currency is the US dollar. Therefore, many studies that have examined the forward premium puzzle have used the foreign exchange rate of the US dollar.

2.6 Summary of Literature Review and Knowledge Gaps

In summary, several conclusions can be drawn from the literature review. First, the foreign exchange market is not efficient. Second, the variance of foreign exchange returns is not constant over time. Third, empirical evidence shows that foreign exchange market is complex and possibly chaotic. This study extends previous literature by analyzing the possible cause of the UIP puzzle.

There are so many empirical studies that have been carried out on the UIP puzzle. However, much of this research has been conducted in developed countries. Seminal and pioneer studies on the UIP puzzle are Bilson (1981) and Fama (1984). A survey of related literature is provided by Engel (1996, 2014). As correctly argued by Engel (2016: 437), to properly account for this puzzle the short-term interest rates in the high-interest rate economy are riskier (according to the risk-return trade-off), and therefore have an expected excess return which is compensation for exposure to higher risk. This expected risk premium is not constant and it varies with the interest differential.

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Studies conducted in Kenya in relation to the effects of interest rates, inflation rates and how they affect exchange rates have yielded minimal significant results.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides methodology that was used in the study under the following subsections. Section 3.2 covers the research design which lays out the methodology and implementation procedures in this study. Section 3.3 covers data and data collection instruments section which outlines how the data was collected and the instruments used to collect the data used in this study. Section 3.4 covers data analysis which shows how the data was analyzed.

3.2 Research Design

The descriptive research design was used in this study. The descriptive research design is suitable because it is used to describe the interrelationship between the variables in this study. This study describes the effect of interest rates on the exchange rates in Kenya.

3.3 Data and Data Collection Instruments

This study used secondary data. In particular, the following data were used: Interest rates and Exchange rates for years 2005-2016. The secondary data were collected from Central Bank and Kenya National Bureau of Statistics.

The daily foreign exchange rate returns were computed as follows:

$$\ln P_t - \ln P_{t-1} = r_t \quad (3.1)$$

where \ln is the natural logarithm, P_t is the current closing price and P_{t-1} is the previous closing price of the Kenya shilling against the US dollar when trading activities ended on the market. The value r_t is the return at time t .

The data for the Kenya Government 91-day Treasury Bill Rates were obtained from the Central Bank of Kenya Website (www.centralbank.go.ke/treasurybills). Data on the US 91-day Treasury Bills rates was obtained from Treasury Department Website (<http://www.publicdebt.treas.gov/of/ofaucrt.htm>). These interest rates were used as proxies for the local and foreign interest rate. The expected forward rates were computed from the UIP using the above interest rates.

3.4 Data Analysis

This section discusses the conceptual model, analytical models, parameterization and measurement of variables and the diagnostic tests.

3.4.1 Conceptual Model

This study used the following mathematical function to explain the interrelationship between interest rates, inflation and exchange rates. The formula is as given below:

$$s_{t+k} = f(s_t, f_t^{(k)}) \quad (1)$$

s_t = Monthly spot exchange rates between Kenya Shillings and US Dollar at time t .

s_{t+k} = Monthly future spot exchange rates between Kenya Shillings and US Dollar at time $t+k$.

$f_t^{(k)}$ = Monthly Forward Rate between Kenya Shillings and US Dollar at time t for k periods ahead.

3.4.2 Analytical Model

The model given below was used to determine the relationship between exchange rates and the other variables.

$$f_t^{(k)} - s_{t+k} = \mu + \delta(f_t^{(k)} - s_t) + v_{t+k} \quad (2)$$

Where,

$f_t^{(k)} - s_{t+k}$ = The spot return on holding an asset denominated in a foreign currency
(forward bias)

$f_t^{(k)} - s_t$ = The expected rate of return on an asset denominated in a foreign currency
(forward premium)

s_t = The spot rate in Kshs/USD

s_{t+k} = The future spot rate k periods ahead.

μ = The mean exchange rate between US dollar and Kenya Shillings

δ = Co-efficient of interest rate

V_t = Disturbance term

Table 1 Diagnostics of the Forward Premium

Case		$\delta = \frac{\text{cov}(D, P)}{\text{var}(D + P)}$	Var (D) and Var (P)	cov(D, P)
I	UIP holds	= 1	Var (D) > Var(P) = 0	cov(D, P) = 0
II	Forward premium puzzle	< 0	Var (P) > cov(D, P) > Var(D)	cov(D, P) < 0
III		> 1	Var (D) > cov(D, P) Var(P)	cov(D, P) < 0

Note: $D = \Delta s_{t+k}$, $P = f_t^{(k)} - s_t$

3.5 Diagnostic Tests

3.5.1 Test for Normality

The normal distribution has the skewness of zero and the kurtosis is 3. The study applied the Jarque – Bera (JB) test of goodness-of-fit to the normal distribution. The JB test determines whether the sample skewness and kurtosis are significantly different from their expected values, as measured by the chi-square statistic. The null hypothesis tested is, H_0 : The error terms are normally distributed. The alternate hypothesis is, H_1 : The error terms are not normally distributed.

