



FACTORS AFFECTING EXCHANGE RATE VOLATILITY IN KENYA

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Abstract

The purpose of the study was to identify the determinants of exchange rate volatility in Kenya. The specific objectives of the study are to establish the effect of inflation rates on exchange rate volatility in Kenya. To ascertain the effect of interest rates on exchange rate volatility in Kenya. To evaluate the effect of remittances on exchange rate volatility in Kenya. Among the theories that shaped the study are; the balance of payments theory, interest rate parity theory, purchasing power parity theory and fisher effect theory. Secondary data from Central Bank of Kenya was used for the variables; Inflation, exchange rates, interest rates and remittances. Data was then analyzed by the use of E-views, which was then visually displayed using bar charts. The study found out that, from the years 2004 to the year 2019 there is a mild long term increasing trend in the Kenya's exchange rate but shows low volatility except in the years 2008, 2011 and 2015. Interest rate portrays a stationary characteristic but high volatility rate. There has been an increase in remittances between the years 2004 to the year 2019. The rate at which remittances has been increasing has been low. The study found out that Inflation and Interest rates seem to be stationary while diaspora remittance is trending upwards. One percent increase in interest rate decreased exchange rate volatility by 3.5201%. One percent increase in inflation rate increased exchange rate volatility by 2.0419%. One percent increase in Remittances increased exchange rate volatility by 4.1894%. The study recommended that the

government should constantly revisit the current policies in order to better track the effects of these macro-economic variables to ensure informed decision-making going forward. The government should encourage foreign remittances in the country through creating conducive environment for investment.

Keywords: Exchange rate volatility, Inflation, Diaspora Remittances, Interest rates

INTRODUCTION

Background of the Study

Exchange rate shows a country's competitiveness in global markets. Exchange rate between two currencies specifies how much one currency is worth in terms of the other, that is, the value of a foreign nation's currency in terms of the home nation's currency (Basirat, 2014). The exchange rate is determined by the interaction of supply and demand for foreign currency in the interbank market for foreign exchange. Like the stock exchange, money can be made or lost on the foreign exchange market by investors and speculators buying and selling at the right times (Awan, Asghar & Rehman, 2011). Draz & Ahmad (2015) upheld that exchange rate fluctuations have real economic costs that affect price stability, firm profitability and the general economic stability. The financial position of an economy that is mainly determined by the capital market is susceptible to its foreign exchange fluctuation. Hence, this makes foreign exchange market developments to have cost implications on market capitalization.

Foreign exchange market (forex or currency market) is a worldwide-decentralized over-the-counter financial market for the trading of currencies. The purpose of the foreign exchange market is to assist international trade and investment, hence, allows businesses to convert one currency to another (Burstein, Eichenbaum & Rebelo, 2007). The internationalization of capital markets has resulted in inflow of vast sums of funds between countries and in the cross listing of equities. This has therefore made investors and firms more interested in the fluctuation of exchange rate and its effects on stock market. Floating exchange rate appreciation reduces the competitiveness of export markets; and has a negative effect on the domestic stock market (Awan, Asghar & Rehman, 2011). But, for import dependent economy like Kenya, it may have positive effects on the stock market by lowering input costs. Exchange rate in Kenya was liberalized in October 1993 and since then has largely been determined by demand and supplies for the Kenya shilling vis-à-vis other currencies (Alam & Taib, 2013).

The significant role played by exchange rates cannot be underrated in a country's economy because it affects price level, productivity of firms, distribution of resources and

investment decision (Fida, 2012). Burstein, Eichenbaum & Rebelo (2007) concluded that exchange rate is a fundamental economic adjustment instrument and a complex and contentious econometric tool. Grier & Mark (2010) argued that exchange rate connects the pricing system across countries thereby facilitating traders to compare price directly. For developing countries like Kenya, where financial markets are still underdeveloped, exchange rate volatility creates a risky business environment relating to profit uncertainties (Fida, 2012).

Hargreaves & Watson (2011) while examining the exchange rate volatility and United States' stock returns used squared residuals from autoregressive models covering 1980 to 2008 and revealed changes in exchange rate negatively affected United States' stock returns despite the existence of hedging instruments intended to reduce the negative effect on trade volumes. In a related study, Corsetti, Dedola & Leduc (2008) conducted a research on the effects of exchange rate on the stock market development in Nigeria both in the long run and short run using Johansen co-integration tests. The results revealed that in the short run, there was a significant positive stock market performance to exchange rate unlike in the long run where the reverse was true. Empirically, evidence used in the study confirmed diverse views on the relationship between the two variables.

Dufour, Jean-Marie & Tessier (2010) who employed co-integration analysis on quarterly data and found out that there was a significant relationship between changes in foreign exchange rate and South African goods and services exported to the international market, studied the behaviour of volatility of foreign exchange rate. Dufour et al, (2010) further measured volatility using moving standard deviation and established there was no statistically significant relationship between changes in foreign exchange rate and South African exports and should such a relationship exist, it would be positive.

A study by Grier & Mark (2010) in Nigeria using Egarch model revealed that indeed real exchange rate should be monitored by optimal exchange rate policies so as to maintain an equilibrium balance in the economy. He further argued that when the rate of depreciation increases by a greater margin than the domestic production, then exchange rate depreciation safeguards the domestic industry. Gust, Leduc & Vigfusson (2010) while using the ARGH and GARCH models in their study of the effect of real exchange rate volatility in South Africa established that real exchange rate volatility impacts negatively on exports both in the short run and long run.

Hargreaves & and Watson, (2011) defines exchange rate volatility as unforeseen variations in exchange rate and the risk thereof. He further postulates that econometrics considered sources of exchange rate volatility namely balance of payments, inflation, and interest rate has increasingly exhibited fluctuation tendencies. Exchange rates in Kenya have

been fluctuating over the last few years with a rising trend. It has resulted in dire effects on employment opportunities, pricing, Gross Domestic Product, wages rates and interest rates (Marazzi & Sheets, 2007). Most recently in 2015, the KES was depreciated against USD with the highest rate of 106.035 on 07 September 2015, the highest rate ever witnessed in Kenya since independence (CBK, 2015). In 2011, Kenya experienced exchange rate overshooting from KES 83 to over KES 100 within a span of 6 months and it rose steadily to over KES 106 in September 2015. This shows a weakening shilling from 2007-2015.