3.5.2 The Serial Correlation Test

To test for serial correlation the model below was applied:

$$R_t = \mu_t + \sum_{i=1}^p \rho_i R_{t-i} + \phi(i_{t-1} - i_{t-1}^*) + e_t$$

$$e_t = \rho e_{t-1} + \varepsilon_t \tag{3}$$

The variable μ_t is a constant, ρ and ϕ are the coefficients of R_{t-1} and the AR (1) process, respectively, p is the optimal lag structure and e_t is an AR (1) process. The serial correlation test is used to test the null hypothesis that error terms from the AR (1) process of returns are not autocorrelated. The focus here is on the first order serial correlation of the error term of the AR (1) process. Also, if $\rho = 1$ then R_t is non-stationary (i.e. $\phi = 1$).

The problem of serial correlation was solved by fitting an autoregressive model using Cochrane-Orcutt Iterative Least Squares. The null hypothesis tested is, H_0 : The error terms are serially

correlated. The alternate hypothesis is, H_1 : The error terms are not serially correlated. The t -statistics and the Durbin-Watson statistic (DW) were used to determine the significance of the correlation coefficients of the lagged error terms in the regression model.

3.5.3 Unit Root Test

To test for non-stationarity and unit roots in spot rates the Augmented Dickey-Fuller (ADF) test was applied. The ADF test was based on model in equation (4). If $\rho < 0$ then R_t is stationary around the deterministic trend μ_t . However, if $\rho_t = 0, t = 1, \dots, p$, then R_t is non-stationary.

The equation used for conducting ADF test has the general structure of equation (4).

$$R_t = \alpha_0 + \sum_{t=1}^p \rho_t R_{t-1} + \sum_{k=2}^l \delta_k \Delta R_{t-k} + \varepsilon_t \quad (4)$$

Where ρ_t the coefficient of the lagged return, t is the time, ε_t is a white noise error term. The

value of l is computed as $l = \left[12 \left(\frac{T}{100} \right)^{1/4} \right]$ (Schwert, 1989). T is the sample size. The test

statistics are computed from the above regression. The null hypotheses is $H_0: \rho_t = 0, t = 1, \dots, p$

If the null hypothesis is rejected then it shows that the foreign exchange market is inefficient.

3.5.4 Testing for the Time Varying Risk Premium

In this test the assumption that foreign exchange returns are constant is relaxed. The objective is to assign some structure on the returns and reduce the size of the error term in the constant returns model. Assuming that market participants are rational and risk averse, the UIP condition will be distorted by the presence of a risk premium as in equation. In order to test for the presence of a time varying risk premium equation (5) was estimated assuming the error term contains the risk premium. Then the error term is tested for whiteness. If the error term is not white noise, the risk premium is removed from the error term by incorporating the term ζ_{t+k-1} . As shown in equation (5) equilibrium will exist when the expected return on a Kenyan shilling is equal to the interest differential between Kenya and USA minus the risk premium for holding the US dollar.

$$R_t = \mu_t + \sum_{t=1}^n \rho_t R_{t-1} + \phi(i_{t-1} - i_{t-1}^*) - \zeta_{t-1} + \varphi_1 D_1 + e_t \quad (5)$$

The risk premium was computed at the 1-month horizon. This was substituted into equation (5) and the equation re-estimated.

The forward premium is decomposed into three parts – the risk premium, the spot return, and the rational expectations error term. From the fact that spot exchange rates follow a martingale process, the spot return series is a martingale difference or stationary process. The rational expectations error term is stationary by definition. Therefore, the order of integration of the risk premium depends on the on the order of integration of the forward premium. The tests for unit roots in the term structure of forward premium were achieved by applying the Johansen Likelihood Ratio (JLR) test to the 1-month forward premium.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results of the data analyses and their discussion. Section 4.2 presents summary statistics. Section 4.3 discusses the results of the diagnostic tests. Section 4.4 presents the results of the test of the forward premium puzzle. Section 4.5 is the summary of the chapter.

4.2. Summary Statistics

Table 2 Summary Statistics

	KE_TBILL	US_TBILL	S_T	_KETBILL	LN_FT	LN_ST	_USTBILL
Mean	13.7166	4.8209	68.5039	1.1372	4.2967	4.2149	1.0453
Maximum	33.5500	5.2100	81.2044	1.3360	4.4572	4.3970	1.0521
Minimum	0.8300	4.3600	42.3823	1.0080	3.8532	3.7467	1.0000
Std. Dev.	8.0876	0.2152	10.1183	0.0809	0.1269	0.1590	0.0118
Skewness	0.4075	-0.1946	-0.6990	0.4081	-1.4555	-0.9515	-3.4520
Kurtosis	2.1553	2.1081	2.3909	2.1547	5.3486	3.1063	13.4075
Jarque-Bera	9.2999	6.1559	16.0854	9.3212	94.4347	25.1263	1052.886
Probability	0.0096	0.0460	0.0003	0.0094	0.0000	0.0000	0.0000
Observations	162	156	166	162	162	166	162

Table 2 displays the descriptive statistics for the data used in this study. The results show that all the variables are not normally distributed. This is attributed to the excess kurtosis.

4.3 Results of Diagnostic Tests

The following tests were performed before the correct model for testing the forward premium puzzle was determined.