Kenya has witnessed in recent years a continuous trend of unpredictable fluctuations of the Shillings. The currency fluctuations affect economic growth movement in the country by hindering firms from participating in investment, innovation and trade especially for exporting companies as compared to the domestic firms. The risk-averse investors involved in international trade may reduce their trading activities and investments in the event that the exchange rate fluctuations are not contained (Omojimitte & Akpokodje, 2010).

The exchange rate plays a vital role in the Kenyan economy since it participates in the stock market, foreign exchange market and also affects international trade i.e. export and import of goods and services. (Neiman, 2010) indicate that fluctuations affect the stock market depending on whether the currency appreciates or depreciates. The argument of is also supported by (Musyoki 2012) who states that the Kenyan financial market has been affected by the exchange rate volatilities in his study on the effects of real exchange rate volatility and misalignment on trade and investment in Kenya. In the event of a rise in value of its currency, there will be a reduction in the competitiveness of a country like Kenya, which is export oriented and hence having a negative impact on the stock market (Musyoki, 2012).

Exchange rate stability is one of the main factors that promote total investment, price stability and stable economic growth (Rehman, Adil & Anis, 2012). Volatility of the exchange rates could have a negative effect on trade and investment hence a country's international competitiveness will deteriorate. The exchange rates in Kenya have been fluctuating with the shilling depreciating between 2007- 2015. There has been a continuous trend of exchange rate fluctuations in the country and this is has translated into a high degree of uncertainty for the two main monetary policy objectives that policymakers often seek to achieve; price stability and economic growth (Reyes, 2007).

Statement of the Problem

Exchange rates, just like prices of commodities, keep shifting. Most recently in 2016, the KES depreciated against USD with the highest rate of 107.00, the highest rate ever witnessed in Kenya since independence (CBK, 2015). In 2011, Kenya experienced exchange rate

overshooting from KES 83 to over KES 100 within a span of 6 months and it rose steadily to over KES 106 in September 2015. Exchange rates play an increasingly significant role in any economy as they directly affect domestic price levels, profitability of traded goods and services, allocation of resources and investment decision (Omojimite & Akpokodje, 2010). The continuous trend of exchange rate fluctuations in the country has translated into a high degree of uncertainty for the two main monetary policy objectives that policymakers often seek to achieve; price stability and economic growth. For these reasons various studies have been done to evaluate the determinants of exchange rate volatility in an attempt to understand the contributing factors and the extent to which they affect exchange rate volatility (Musyoki, 2012).

Different research works done on the effects and the contributing factors to exchange rate volatility remain inconclusive. For instance (Neiman, 2010), ascertained that inflation and money supply contribute majorly to the volatility of exchange rates in Latin American countries. While (Marazzi & Sheets, 2007), established inflation rate as one of the most important determining factor while market interest rate was one of the least factors affecting the EUR/PLN exchange rate level. Hargreaves, & Watson (2011) established inflation rate and interest rate to affect the KES/USD exchange rate the most while other unexplained factors impacted the least between the years 2007 to 2012. Moreover, Grier & Mark (2010) suggested that more studies to be carried out on the relationship between the exchange rates and other factors in addition to interest rates and inflation rates. This shows that there is limited literature available to indicate the relationship between them. This study therefore fills the necessary gap of investigating the factors determining exchange rate volatility in Kenya by focusing on three variables namely Inflation, Interest rate and Remittances.

The study was guided by general and specific objectives as follows. The main objective of the study was to evaluate the factors affecting exchange rate volatility in Kenya. While the specific objectives were: To establish the effect of inflation rates on exchange rate volatility of Kenyan shilling against the US dollar; To find out the effect of interest rates on exchange rate volatility of Kenyan shilling against the US dollar; To ascertain the effect of remittances on exchange rate volatility of Kenyan shilling against the US dollar. The research questions were the following:

- i. How does inflation rates affect exchange rates volatility in Kenya?
- ii. How does interest rates on exchange rates volatility in Kenya?
- iii. How does remittances affect exchange rates volatility in Kenya?

Policy makers in the banking sector will find this study invaluable notably the Central Bank of Kenya and the Treasury in developing policies to manage exchange rates. This study will

enable the Central bank of Kenya Monetary Policy to establish sustainable and effective policies in curbing the exchange rate volatility that has been on a rising trend in Kenya.

This study will be valuable to practitioners, as it will help them better understand the dynamics of changes in exchange rate and the implications on financial performance. Practitioners will be able to identify research gaps and recommendations for further study of exchange rate volatility influence across other sectors of the economy.

This area of study will add to the pool of knowledge on the under researched area on determinants of exchange rate volatility in Kenya. Future researchers will have a reference point from the information gathered that will contribute to understanding the determinants of exchange rate volatility in Kenya. It forms a basis for and stimulates research in order to develop a better understanding of the determinants of exchange rate volatility in Kenya.

The study was limited to determinants of exchange rate volatility in Kenya. The objectives of the study are to determine the effects of inflation rates, interest rates, and remittances on Kenyan shilling exchange rates against the USD. The literature review provided the reader with an explanation of the theoretical rationale of the problem being studied as well as what research has already been done and how the findings relate to the problem at hand. The study used secondary data from central bank of Kenya.

Limitations of the Study

The study employed secondary data that may have been collected for other research thereby diluting the objectivity and consequently, the conclusions were arrived at from use of such data. Errors of omission and commission that are usually common in the financial statements were not ruled out. Such omissions may have unintentionally influenced the data collection process and hence the analysis.

LITERATURE REVIEW

Purchasing power parity (PPP)

This is an economic theory that states that the exchange rate between two currencies is equal to the ratio of the currencies' respective purchasing power. The idea originated with the School of Salamanca in the 16th century, and was developed in its modern form by Gustav Cassel in 1918. The concept is based on the law of one price, where in the absence of transaction costs and official trade barriers, identical goods will have the same price in different markets when the prices are expressed in the same currency (Babu, 2014).

Assuming non-existence of tariffs and other trade barriers and zero cost of transport, the law of one price, the simplest concept of purchasing power parity (PPP), states that identical

goods should cost the same in all nations (Rehman et al., 2012). Therefore, prices of goods sold in different countries, converted to a common currency, should be identical. The equilibrium price rate between two currencies, according to the purchase power parity theory, would be equal to the ratio of price levels in two countries. However, prices can be distorted by a range of factors, such as taxes, transport costs, labour laws, and trade barriers like tariffs. Based on PPP, the cross-country comparison of the exchange rates of currencies may be carried out using the Big Mac Index and CommSec iPod index (Babu, 2014). Exchange rate movements in the short term are news-driven. Announcements about interest rate changes, changes in perception of the growth path of economies and the like are all factors that drive exchange rates in the short run. Purchasing power parity, by comparison, describes the long run behaviour of exchange rates. The economic forces behind PPP will eventually equalize the purchasing power of currencies (Babu, 2014).