4.3.1 Unit Root Test

The first step in the analysis was to examine the time series characteristics of the data sets used to test for market efficiency. This was necessary because often the results of the tests are influenced by the characteristics of the data such as stationarity and seasonality. This section examines the stationarity of the data using the ADF test. The results of the unit root test based on

the ADF tests are displayed in Table 3. The optimal lag for the returns was one, hence the use of R_{t-1} in the analysis. Figure 4.2.1 shows the time series of daily exchange rates and returns at the daily, weekly and monthly intervals. The exchange rates do not have a constant mean and variance. Therefore, the exchange rate is likely to be non-stationary. This is confirmed by the unit root test. Clearly, returns fluctuate around a long-run mean value.

Table 3a Unit Root Test for Foreign Exchange Rate Returns

This table summarizes the results of the unit root test for monthly returns. R = currency return, R (-1) = lagged R. The results for the best fitting models based on the AIC are reported in this table.

Variable	Returns in Level Form
Constant (μ)	0.000375
R(-1)	-0.737278
AIC	-5.083362
ADF	-4.798469***
LAG	5

Note: Critical values for the ADF-test and the indication of significance are -3.4718, -2.8796 and -2.5765 at 1% (***), 5% (**) and 10% (*) levels, respectively. Critical values for the *t*-test and the indication of significance are 2.576, 1.96 and 1.645 at 1% (***), 5% (**) and 10% (*) levels.

As a matter of procedure, first, the ADF test was applied on the level form of the monthly returns. The computed *t*-statistic was -4.798469. The critical values at 1 percent and 5 percent significance level are -3.4718 and -2.8796, respectively. Thus the null hypothesis of unit root is rejected since the computed statistic is more negative than the critical values. Then, the ADF test was applied on the monthly return series in level form plus the time trend. The computed *t*-statistic was -5.616485 for the lagged return and -0.0506214 for the time trend. Thus the null hypothesis of unit root is rejected and there is a statistically insignificant trend in returns. Therefore weekly returns are integrated of order zero, $I(0)$. The implications of these results are similar to those of weekly returns.

The same procedure for testing for unit roots in returns was applied to the interest rate differentials. Since the hypothesis of unit root could not be rejected in level form, first differences of the interest differentials were employed in the second stage. The results

summarized in Table 3b indicate that interest rate differentials are integrated of order one, I (1). Thus, interest rate differentials are nonstationary. This implies that interest rate differentials have no tendency to return to their long run mean. Furthermore, the variance of the interest rate differentials is time-dependent and becomes infinite as time goes to infinity. Therefore, interest rate differentials follow a random walk and cannot be accurately forecasted. Also further analysis involving the interest differential applied the first differences of the interest rate differential. This is in accord with the assumptions of the classical regression model.

Table 3b Unit Root Test for Interest Rate Differentials

Variable	Monthly Interest Rate Differentials		
Constant (μ)	0.213222	0.604014	-0.091151
IDIFF(-1)	-0.039796	-0.055472	
D(IDIFF(-1))			-0.542638
Trend(1)		-0.00486	0.000507
AIC	1.306121	3.371629	3.183784
ADF	-2.352538	-1.935862	-5.139626***
LAG	1	0	2

Note: Critical values for the *ADF*-test and the indication of significance are -3.4718, -2.8796 and -2.5765 at 1% (***) , 5% (**) and 10% (*) levels, respectively. Critical values for the *t*-test and the indication of significance are 2.576, 1.96 and 1.645 at 1% (***) , 5% (**) and 10% (*) levels.

In Table 3c the first column for each time horizon presents the results for the unit root test assuming a constant and linear trend in the risk premiums. The second column reports the result of the differenced series with assuming a constant and linear trend in the risk premiums. Overall, the results show that the risk premium is not stationary at the 1-month interval. Thus, further analysis using these variables employed their first difference according to classical theory of regression analysis.

Table 3c Unit Root Test for the Risk Premiums

This table summarizes the results of the unit root test for the risk premiums. D_1 = risk premium at one month horizon, $D_1(-1)$ = lagged D_1 . $D(D_1(-1))$ = first difference of lagged D_1 . D = Risk Premium. The results reported in this Table are for the best estimated models as indicated by the Akaike Information Criterion (AIC).

Variable	1 Month Risk Premium	
Constant (μ)	3.78326	-0.20067
$D_1(-1)$	-0.247215	
$D(D_1(-1))$		-0.53617
Trend(1)	-0.28242	0.00074
AIC	5.1389	5.2190
ADF	-3.4104	-5.0954***
LAG	2	0

Note: Critical values for the ADF-test and the indication of significance are -3.4718, -2.8796 and -2.5765 at 1% (***), 5% (**) and 10% (*) levels, respectively. Critical values for the t -test and the indication of significance are 2.576, 1.96 and 1.645 at 1% (***), 5% (**) and 10% (*) levels, respectively. *Results are based on the modified AIC.

There are similarities between the term structure of the forward premium and the term structure of the risk premium. Again the forward premium does not have a constant mean and variance as shown in Figure 3b and this is confirmed by the unit root test results in Table 3d. There is also an obvious downward trend in the forward premiums.