Fisher Effect theory

The Fisher effect is an economic theory proposed by economist Irving Fisher that describes the relationship between inflation and both real and nominal interest rates. The Fisher effect states that the real interest rate equals to the nominal interest rate minus the expected inflation rate. Therefore, real interest rates fall as inflation increases, unless nominal rates increase at the same rate as inflation (Vigfusson, 2009).

The Fisher effect equation reflects that the real interest rate can be taken by subtracting the expected inflation rate from the nominal interest rate. In this equation, all the provided rates are compounded (Neiman, 2010). Establishing a relationship between the inflation and interest rates, the Fisher Effect (FE) theory states that the nominal interest rate 'r' in a country is determined by the real interest rate 'R' and the expected inflation rate 'i'.

Real interest rate is used to assess exchange rate movements as it includes interest and inflation rates, both of which affect exchange rates. Given all other parameters constant, there is a high co-relation between differentials in real interest rate and the exchange rate of a currency. The International Fisher Effect (IFE) combines the PPP and the FE to determine the impact of relative changes in nominal interest rates among countries on their foreign exchange values. According to the PPP theory, the exchange rates will move to offset changes in inflation rate differentials. Thus, a rise in a country's inflation rate relative to other countries will be associated with a fall in its currency's exchange value (Vigfusson, 2009).

It would also be associated with a rise in the country's interest rate relative to foreign interest rates. A combination of these two conditions is known as the IFE, which states that the exchange rate movements are caused by interest rate differentials. If real interest rates are the

same across the country, any difference in nominal interest rates could be attributed to differences in expected inflation. Foreign currencies with relatively high interest rates will depreciate because the high nominal interest rates reflect expected inflation. The IFE explains that the interest rate differential between any two countries is an unbiased predictor of the future changes in the spot rate of exchange (Neiman, 2010).

In the Fisher effect, the nominal interest rate is the provided actual interest rate that reflects the monetary growth padded overtime to a particular amount of money or currency owed to a financial lender. Real interest rate is the amount that mirrors the purchasing power of the borrowed money as it grows overtime. The Fisher effect is more than just an equation: It shows how the money supply affects nominal interest rate and inflation rate as a tandem (Vigfusson, 2009).

Interest rate parity theory

Interest rate parity refers to a condition of equality between the rates of return on comparable assets between two countries. Investor behavior in asset markets that results in interest parity can also explain why the exchange rate may rise and fall in response to market changes. In other words, interest parity can be used to develop a model of exchange rate determination. This is known as the asset approach, or the interest rate parity model. The strictest version of uncovered interest parity supposes risk neutrality so that risk premiums should be identically zero, implying that a currency's expected appreciation should equal the current interest differential

Empirical Review

Vigfusson (2009) argues that maintaining appropriate and stable exchange rate volatility enables countries to explore their growth and development capacities. Excess exchange rate volatility has been identified to reduce the level of economic growth by creating business uncertainty, deteriorates competitiveness, lower productivity and profits as well as increasing domestic prices. This clearly has welfare implications and should be a policy concern. Changes in real exchange rate need to be guided by aligning exchange rate with fundamentals. This in effect maintains external competitiveness and domestic stability. In this study, we attempt to closely identify the causes of exchange rate volatility and the dynamic linkages between exchange rate volatility and economic growth in Ghana (Reyes, 2007).

Hargreaves & Watson (2011) examine the impact of volatility on trade and welfare in the context of both fixed and flexible exchange rate regimes. They employ the general equilibrium model on the assumption that uncertainty arises only from monetary and fiscal policy. An

interesting finding from their study show that the monetary stimulus in a country that causes depreciation of its currency may not have much impact on its trade as depreciation of the exchange rate on one hand reduces imports but on the other hand, the increase in domestic demand relating to the monetary stimulus may increase imports in the same magnitude.

Marazzi & Sheets (2007) examined the impact of real exchange rate volatility on long-run economic growth for advanced and emerging economies over the period 1970–2009 and found that, high (low) exchange rate volatility positively (negatively) affects real GDP growth rate. However, controlling for exchange rate volatility in a model containing levels of exchange rate and exchange rate misalignment renders the variables insignificant suggesting that exchange rate stability is more crucial in propelling long-run growth than exchange rate misalignment. However, while finding no significant link between exchange rate volatility and long-run productivity growth, Neiman (2010) recent study reveal nonlinearities between real exchange rate volatility and output volatility among emerging market economies. Their finding suggests that real exchange rate volatility aids in absorbing shock as well as limit output volatility but too much of volatility in exchange rate increases output volatility.

Draz & Ahmad (2015) examined the role of financial development on the exchange rate volatility–productivity growth nexus exploiting panel data for 83 countries over 1960–2000. The authors argue that higher levels of exchange rate volatility adversely affect growth especially in economies with thin capital markets. They show that this effect is consistent with a model where real exchange rate uncertainty thwarts investment especially when agents are more credit constrained. It is reasonable to think that firms in higher income economies are more likely to internalise exchange rate fluctuations by effectively hedging against exchange rate risk. Alam & Taib (2013) argued that flexible exchange rate regimes neutralize the effects of terms of trade shocks on growth. Aghion et al (2009) however notes that even though exchange rate flexibility absorbs the effects of terms of trade shocks, its overall impact on growth is negative only for countries with less financial development. Burstein et al., (2007) further examined the threshold effect in 15 sub-Saharan African countries and found that, volatility in exchange rate is deleterious to growth only when the ratio of domestic credit to GDP falls below 57%.

Gust et al., (2010) investigated the effects of exchange rate volatility on output growth and inflation in the West African Monetary Zone (consisting of Ghana, The Gambia, Guinea, Liberia, Nigeria and Sierra Leone) following exchange rate regime shift. Results from their study reveal that while exchange rate volatility is inflationary across all the countries, its effect on output growth differ. Specifically, volatility and depreciation in particular negatively affects real GDP growth in Liberia and Sierra Leone but positively impacts on output in the other countries

albeit weakly. The difference in direction and magnitude of effect is not far-fetched from the differences in macroeconomic conditions prevailing in each country.

According to Omojimite & Akpokodje (2010) inflation is the rate at which the general level of prices for goods and services is rising, and, subsequently, purchasing power is falling. Central banks attempt to stop severe inflation, along with severe deflation, in an attempt to keep the excessive growth of prices to a minimum. High inflation levels in many developing countries have been a cause for concern to their central banks. This has led to the adoption of monetary policy frameworks such as inflation targeting to help lower inflation to more sustainable levels. The determinants of inflation are important factors to consider when looking at the different monetary policy frameworks to adopt. One of the major determinants of inflation is exchange rate movements and the degree of sensitivity of domestic prices to these movements.

Exchange rate movements can influence domestic prices via their effect on aggregate supply and demand. On the supply side, exchange rates could affect prices paid by the domestic buyers of imported goods directly (Rehman, Adil & Anis, 2012). In an open small economy (an international price taker), when the currency depreciates it will result in higher import prices and vice versa. Exchange rate fluctuations could have an indirect supply effect on domestic prices. The potentially higher cost of imported inputs associated with an exchange rate depreciation increases marginal cost and leads to higher prices of domestically produced goods. Further import-competing firms might increase prices in response to an increase in foreign competitor price in order to improve profit margins (Reyes, 2007).

Vigfusson et al., (2009) also developed a model with both monetarist and structuralism features. In their model, fiscal deficit was considered as the original force and the propagating mechanism in the inflationary process. One argument put up by structuralisms in their theory of inflation is that, deficit financing by the banking sector is inflationary. Fida, (2012) developed a detailed econometric model of inflation for Zimbabwe. In their model, both structuralisms and monetary factors of inflation were included. In the study, they showed that nominal monetary growth, foreign prices, exchange and interest rates, unit labour costs and real income are the determinants of inflation in Zimbabwe.

As a general rule, a country with a consistently lower inflation rate exhibits a rising currency value, as its purchasing power increases relative to other currencies. During the last half of the twentieth century, the countries with low inflation included Japan, Germany and Switzerland, while the U.S. and Canada achieved low inflation only later. Musyoki et al., (2012) did a study on an assessment of the casual relationship between inflation rates and foreign exchange rates. Those countries with higher inflation typically see depreciation in their currency in relation to the currencies of their trading partners.

Grier & Mark (2010) conducted a research on the effect of exchange rate volatility on inflation in Uganda during the period 1988- 89. His work revealed that rapid monetary expansion and the depreciation of parallel exchange rate were the principal determinants of inflation in Uganda. Corsetti et al., (2008) on the other hand adopted Granger and Pierce causality test in order to establish the role of domestic money supply on inflation in six African countries. Evidence from the study indicated a unit-directional causality from monetary growth to inflation. Basirat (2014) using Australian exchange rate data found that unexpected current account deficit is associated with exchange rate depreciation, and a rise in interest rates. Evidence is found that current account deficits diminishes domestic wealth, and may lead to overshooting of exchange rates.

In recent years, there has been a special interest in the link between exchange rates and interest rates in both advanced and developing countries. This is understandable, given the important role these variables play in determining developments in the nominal and real sides of the economy, including the behaviour of domestic inflation, real output, exports and imports (Babu., 2014). Among emerging market economies (EME), this interest is further spurred by the fact that many of them have recently introduced changes in their monetary and exchange rate policies, moving to inflation targeting frameworks which operate economically under flexible exchange rate regime (Alam & Taib, 2013).

Gust et al., (2010) studied the relationship between money, output and stock prices in Malaysia. They employed co integration test on data from January 1978 to September 1992. Six different indices of stock exchange were tested by using money supply (both M1 and M2) and GDP as a proxy of output. They concluded that Malaysian stock market is informationally efficient with respect to both these variables.

Grier & Mark (2010) analyzed interest rate sensitivity to stocks in UAE. Data covering a period of January 1990 to December 1994 are analyzed. Simple OLS technique was adopted. Results showed that interest rate fluctuations have a significant and negative effect on the stocks of banking sector. Furthermore, even in absence of an official stock market, investors in UAE do take in to consideration the interest rate factor while dealing in stocks.

Marazzi & Sheets (2007) investigated the long run relation between macroeconomic variables and KSE index. Quarterly data covering a period of 1973- 2004 are used. Industrial production index, inflation, broad money, value of an investment earning and money market rate are tested with error correction model and Granger causality technique. The cointegration results indicate a long term relation among these variables. It is further concluded that industrial production and inflation are the largest positive and negative determinants respectively. There also existed a casual relation between stock market and interest rate.

Dufour et al., (2010) analyzed the impact of interest rates and exchange rate on volatility of different sectors (financial, industrial, services and technology) and composite indices in Istanbul stock exchange. Daily data covering a period within interval 2001-2008 was analyzed using GARCH model. Results show strong power of prediction of the two variables on the volatility of the composite index. Specifically exchange rate changes are strongly predictive for all the indices except technology index. Moreover interest rate volatility showed significant positive relationship with all indices except services sector, which shows a negative relationship. It is suggested that investors should follow the monetary policies in order to effectively manage risk while taking investment decision in these sectors.

Fida (2012) analyzed the effect of exchange rate fluctuations and their impact on the Ghana stock exchange. The monthly data covered period of 1951:1 – 2005:6. EGARCH model is used to determine and forecast the variance. It is concluded that volatility in stock return is not the sole result of exchange rate volatility, but it is also affected by other macroeconomic factors. Furthermore, results also showed an inverse relationship between exchange rate volatility and stock market returns. It is recommended that measure should be taken to ensure stable macroeconomic environment, for better investor inflow and informed and decision making for future investment.

It is often argued that many economies are affected by conditions in foreign countries. Grier & Mark (2010) explored the connection between interest rates in 20 major industrial countries and annual real output growth in other countries. The results show that high foreign interest rates have a contractionary effect on annual real GDP growth in the domestic economy, but that this effect is centered on countries with fixed exchange rates. The study then examines the potential channels through which major-country interest rates affect other economies. The effect of foreign interest rates on domestic interest rates is the most likely channel when compared with other possibilities, such as a trade effect.

Remittance means the transfer of funds from international migrants to their family members in their home country. It is different from other external capital inflow like foreign direct investment, foreign loans and aids. It is the largest source of foreign exchange earnings for developing countries (Grier & Mark, 2010).

Informal remittances are defined as all types of money transfers that do not involve formal contracts and therefore are unlikely to be recorded in national accounts. Such transfers are usually made via personal relationships through business people, friends, relatives or oneself, personal couriers and/or returnee migrants. Formal migrant remittances include transfer services offered by banks, post offices, non-bank financial institutions and money transfer

operators, such as Western Union and MoneyGram. The sheer size of migrant remittances indicates that they are economically very important to many countries.