The results of the unit root test in Table 3d indicate that the forward premium is nonstationary at the 1-month interval. However, the trend in the forward premium is not significant at 5 percent level in the monthly forward premium.

4.3.2 Test for Normality

One reason for the rejection of market efficiency is the presence of non-normally distributed error terms. In this study the Jarque – Bera (JB) test of goodness-of-fit to the normal distribution was used. The test was applied to monthly returns. The results are summarized in Table 4 below. For the normal distribution the sample skewness should be close to zero and the sample kurtosis close to 3. The JB test shows that the sample skewness and kurtosis are significantly different from their expected values, as measured by the chi-square statistic. Therefore, the null hypothesis that the monthly returns are normally distributed is rejected. Hence monthly returns are not normally distributed. The excess kurtosis suggests that the market experiences large

depreciations and appreciations in the exchange rates than is normal. Depreciations appear to be common at intervals as indicated by a positive constant term for e^{μ} in Table 4. Monthly returns have a kurtosis of 20.1554 and a skewness of 0.0594.

Table 3d Unit Root Test for the Forward Premiums

This table summarizes the results of the unit root test for the forward premium. P_{-1} = forward premium at one month horizon, $P_{-1}(-1)$ = lagged P_{-1} . $D(P_{-1}*(-1))$ = first difference of lagged P_{-1} . P = Forward Premium. The results reported in Table 3d are for the best estimated models as indicated by the Akaike Information Criterion (AIC).

Variable	1 Month Forward Premium	
Constant (μ)	0.8623(1.5620)	-0.1491(-0.8729)
$P_{-1}(-1)$	-0.0660(-1.9499)*	
$D(P_{-1}(-1))$		-0.5786(-7.9807)***
Trend(1)	-0.00618(-1.5131)	0.00112(0.5655)
AIC	2.8174	5.2190
ADF	-1.9499	-7.9807***
LAG	10	0

Note: Critical values for the ADF-test and the indication of significance are -3.4718, -2.8796 and -2.5765 at 1% (***) , 5% (**) and 10% (*) levels, respectively. Critical values for the t -test and the indication of significance are 2.576, 1.96 and 1.645 at 1% (***) , 5% (**) and 10% (*) levels, respectively.

Table 4 Results of the Normality Test for Exchange Returns

This table summarizes the results for the normality test based on the constant returns model.

$R_t = \mu + e_t$. Where μ is the constant mean return and e_t is the error term.

Variable	Monthly Returns
Constant(μ)	-0.000180 (-0.118802)
Mean	2.75E-18
Std. Deviation	0.017618
Skewness	0.515445
Kurtosis	20.1554
Jarque-Bera	5.7297

Note: Critical values for the t -test and the indication of significance are 2.576, 1.96 and 1.645 at 1% (***) , 5% (**) and 10% (*) levels, respectively. Stdev = standard deviation

The evidence above shows that the returns are not normally distributed and suggests that the market is not efficient. The next step was to test the error terms in the constant returns are not serially correlated.

4.3.3 The Serial Correlation Test

Another reason for the rejection of market efficiency is the presence of autocorrelation in the error terms. The results of the serial correlation test are displayed in Table 5. The regression results of the lagged returns plus the month of the year dummies are shown in Table 5. The variables were sequentially introduced in the model to allow the impact of each variable on the auto correlated errors of the model to be isolated. The results showed that the constant terms in the models are positive and significant at the 5% level for the monthly returns. Thus when seasonal variables are included in the model the results show that the exchange rate has been depreciating most of the time. The results show that the problem of serial correlation is absent in the monthly returns model after including seasonal dummies.

The same procedure was repeated for monthly returns incorporating the interest rate differential. The results for the autocorrelation test shown in Table 4 indicate that there is statistically significant positive serial correlation in the monthly returns. This implies that monthly returns are not mean-reverting. In conclusion, and monthly returns are positively auto correlated.

4.4 Results of Testing for the Forward Premium Puzzle

The first step in testing for the forward premium puzzle in the market was to examine whether the one monthly expected return and the forward premiums are co-integrated. This was achieved using the Johansen co-integration test. The results are shown in Table 5a. The results indicate that the one month expected return and the forward premium are co-integrated at the one month horizon. There are four co-integrating vectors.

Engle and Granger (1987) showed that if variables such as the forward bias (D_t) and the forward premium (P_t) are integrated of order one, $I(1)$, and $\eta_t = D_t - \alpha P_t$ and $\vartheta_t = P_t - \gamma D_t$ are both integrated of order zero, $I(0)$, that is, if long-run relationships exist between these two variables, then D and P are said to be co-integrated. Such variables may be considered to be generated by an autoregressive error-correction model (VECM). In this model the error correction terms are

expected to capture the adjustment of the changes in D and P toward the long run equilibrium, while the lagged differenced terms of these variables are expected to capture the short run dynamics in of the model.

Table 5a Results of the Co-integration Test

This table provides a summary of the co-integration test between the risk premium and the forward premium. D_1 is the one month expected return, P_1 is the one month forward premium, is the one month forward premium. CE = Co-integrating Equations. CV = Co-integrating Vectors.