Many developing countries have experienced tremendous surge in the inflow of remittances in past two decades. They export labor to generate remittances. Foreign remittances are the source of poverty reduction, better health care and education. Remittances are the main source of increasing investment and consumption in recipient countries (Fida, 2012).

The increase in investment and consumption is the sign of economic development. Remittances support in poverty reduction. These flow to neediest group of the population. In this way remittances directly contribute in poverty reduction (Alam & Taib, 2013). These draw positive effect even fully consumed as these are better for the welfare of the society. Remittances can contribute to higher investment in human and physical capital. But if remittances are used for consumption not for investment as is the nature of the developing countries then these can be harmful, as they fail to create enough savings that are necessary for economic growth (Babu, 2014).

Hargreaves & Watson (2011) investigates the impact of foreign remittances on economic growth of Pakistan. They used secondary time series data for the period of 1978 to 2011. The multiple regression analysis is used to identify the relationship among the variables. GDP is taken as dependent variable while foreign remittances, FDI, inflation and exchange rate as independent variables. Augmented Dickey Fuller (ADF) test is used to check the stationarity of variables and all variables found stationary at level. Ordinary Least Squares technique is applied to check the relation among these variables. Results indicate that foreign remittances have positive and significant relation with GDP of Pakistan while inflation and exchange rate has negative effect on economic growth. Foreign direct investment has positive but insignificant relation with GDP of Pakistan. One percent increase in foreign remittances will raise GDP by 0.25 percent. The model is free from heteroskedasticity and autocorrelation with satisfactory functional form that suggests the stability of our model. The CUSUM and CUSUMSQ are showing that the model is structurally stable within the 5% of critical bounds. Pakistan needs stable and visionary government to enhance foreign capital inflow to boost investment and economic growth.

Neiman (2010) investigated the determinants of remittances to 9 Latin American countries. In addition, it analyzes the effects of exchange rate uncertainty and political risk in affecting remittances inflows into the region. The empirical evidence from this study shows that for the period of 1986-2005, variables such as exchange rate uncertainty and political risk were important determinants of remittances into the selected Latin American countries. Based on the

findings of this paper, we can say that governments of the remittance receiving countries can influence the inflow of remittances by means of adopting appropriate macroeconomic policies and improving their political environments.

Grier & Mark (2010) examined the long-run relationship between remittances and the real exchange rate for less developed countries using a panel cointegration approach. They employ an innovative method for the measurement of the multilateral real effective exchange rate and they focus on high remittance economies. They found a small inelastic, but significant, long-run relationship which confirms a “Dutch disease” type effect. Short-run confirmation is given by a panel error correction model. Potential asymmetries in this relationship are explored using quantile regression analysis.

For many years ,workers’ remittances have grown to become a significant source of foreign exchange in many developing countries, however, workers’ remittances has not been given a big recognition as a source of economic growth in developing countries especially when considering that remittances in Kenya continued to show an upward trend in the past (Musyoki, 2012). Therefore, this paper investigates the factors determining exchange rate volatility by focusing on three important variables namely; interest rates, inflation and Remittances.

This chapter discusses the literature review of the study; the empirical review explains the past studies previously undertaken on the determinants of exchange rate volatility in Kenya. The theoretical review discusses the major past activities that addressed the variables stated by the study objectives, this made the study to explore widely on the past efforts that have been undertaken on the determinants of exchange rate volatility in Kenya. Critical analysis was made and gaps discussed.

The past researchers demonstrated an effort towards addressing the determinants of exchange rate volatility in Kenya, though different researchers with different views, an effective conclusion, conducted research on this topic was not arrived at, their studies involved suggestions and assumptions, which could not be relied upon in times of assessing the determinants of exchange rate volatility in Kenya. Furthermore, the past studies have mainly focused on Inflation, exchange rates and money supply. Therefore, this study focused on a third important factor, Remittances in an attempt to bring out new evidence on the factors that affect exchange rate volatility in Kenya.

METHODOLOGY

The research design adopted was a descriptive research design that ensured collection and descriptive analysis of data from the population of study. A descriptive design is defined by Peil, (2005) as a Research design that determines and reports the way things are and attempts to

describe such things as possible behavior, attitudes, values and characteristics. A descriptive design was adopted for this research. Zikmund (2010) defines a descriptive design as an intensive study of a single unit with an aim to generalize across larger sets of units. The researcher therefore considered the descriptive design study to be appropriate for the study. The research design enabled the researcher to bring out the determinants of exchange rate volatility in Kenya.

The population of this study focused on economic indicators from Central bank of Kenya. The research used information from secondary data and in particular, the following data was used; Interest rates, Inflation rates and diaspora remittances for each quarter from the period 2004 to 2019. The study used CBK as a data source in the pursuit to establish the effects of Interest rate, Inflation rate and remittances on exchange rate volatility of Kenyan shilling relation to USD.

Since the researcher used secondary data, the researcher got the information on inflation rates, interest rates, remittances and Exchange rates volatility from CBK website. The study covered the period between 2004 to the year 2019. The choice of the period of study was influenced by the fact that the Kenyan economy experienced major reforms under Kibaki and Uhuru's regime. The Economy opened up to the world and reforms in various sectors such as debt management, Kenya Revenue Authority (KRA), financial laws on banking sector were tremendous. This was seen as period where important macro-economic factors like exchange rates and their effects could be studied for better decision making.

Data was then analyzed by using regression analysis using E-views software. Descriptive statistics, which was presented using, mean, median, standard deviation, skewness and kurtosis. The study used GARCH model, which was presented as follows;

Dependent Variable: DLNER

Dependent Variable: DLNER

Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)

Coefficient covariance computed using outer product of gradients

Presample variance: backcast (parameter = 0.7)

GARCH = $C(5) \cdot \text{RESID}(-1)^2 + (1 - C(5)) \cdot \text{GARCH}(-1)$

A unit root test tests whether a time series variable is non-stationary and possesses a unit root. Unit root test showed there exist unit root for exchange rates, interest rates and remittances. In order to check for stationarity of the data, the study employed Augmented Dickey Fuller unit root

test (ADF); this was chosen because it is not affected by autocorrelation. If the data was found to contain unit root and require first difference in order to be stationary, then the variable in question might be deemed to have a long run relationship with the dependent variable and may therefore require a co-integration test to be conducted.

ARCH-LM test is the standard approach to detect autoregressive conditional heteroscedasticity. The actual statistical size of the ARCH-LM test is generally less than its nominal size in finite samples. This implies that the nominal size of the test tends to overestimate the true probability of a type-1 error in finite samples. Consequently, if this is the case, there should be a good potential to adjust the statistical size of the original ARCH-LM test to increase the statistical power of this test. Homoscedasticity was conducted and the f-statistic was 0.853 with a p-value greater than 0.05. Therefore, there was homoscedasticity.

The researcher performed test of multi collinearity by checking the correlation between the variables. If the results indicated that the correlation between the independent variables was less than 0.3, it was inferred that the expected model is devoid of multicollinearity. This means that none of the variable involved in this study, is correlated with another and hence we confidently concluded that there is no multicollinearity.

FINDINGS AND DISCUSSION

Descriptive Statistics

Table 1 Descriptive Statistics

	Exchange Rate	Interest Rates	Inflation	Remittance
Mean	85.83471	2.319917	7.948333	157013.8
Median	84.44184	0.666667	6.640000	87905.17
Maximum	103.4910	8.030000	19.18667	783869.8
Minimum	62.64600	0.250000	2.626667	26608.67
Std. Dev.	12.28724	2.651535	4.358379	206943.5
Skewness	0.079227	0.955199	1.189984	2.115535
Kurtosis	1.771581	2.426817	3.299432	5.870984
Jarque-Bera	4.090987	10.60842	15.34375	69.71869
Probability	0.129316	0.004971	0.000466	0.000000
Sum	5493.421	148.4747	508.6933	10048884
Sum Sq. Dev.	9511.508	442.9301	1196.715	2.70E+12
Observations	64	64	64	64

Table 1 presents the descriptive statistics for all the individual variables in real terms. The makes it necessary to confirm the normality characteristics of the variables using the Jarque-Bera statistic. The jarque-bera statistics and their (p-value) are given as 4.090987 (0.129316), 10.60842(0.004971), 15.34375 (0.000466) and 69.71869 (0.00000) for variables Exchange rate, Inflation, Interest rate and Remittances respectively. Only exchange rate is normally distributed at least at 10 % significance level. We normalize the data by transforming them into logarithm form.

The mean and the median values of exchange rates seem to be very close which portrays a high level of normality Likewise to the mean and media values of inflation rate. The mean values for variables Exchange rate, Inflation, Interest rate and Remittances were 85.83471, 2.319917, 7.948333 and 157013.8 respectively while the Median values were 84.44184, 0.666667, 6.640000 and 87905.17 respectively. This was done by checking skewness, kurtosis, and Jacque-Bera statistics. The JB test of normality is a test of the joint hypothesis that S and K are 0 and 3, respectively. The Jarque-Bera statistic is compared by using the p-values give in brackets in table above.

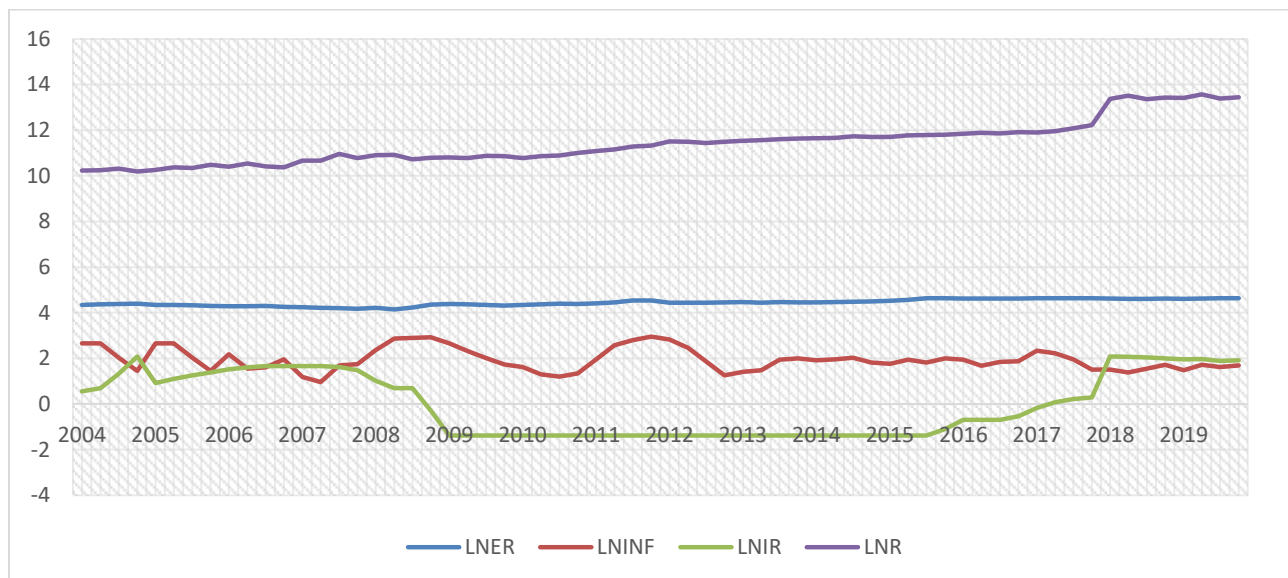


Figure 1 The variables in natural logs

For clarity and because of big numbers, the data has been graphed in its natural logs. As shown in figure 1, though out from the years 2004 to the year 2019 there is a mild long term increasing trend in the Kenya's exchange rate but shows low volatility except in the years 2008, 2011 and in 2015. Interest rate portrays a stationary characteristic but high volatility rate. Inflation and exchange rates seem to be stationary while diaspora remittance are trending upwards. Inflation

in Kenya has been constant since 2008 which shows that the Kenya monetary policy has been adequate. Remittance seems consistently increasing while also showing low volatility.

Unit Root Test

Time series data is often known to have problems with non-stationarity. It is important to determine whether a series is stationary (do not contain a unit root) or not stationary (contains a unit root) before using it. One can obtain a high R^2 with non-stationary data even though there is no meaningful relation between variables, otherwise known as a spurious regression between unrelated variables. Therefore, before testing for the existence of cointegration among the variables of interest in the study, unit root tests were carried out using Augmented Dickey-Fuller test.