Variable	D 1 vs P 1
Trace Statistic	46.2864**
Critical Value	15.49471
No CE(s)	Reject
At most 1 CE	Reject
CVs	4

**denotes rejection of the hypothesis at 5 percent level.

Thus evidence adduced in this study support the argument that the risk premium is time varying. Furthermore, the results show that the term structure of the forward premiums contain significant information that can be exploited to forecast the future spot exchange rates.

The results for estimating the error correction models for 1-month horizon are shown in Table 5b. The null hypothesis that the coefficient of the error correction term is equal to 1 is rejected at all horizons. Indeed the coefficient is negative. Therefore, the forward premium puzzle exists in the foreign exchange market in Kenya. The first difference of the forward premium variable is significant at all horizons. Therefore, null hypothesis that the coefficient of the lagged one month expected return is equal to 1 is also rejected. The null hypothesis that the coefficients of the other lagged variables in the model are equal to zero is not rejected at the one month horizon. This implies that in the short run the market is not efficient at the one month horizon.

Table 5b Vector Error Correction Estimates of the Risk Premiums

This table summarizes the results of estimating the error correction models for the term structure of the one month expected return. CE = Co-integration Equation, ECT = Error Correction Term, D_1 = Error correction term for the co-integration equation for the 1-month month expected return, D (D_1) = the difference of the error correction term D_1. Other error correction terms are defined in the same way. D (-i) = D lagged *i* times. P (-i) = P lagged *i* times. D = one month expected return, D (D (-1)) = First difference of D lagged once and D (P (-1)) = First difference of P lagged once. Other variables are defined in similar manner. μ = Constant.

Variable	1-Month Risk Premium	
CE	D_1	
D(-i)	1.0000	
P(-i)	-1.1002(-26.2733)***	
μ	0.5203	
CE	D(D_1)	D(P_1)
ECT	-0.794528 (-5.1734)***	0.119218 (2.2988)**
D(D(-1))	0.026018 (0.2024)	0.004208 (0.09692)
D(D(-2))	0.002256 (0.0239)	0.005974(0.18761)
D(P(-1))	0.458649 (1.8438)*	0.508641 (6.0552)***
D(P(-2))	-0.046767 (-0.2023)	-0.169849 (-2.1756)**
μ	-0.049860 (-0.2112)	-0.062757 (-0.7872)
F-statistic	15.7353***	12.2246***
AIC	7.6443	

Note: Critical values for the *F*-test and the indication of significance are 2.576, 1.96 and 1.645 at 1% (***), 5% (**), 10% (*) and 25% (•) levels, respectively. The null hypothesis of market efficiency is analyzed by testing the restrictions that ECT = 1; D (P (-1)) = 1 and D (D (-1)) = D (D (-2)) = D (P (-2))

4.5 Summary

The results of the data analysis demonstrate the presence of the forward premium puzzle in the foreign exchange rate market in Kenya. This is attributed to the existence of the time varying risk premium in the foreign exchange market. The term structure of the interest rate differential and the foreign exchange risk premium are nonstationary and they are higher in the short run and decline steadily in the long run.

CHAPTER FIVE

SUMMARY AND CONCLUSION

5.1 Introduction

This chapter presents the summary of the study and the main conclusions drawn from the analysis of the data in Chapter Four. The chapter is organized as follows. Section 5.2 presents the summary of the study while section 5.3 is the conclusion. Section 5.4 discusses the limitations of the study. Lastly, section 5.5 examines policy issues arising from the results of this study and section 5.6 the recommendations for further research.

5.2 Summary of the Study

The main objective of this study was to examine the presence of the forward premium puzzle in the foreign exchange market in Kenya. The study used the Kshs/USD exchange rate for the period 1994 to 2016. That data consisted of monthly observations of the exchange rate, monthly observations of the 91-day Kenya government Treasury Bills Rate and the 91-day US government Treasury Bills rate.

As a matter of procedure the data were tested for nonstationarity using the ADF test in level forms and in first differences. The result revealed that foreign exchange rates, interest rates and the risk premium are nonstationary. Therefore, this study applied the VECM instead of the classical Granger causality tests to the data.

The results show that the coefficient of the forward premium is not only negative but also statistically significant at the 5 percent level. This indicates the presence of the forward premium puzzle in the foreign exchange rate market in Kenya. Moreover, the forward premium contains information that can be used to improve the prediction the foreign exchange rate.

5.3 Conclusions

There are at least three conclusions that can be drawn from the data analyses in this study. First, the foreign exchange rate market exhibits the forward premium puzzle. Second, foreign exchange rates and interest rates are nonstationary. Thus, foreign exchange rates and interest rates have unit roots.

Third, that the correct framework for testing for the forward premium puzzle is the vector error correction model (VECM). This is the result of the fact that foreign exchange rates and interest rates are co-integrated.

Fourth, the forward premium contains information that can be used to improve the prediction the foreign exchange rate.

5.4 Limitations of the Study

There are several areas where the study is wanting. First the study considered only the Kshs/USD exchange rate. Other foreign currencies against the local currency were not studied.

Second, this study considered only monthly data. There are several sampling intervals for data that can be applied. These are daily, weekly, quarterly, semi-annually and annual data.

Third, the study used treasury bills rates as the proxy for interest rates. There are other measures of the interest rate on other comparable financial assets that could be used.

Fourth, the interest rate was the only macroeconomic factor considered among the other determinants of foreign exchange rates. Certainly, there are many other determinants of the foreign exchange rate apart from the interest rate.

5.5 Recommendations for Policy

A number of policy implications can be derived from the findings of this. First, borrowing activities in the government securities market has impact on the foreign exchange rate. Specifically, increased government borrowing in the local market is likely to cause distortions in the foreign exchange rate market. The evidence provided in this study suggests that there is volatility spill over across markets.

5.6 Recommendations for Further Research

This study makes several recommendations for further research. First the study considered only the Kshs/USD exchange rate. Other foreign currencies against the local currency should be studied.

Second, this study considered only monthly data. Future studies should consider daily, weekly, quarterly, semi-annually and annual data.

Third, the study used treasury bills rates as the proxy for interest rates. Future studies should use other measures of the interest rate on other comparable financial assets that could be used.

Fourth, the interest rate was the only macroeconomic factor considered among the other determinants of foreign exchange rates. Thus further research is required to enquire into the macroeconomic determinants of the foreign exchange rates.

REFERENCES

- Bacchetta, P., and E. Wincoop, (2010). Infrequent Portfolio Decisions: A Solution to the Forward Discount Puzzle. *American Economic Review* (100), 870 – 904.
- Bakshi, G., and Z. Chen. (1997). Equilibrium Valuation of Foreign Exchange Claims. *Journal of Finance*, (52), 799 - 826.
- Bansal, R., (1997). An Exploration of the Forward Premium Puzzle in Currency Markets. *Review of Financial Studies*, (10), 369 - 403.
- Bansal, R., and I. Shaliastovich. (2013). A Long-Run Risks Explanation of Predictability Puzzles in Bond and Currency Markets. *Review of Financial Studies*, (26), 1- 33.
- Bekaert, G. and Hodrick, R.J. (1993). On Biases in Measurement of Foreign Exchange Risk Premiums, *Journal of International Money and Finance*, 12: 115-38
- Bergen, J.V. (2010). *Factors That Influence Exchange Rates*, Investopedia.
- Bleaney, M. & Fielding, D. (2002). Exchange rate regimes, inflation and output volatility in developing countries. *Journal of development economics*, v. 68, pp. 233-245.
- Bowe, M. & Saltvedt, T. M. (2004). Currency invoicing practices, exchange rate volatility and pricing-to market: evidence from product level data, *International Business Review*, 13, pp. 281-308.
- Brunnermeier, M., and L.H. Pedersen, (2009). Market Liquidity and Funding Liquidity. *Review of Financial Studies*, (22), 2201- 2238.
- Burnside, C., B. Han, D. Hirshleifer, and T.Y. Wang, (2011). Investor Overconfidence and the Forward Premium Puzzle. *Review of Economic Studies*(78), 523 - 558.
- Calvo, G. & Reinhart, C. (2000). Fear of Floating. *NBER, Working Paper no. 7993, November*.
- Chen, Y., and R. Gwati, (2013). FX Options and Excess Returns: A Multi-Moment Term Structure Model of Exchange Rate Dynamics. *Working Paper*.
- Clarida, R. H. and Taylor, M. P. (1997). The Term Structure of Forward Exchange Premiums and the Forecast Ability of Spot Exchange Rates: Correcting the Errors, *Review of Economics and Statistics*, 79: 353-61
- Cumby, R.(1988). Is It Risk? Explaining Deviations from Uncovered Interest Parity. *Journal of Monetary Economics*,(22), 279 - 299.
- Devereux, M. B. & Engel, C. (2003). *Monetary Policy in the Open Economy Revisited: Price Setting and Exchange Rate Flexibility*. The Review of Economic Studies, October