Table 2 Unit Root Test

Variable	Augmented Dickey-Fuller test statistic	p-values	1 % sig level	5% sig level	10% sig level
LNER	-3.062822	0.1243	-4.113017	-3.483970	-3.170071
LNER at 1 st deference	-6.542749	0.0000	-3.540198	-2.909206	-2.592215
LNINF	-4.351037	0.0009	-3.544063	-2.910860	-2.593090
LNIR	-0.880823	0.7880	-3.54198	-2.909206	-2.592215
LNIR at 1 st deference	-6.717706	0.0000	-3.54198	-2.909206	-2.592215
LNR	0.339973	0.9786	-3.53062	-2.908420	-2.591799
LNR at 1 st deference	-7.860488	0.0000	-3.540148	-2.909206	-2.592215

The table 2 gives a summarized output of the augmented dickey-fuller tests for each of the variables under study. By comparing the absolute figures of augmented dickey-fuller and corresponding test statistics, it can be checked whether a variable under study has unit root or not, with 95% confidence level. LNER has a unit root since the absolute value of Augmented Dickey-Fuller test statistic value is 3.062822, which is less than 3.48, and has p-value of 0.12, which is greater than the 0.05 significance level. However, the unit root disappears at first differencing with ADF statistic of 6.542, which is greater than 2.90 at 0.05 significance level with a p-value of 0.0000.

LNINF has no unit root since the absolute value of Augmented Dickey-Fuller test statistic value is 4.35, which is greater than 2.91, and has p-value of 0.0009, which is less than 0.05 SL. LNR has a unit root since the absolute value of Augmented Dickey-Fuller test statistic value is 0.34, which is, less than 2.91, and has p-value of 0.98, which is greater than 0.05SL. However, the unit root disappears at first differencing with ADF of 7.86, which is greater than 2.91 at 0.05 significance level with a p-value of 0.0000.

Unit root is present in three of the variables. Inflation has no unit root while the rest (exchange rate interest rates and remittances) show presence of unit root. This being cleared provided a go-ahead to proceed in performing GARCH using the maximum eigenvalue likelihood ratio test statistic. The presence of unit root in the manner provided by the results demands the data on exchange rate, interest rate and diaspora remittances should be differenced accordingly before analysis.

Correlation and covariance Analysis

Table 2 Correlation and covariance table

	<i>LNER</i>	<i>LNINF</i>	<i>LNIR</i>	<i>LNR</i>
<i>LNER</i>	1			
<i>LNINF</i>	-0.1394	1		
<i>LNIR</i>	-0.14149	-0.19427	1	
<i>LNR</i>	0.800815	-0.28379	0.145305	1

The table above gives the correlation between the variables. The results indicate that the correlation between the independent variables was less than 0.3. Based on the figure summarized in the table, it was inferred that the expected model is devoid of multicollinearity. This means that none of the variable involved in this study, is correlated with another and hence we can confidently say that there is no multicollinearity. Therefore, there was no multicollinearity among the independent variables was present allowing for the model estimation and therefore there is no reason to invalidate the regression results.

Garch Estimation

Dependent Variable: DLNER

Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)

Date: 04/28/20 Time: 14:25

Sample (adjusted): 2004Q2 2019Q4

Included observations: 63 after adjustments

Coefficient covariance computed using outer product of gradients

Presample variance: backcast (parameter = 0.7)

GARCH = $C(5) \cdot \text{RESID}(-1)^2 + (1 - C(5)) \cdot \text{GARCH}(-1)$

Table 3 GARCH Model

Variable	Coefficient	Std. Error	z-Statistic	Prob.
LNINF	0.020419	0.003318	6.154026	0.0000
DLNIR	-0.035201	0.004253	-8.277008	0.0000
DLNR	0.041894	0.010830	3.868185	0.0001
C	-0.033958	0.009080	-3.739837	0.0002
Variance Equation				
RESID(-1)^2	-0.122225	0.006803	-17.96654	0.0000
GARCH(-1)	1.122225	0.006803	164.9620	0.0000
R-squared	0.196936	Mean dependent var		0.004616
Adjusted R-squared	0.134746	S.D. dependent var		0.034745
S.E. of regression	0.037978	Akaike info criterion		-4.386728
Sum squared resid	0.085097	Schwarz criterion		-4.216637
Log likelihood	143.1819	Hannan-Quinn criter.		-4.319830
Durbin-Watson stat	1.848096			

From the table above, it can be clearly concluded that all the model parameters are significant at least at 95 percent confidence level. The R^2 and the adjusted R^2 of the model were 0.197 and 0.135, which means that 19.7% percent of the movements have been explained by the model. The other part could be as a result of other factor such as the socioeconomic factor, risk factors etc. Any increase in the exchange rate volatility in Kenyan economy is influenced by interest rate, inflation rate and Remittances by 19.7 %. The GARCH equation is given as

$$\text{GARCH} = C(5) * \text{RESID}(-1)^2 + (1 - C(5)) * \text{GARCH}(-1)$$

The coefficient C(5) indicates the impact of long term volatility or the persistence of the last volatility. The GARCH coefficient is significant with p value of 0.00. Also all the variable used were significant.

Diagnostic Checks

ARCH LM Test

A combined Lagrange multiplier (LM) test for autoregressive conditional heteroskedastic (ARCH) errors in vector autoregressive (VAR) models is proposed by replacing an exact Monte Carlo (MC) test by a bootstrap MC test when the model includes lags. The test circumvents the problem of high dimensionality in multivariate tests for ARCH in VAR models. This is the most suitable test for this model.

Table 4 Heteroskedasticity Test: ARCH

F-statistic	0.043789	Prob. F(1,60)	0.8350
Obs*R-squared	0.045216	Prob. Chi-Square(1)	0.8316

The null hypothesis for the test was that “there is homoscedasticity” in the model presented. The result gave an F-statistic of 0.043789 with a p value 0.8350. The P-value is higher than 0.05 hence means we fail to reject the null hypothesis and conclude that there is no heteroscedasticity.

Residuals normality

A good model does not violate the normal distribution of the error term.