- Domowitz, I., and C. Hakkio, (1985). Conditional Variance and the Risk Premium in the Foreign Exchange Market. *Journal of International Economics*,(19), 47 - 66.
- Dornbusch, R, 1976. Expectations and Exchange Rate Dynamics. *Journal of Political Economy* 84, 1161-1176.
- Duarte, M. & Stockman, A.C. (2002). Comment on: Exchange rate pass-through, exchange rate volatility, and exchange rate disconnect. *Journal of Monetary Economics*, V. 49, n. 5, July, 941-946.
- Duffee, G. R. (2002). Term Premia and Interest Rate Forecasts in Affine Models. *Journal of Finance*, (57), 405 - 443.
- Duffee, G. R. (2011). Information in (and not in) the Term Structure. *Review of Financial Studies*, (24), 2895 - 2934.
- Edwards, S. (2002). The Great Exchange Rate Debate after Argentina. *Working Paper No. 74, Oesterreichische National bank*.
- Eichenbaum, M., and C.L. Evans. (1995). Some Empirical Evidence on the Effects of Shocks to Monetary Policy on Exchange Rates. *Quarterly Journal of Economics*, (110), 975 - 1009.
- Eichengreen, B. (2004). *Monetary and Exchange Rate Policy in Korea: Assessments and Policy Issues*. Paper prepared for a symposium at the Bank of Korea, Seoul.
- Eiteman, David K., Stonehill, Arthur I., and Moffett, Michael H. (2001). *Multinational Business Finance 9th edition*. Addison-Wesley Longman, Inc.
- Engle, R. F. and C. W. J. Granger (1987), Co-Integration and Error-Correction: Representation, Estimation, and Testing, *Econometrica*, 55 (2), 251 – 276.
- Engel, C. & Robert, F. (2002). Dynamic conditional correlation - a simple class of multivariate GARCH models. *Journal of Business and Economic Statistics*, v.20, n.3, July
- Engel, C. (2016), Exchange Rates, Interest Rates, and the Risk Premium. *American Economic Review*, 106 (2), 436 – 474.
- Fama, E.F. (1984). Forward and Spot Exchange Rates. *Journal of Monetary Economics*,(14), 319 - 338.
- Farhi, E., and X. Gabaix(2014). Rare Disasters and Exchange Rates. *Manuscript*, Department of Economics, Harvard University.
- Farhi, E., S.P. Fraiberger, X. Gabaix, R. Ranciere, and A. Verdelhan(2009). Crash risk in currency markets. *Working paper*, MIT Sloan.

- Fleming, J. M. (1962). Domestic Financial Policies under Fixed and Flexible Exchange Rates, *IMF Staff Papers*, November, 369 - 379.
- Fraga, A., Goldfajn, I. and Minella, A. (2003). "Inaction Targeting in Emerging Market Economies". In Gertler, M. and Rogo, K. (Eds.), *NBER Macroeconomics Annual, Washington, DC*, 3 65-400.
- Frankel, J.A.(1979). On the Mark: A Theory of Floating Exchange Rates Based on Real Interest Differentials. *American Economic Review*, 69, 610-622.
- Frankel, J. A. and C. M. Engel. (1984). Do Asset Demand Functions Optimize over the Mean and Variance of Real Returns? A Six-Currency Test, *Journal of International Economics*, 17, 309 – 323.
- Frankel, J. A. and Froot, K.A. (1987a), Using Survey Data to Test Standard Propositions Regarding Exchange Rate Expectations, *American Economic Review*, 77: 133-153
- Froot, K.A., and R.H. Thaler. (1990). Anomalies: Foreign Exchange. *Journal of Economic Perspectives*,(4), 179 - 192.
- Gagnon. J. E., and Thrig, J. (2004). Monetary policy and exchange rate pass through *International Journal of Finance and Economics*, 9, pp. 31 5-338.
- Gall, J. and Monacelli, T., (2005). Monetary Policy and Exchange Rate Volatility in a Small Open Economy. *Review of Economic Studies*, forth-coming.
- Gerlach, S. and Smets, F. (2000). MCIs and Monetary Policy. *European Economic Review*, 44, 1677 - 1 700.
- Gudmundsson, M. (2012), Currency and Exchange Rate Regime Options, *Central Bank of Iceland Website*, September, 7.
- Hadzi-Vaskov, M. and C. J. M. Kool (2006). The Importance of Interest Rate Volatility in Empirical Tests of Uncovered Interest Rate Parity, *Working Papers06-16*, Utrecht School of Economics.
- Hai, W., Mark, N. and Y. Wu. (1997). Understanding Spot and Forward Exchange Rate Regressions, *Journal of Applied Econometrics*, 12 (6), 715 – 734.
- Hansen, L.P. and Hodrick, R.J. (1980). Forward Exchange Rates as Optimal Predictors of Future Spot Rates: An Econometric Analysis, *Journal of Political Economy*, 88: 829-53
- Hassen, T.A.(2013). Country Size, Currency Unions, and International Asset Returns. *Journal of Finance*, (68), 2269 - 2308.