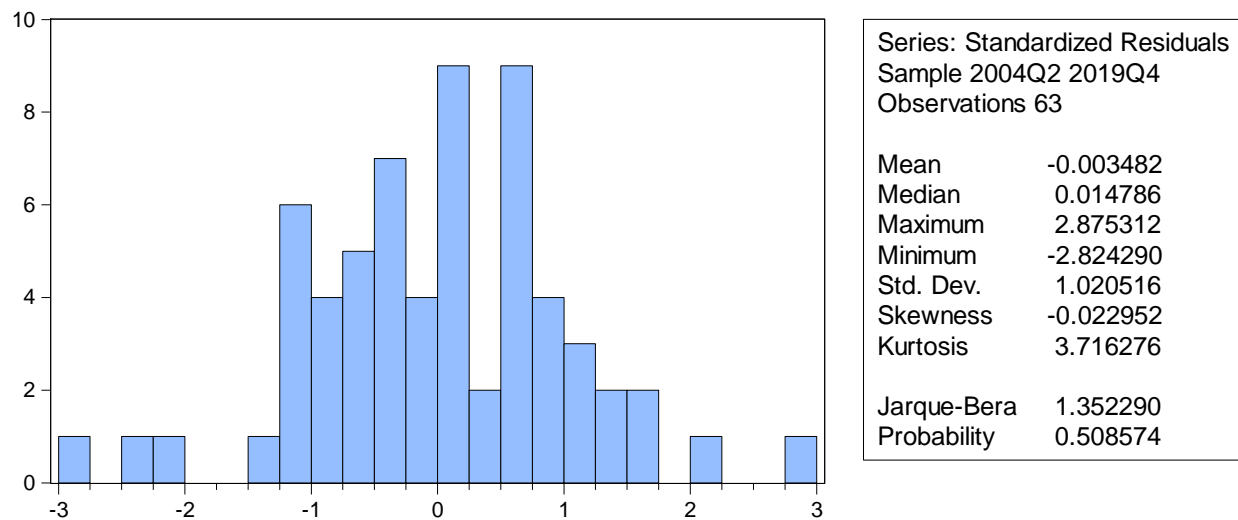


Figure 2 Residuals normality

The residuals give a Jarque-Bera statistic of 1.35 with a p-value of 0.53. The figure above shows that the residuals are normally distributed.

Hypotheses test results

The coefficient of interest rate was -0.035201, which was significant with p-value of 0.0000. One percent increase in interest rate decreases exchange rate volatility by 3.52 %. The coefficient is significant with p-value of 0.00. This means that a one percent increase in interest rate causes 3.52% decrease in exchange rate volatility. The findings were similar to those of Alam & Taib, (2013).Alam & Taib, (2013) and Dufour et al., (2010) who found out that exchange rate volatility

is determent largely by the interest rate volatility. The study is also consistent with that of Mbaya (2013), who explored the impact of interest on Exchange in Kenya. He revealed that interest rates had a positive relationship with exchange rates. Obura and Anyango (2015), however, found out that interest rates had a moderating effect on exchange rates volatility.

The study found that inflation rate is a significant determinant of exchange rate volatility. It had a coefficient of 0.02 with a p value of 0.00. This to some extent relate with the findings of Rehman, Adil & Anis, (2012) who found that exchange rates affects prices paid by the domestic buyers of imported goods directly. The findings are in contrast with that of Abass Iqbal and Ayaz (2012) who focused on 10 countries to examine the relationship between Exchange rates, inflation rates and GDP. Their study revealed that GDP had a valuable connection with exchange rates while inflation did not.

TThis study found that remittances is also a significant determinant of enhance rate volatility. This result aligns well with Grier & Mark (2010) and contradicts with that of Izquardo and Montel (2006) who carried out a study on six south American countries and concluded that Remittances induced currency depreciation in some countries while in some other countries it induced currency appreciation. In the real sense, it is undoubtable that there is a long run relationship between diaspora remittances and exchange rate volatility.

SUMMARY

This study sought to establish the determinant of exchange rate volatility in Kenya the time series data from 2004 to 2019 in quarterly basis. This chapter reviews that findings of the study and presents a summary of key findings, conclusions and the necessary recommendations in line with the objectives and research hypotheses of the study. Policy recommendations based on the conclusions drawn are provided. Finally, areas for further study are given.

The study found out that interest rate was a significant determinant of exchange rate volatility. The coefficient of interest rate was -0.035201, which was significant with p-value of 0.0000. One percent increase in interest rate decreases exchange rate volatility by 3.52 %. The coefficient is significant with p-value of 0.00. This means that a one percent increase in interest rate causes 3.52% decrease in exchange rate volatility. The findings were similar to those of Alam & Taib, (2013).Alam & Taib, (2013) and Dufour et al., (2010) who found out that exchange rate volatility is determent largely by the interest rate volatility. The study is also consistent with that of Mbaya (2013), who explored the impact of interest on Exchange in Kenya. He revealed that interest rates had a positive relationship with exchange rates. Obura and Anyango (2015), however, found out that interest rates had a moderating effect on exchange rates volatility.

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CONCLUSION

The aim of this study was to bring to out the factors affecting exchange rate volatility of Kenyan shilling relative to the USD in Kenya for the period between 2004 to 2019. The independent variables were interest rate, inflation, and remittances whose data were sourced from the CBK. The study found out that all the variables were significant predictors of exchange rate volatility. The study found out that an increase in interest rate decreases exchange rate volatility. This is in line with the concept of Interest rate parity (IRP) theory. This evidence of interest rate significantly predicting exchange rate volatility in Kenya confirms the initial hypothesized relationship for the study while also maintaining the relevance of IRP. An increase in interest rate attracts foreign investors into a country, therefore increases the supply of the foreign currency, in this case US dollars, and thus stabilizes the exchange rate. This therefore places a critical emphasis on the need for the existence of efficient money market and capital markets to support both local and foreign investment into the country. The study also found that Inflation is a significant determinant of exchange rate volatility in Kenya. An increase in inflation rate increases the exchange rate volatility and this is in line with the Purchasing power parity theory (PPP). This was in line with initially-hypothesized relationship where higher inflation rates would potentially increase exchange rate volatility. The policy makers should monitor inflation levels in order to achieve stability in exchange rate. The study also found that remittances are a significant determinant of exchange rate volatility. This was in line with the hypothesized relationship where higher remittances rates would potentially increase exchange rate volatility.

RECOMMENDATIONS

Based on the study findings, below are some of the recommendations that will be beneficial to the government and other the stakeholders. These include- The macro-economic factors (Interest rate, inflation rate and remittances) are significant factors affecting exchange rate volatility. This therefore places a critical emphasis on the need for the policy makers to establish the extent to which these macro-economic variables affect exchange rate dynamics and stability in order to construct sound monetary policies for the Kenyan economy.

Remittances being the largest determinant of exchange rate volatility, this shows the significant role played by remittances in stabilizing exchange rate volatility. The policy makers should take keen interest in tracking the trends in diaspora remittances and educate its citizens on the importance of remittances in managing the exchange rate stability.

AREAS FOR FURTHER RESEARCH

The main aim of this study was to bring out the determinants of exchange rate volatility in Kenya. With the study's limited, its scope to three key determinates interest rates; inflation and remittances that explained 19.69% of the variations in exchange rate volatility, it is important to recognize that a universe of potential determinants were left of which some of them are socioeconomic in nature. More needs to be done especially also on the areas such as causality and correlation of the economic variables. Potential factors such as Public debts should be considered in future studies.

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