- Hodrick, P. (1997). Postwar U.S. Business Cycles: An Empirical Investigation. *Journal of Money Credit and Banking*, 29 (1), 1 – 16.
- Jurek, J.W., and Z. Xu(2014). Option-Implied Currency Risk Premia. *Working Paper*.
- Kidwell, D. S., Blackwell, D.W., Whidbee D.A. & Peterson R. L. (2008). *Financial Institutions, Markets, and Money*. Tenth Edition.
- Kimani, S.W. (2007), “Efficiency of Foreign Exchange Market in Kenya”, MBA Dissertation, University of Nairobi
- Kiptoo, C. 2007. *Real Exchange Rate Volatility, and misalignment in Kenya, 1993- 2003, Assessment of its impact on International Trade, and investments*. Unpublished Ph.D. Thesis, University of Nairobi.
- Kisaka, S.E., Ngugi, R.W., Pokhariyal P.G. and Gituru, W. (2008). An Analysis of the Efficiency of the Foreign Exchange Rate Market in Kenya, *Economics Bulletin*, 14 (2), 1 – 13.
- Kurgat, P. (1998). “An Empirical Study of Spot Market Efficiency of Kenya’s Foreign Exchange Bureaus”, Unpublished MBA dissertation, University of Nairobi.
- Levi, M.D. (2007). *International Finance: Contemporary Issues*. Routledge. Business and Economics.
- Levich & Richard, M. (2001) *International Financial Markets*. 2nd Edition. McGraw-Hill.
- Lewis, K. K. (1995), “Puzzles in International Financial Markets” in Grossman and Rogoff (eds), *The Handbook in International Economics*, Amsterdam: North Holland.
- Lustig, H., and A. Verdelhan. (2007). The Cross-Section of Currency Risk Premiaand US Consumption Growth Risk. *American Economic Review*, (97), 89 - 117.
- Lustig, H., N. Roussanov, and A. Verdelhan(2011). Common Risk Factors in Currency Markets. *Review of Financial Studies*,(24), 3731 - 3777.
- Lustig, H., N. Roussanov, and A. Verdelhan(2014). Countercyclical currency risk premia. *Journal of Financial Economics*,(111), 527 - 553.
- Mankiw, N.G., and R. Reis. (2002). Sticky Information versus Sticky Prices: A Proposal to Replace the New Keynesian Phillips Curve. *Quarterly Journal of Economics*,(117), 1295 - 1328.
- McCallum, B. and Nelson, E. (2000). “Monetary Policy for an Open Economy: An Alternative Framework with Optimizing Agents and Sticky Prices”. *Oxford Review of Economic Policy*, 16, 74-91.
- Mehl, A. and Cappiello, L. (2007). Uncovered Interest Rate Parity at Distant Horizons: Evidence on Emerging Economies and Nonlinearities, *Working Paper Series No. 801, August.*, European Central Bank.

- Menkhoff, L., L. Sarno, M. Schmeling, A. Schrimpf (2012). Carry Trades and Global Foreign Exchange Volatility. *Journal of Finance*, (67), 681 - 718.
- Miller, R.L. & Benjamin, D.K. (2004). *The Economics of Macro Issues*. Boston, MA; Pearson - Addison Wesley.
- Mohanty, M. and Klau, M., (2004). “Monetary Policy Rules in Emerging Market Economies: Issues and Evidence”. *BIS Working Paper No. 149*.
- Moron, E. and Winkeiried, D., (2003). Monetary Policy Rules for Financially Vulnerable Economies. *IMF Working Paper No. 39*
- Mugenda and Mugenda (2003). *Quantitative and Qualitative Approaches*. African Centre for Technology Studies: Nairobi, Kenya.
- Muhoro, J.W., (2005). Determining the Efficiency of the Foreign Exchange Market in Kenya, Unpublished MBA dissertation, University of Nairobi.
- Mundell, R. (1963). Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates, *Canadian Journal of Economics and Political Science*, 29, 475 – 485.
- Ndunda, F., (2002). Forward Exchange Rates as Predictors of the Future Spot Rates, Unpublished MBA Dissertation, University of Nairobi.
- Ndung’u, M. (2010). Price and Exchange Rate Dynamics in Kenya: (edits) an Empirical Investigation (1970-1993). AERC research Paper, 58.
- Ndung’u, N.S. 1997. Price and exchange rate dynamics in Kenya: An empirical investigation (1970-1993). *AERC Discussion Paper 58. Nairobi: African Economic Research Consortium*.
- Ndungu and Ngugi (1999). *Adjustment and liberalization in Kenya: The financial and foreign exchange market. Journal of International Development*, vol. 11. 465—49.
- Otuori, O. H. (2013). Influence of exchange rate determinants on the performance of commercial banks in Kenya. *European Journal of Management Sciences and Economics*, 1(2), 86-98.
- Pattnaik, S. and Mitra A. K. (2001), Interest Rate Defence of Exchange Rate: Tale of the Indian Rupee. *Economic and Political Weekly*, November 24, pp. 4418- 4427.
- Pétursson, T. G., (2008). How hard can it be? *Inflation control around the world*. Central Bank of Iceland Working Papers, forthcoming.
- Shambaugh, J., (2004). The Effect of Fixed Exchange Rates on Monetary Policy, *Quarterly Journal of Economics*, (119), 301-352.

Svensson, L., (2000). ‘Open-economy Inflation- Targeting’. *Journal of International Economics*, 50, 155-183.

Shamoo, A.E. & Resnik, B.R. (2003). *Responsible Conduct of Research*. Oxford University Press.

Taylor, J., T. (2001). The Role of the Exchange Rate in Monetary Policy Rules. *American Economic Review*, Papers and Proceedings, 91, 263-267.

Verdelhan, A., (2010). A Habit-based Explanation of the Exchange Rate Risk Premium. *Journal of Finance*,(65), 123 - 146.

Wagacha, M. (2000). Analysis of Liberalization of the Trade and Exchange Rate Regime in Kenya since 1980. *IPAR Discussion Paper Series*, Institute of Policy Analysis and Research, Nairobi.

Willem, N. (1995). Financial Liberalization and Interest Rate Risk Management in Sub-Saharan Africa, *Centre for the Study of African Economies, Institute of Economic Affairs, University of Oxford*, WPS//96-12.

Williamson, R. (2001). Exchange Rate Exposure and Competition: Evidence from the Automotive Industry, *Journal of Financial Economics*, 59 (3), 441 – 475.