

## IS THERE A RELATIONSHIP BETWEEN INFLATION VOLATILITY AND EXCHANGE RATE FLUCTUATION? THE EXTENT TO WHICH THE PURCHASING POWER PARITY THEORY HOLDS IN THE KENYA CONTEXT

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### Abstract

Foreign exchange rate is one of the main macroeconomic variables that affect the economy of a country. Exchange rate affects the level of investment in a country, price stability and the balance of trade. Various macroeconomic factors have been identified by various authors as contributing to fluctuation in exchange rate. This includes among others relative inflation, interest rates, income levels, government interventions and market expectations. The aim of this study was to investigate the relationship between inflation volatility and exchange rate fluctuation in Kenya. The study relied on the hypothesis of purchasing power parity theory of existence of a negative relationship between inflation and exchange rate movement. The research aimed at establishing the extent to which the Purchasing Power Parity (PPP) theory holds in Kenya. The research was for a period of nine years from January 2005 up to December 2013. Secondary data for exchange rate movement were obtained from the Central Bank of Kenya while data for inflation was obtained from the Kenya National Bureau of Statistics. This two are government institutions and therefore the credibility of data was assured. Regression analysis was applied to analyze the data in order to establish the relationship that exists between the two variables. The result from data analysis indicates the existence of a moderate negative relationship between movement in inflation and exchange rate volatility. This finding therefore supports the existence of PPP concept in Kenya during the period of study. The finding also indicates other factors also greatly influence movement in exchange rate and therefore inflation cannot be relied up on as the sole factor determining exchange rate.

**Key words:** Inflation Volatility, Exchange Rate Fluctuation, PPP Theory & Kenya.



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## Introduction

The relationship between prices and exchange rates is one of the classic topics studied in international macroeconomics. This relation is of interest both from a positive and normative perspective. One basic hypothesis connecting prices and exchange rates is that of relative purchasing power parity (PPP) which proposes that changes in prices of goods should be the same across locations when converted into a common currency. Deviations in relative PPP can arise because of differences in the cost of supplying the goods to different locations or because firms price discriminate across locations by charging different mark-ups (Burstein et al, 2013).

Exchange rate and monetary policies are also key tools in economic management and in the stabilization and adjustment process in developing countries, where low inflation and international competitiveness have become major policy targets. The real exchange rate is a measure of international competitiveness. Inflation mostly emanates from monetary expansion, currency devaluation and other structural factors (Ndung'u, 2000). As suggested by Danjuma (2013), exchange rate is one of the most important determinants of a country's relative level of economic health. Changes in exchange rates have powerful effects on the terms of trade of countries concerned through effects on relative prices of goods and services. Exchange rates determine the prices of imported goods relative to domestic goods. Similarly, they determine the competitiveness of domestic goods in the international market. The importance of exchange rates in determining the balance of trade cannot be overemphasized and this makes policy makers worry about the behavior of both nominal and real exchange rates and also have active interest in their determination.

Review of empirical studies also shows that inflation is one of the major factors affecting foreign exchange rates. The more open the economy, the greater the importance of the exchange rate in the policy process. It is generally expected that all other factors remaining the same, when inflation in a country increases, its products become expensive in the international market leading to reduced demand for the local currency. Imports become cheap and demand for foreign currencies increase. Both of these forces place a downward pressure on the high inflation country's currency (Case et al, 2009).

Over the recent years, Kenya has experienced a rapid increase in prices of consumer goods. Statistics from the KNBS indicate a continuous fluctuation in inflation reaching a high of 46% in 1993 and a low of 1.6% in 1995. Indeed, the annual inflationary rate in Kenya has been above 10% for most of the years since the year 2000. The recent surge in inflation in Kenya can be attributed to various factors ranging from macroeconomic imbalances to supply-side constraints and external pressures factors. Empirical studies have arrived at varied conclusions on the causes of inflation in Kenya. Duravall & Ndung'u (1999) in the study on dynamics of inflation in Kenya found that Exchange rate, foreign prices and terms of trade have long-run effects on inflation, while money supply and interest rates only have short-run effects. They also established that the dynamics of inflation are also influenced by food supply constraints. Similarly, Duravall et al (2012) showed that excess money supply, exchange rates, food and non-food world prices, world energy prices and domestic agricultural supply shocks are the main causes of inflation in Kenya. Kenya's exchange rate policy has undergone various regime shifts over the years, largely driven by economic events, especially balance of payments crises. A fixed exchange rate was maintained in the 1960s and 1970s, with the currency becoming over-valued, though not extremely so. Exchange controls were maintained from the early 1970s until a market-determined regime was adopted in the 1990s (Ndung'u, 2000).

Exchange rate regimes in Kenya have been influenced through historical government macroeconomic policy from fixed exchange rate regimes to pegged and later floating through liberalization in the nineties. Since then, the exchange rates have been characterized by significant fluctuations. For instance, data from CBK shows that the exchange rate of Kenya Shillings per USD in December 2004 was Kshs. 77.34 per USD. In October 2011, the shilling had depreciated and was

exchanging at the rate of Kshs. 105.961 per USD. However, the shilling started to strengthen again and by December 2013, the exchange rate was Kshs. 86.3097 per USD (Data from CBK website).

### *Theoretical Literature Review*

This review demonstrates that each theory holds at a particular time in a particular setting and explains some economic fundamental such as inflation, interest rate, government policy and future expectations. The earliest theory explaining the relationship between exchange rate and inflation is the purchasing power parity theory. According to PPP theory, inflation rates vary among countries, causing international trade patterns and exchange rates to adjust accordingly. When a country's inflation rates rises the demand for its currency declines as its exports decline due to their high prices. In addition, consumers and firms in that country tend to increase their imports. The theory bases its predictions of exchange rate movement on changing patterns of trade due to different inflation rates between countries (Madura, 2000).

A high level of inflation in a country relative to the other countries puts pressure on the exchange rate between the two countries. There is a tendency for the currency of the relatively high inflation country to depreciate. When a country's currency depreciates, its imports price rises. On the other hand, its exports prices in foreign currency fall. A depreciation of a country's currency can serve as a stimulus to the economy as domestic products become attractive to foreign buyers (Case et al, 2009).

**Purchasing Power Parity Theory:** Also known as the law of one price, purchasing power parity theory states that in the absence of trade barriers and transportation cost between two countries, the price of same goods should be roughly the same in both countries. If the law of one price held for all goods and if each country consumed the same market basket of goods, the exchange rate between the two countries would be determined simply by the relative prices in the two countries. The theory proposes that exchange rates will adjust so that the price of similar goods in different countries is the same. In practice however, transportation costs for many goods are quite large and the law of one price does not hold for these goods. Also, many products that are potential substitutes for each other are not precisely identical (Case et al, 2009). According to purchasing power parity theory, inflation rates vary among countries, causing international trade patterns and exchange rates to adjust accordingly. When a country's inflation rates rises the demand for its currency declines as its exports decline due to their high prices. In addition, consumers and firms in that country tend to increase their imports. Both these forces place downward pressure on the high-inflation country's currency. The theory bases its predictions of exchange rate movement on changing patterns of trade due to different inflation rates between countries (Madura, 2000). PPP does not however consistently occur because of confounding effects. PPP presumes that exchange rate movements are completely driven by inflation differential between two countries. However, change in currency spot exchange rate is influenced by the other factors including interest rates, income levels, government controls and future expectations. The concept behind PPP theory is that as soon as the prices become relatively higher in one country, consumers shift their demand to the other country. The shift influences the exchange rate. However, if substitute goods are not available in the other country, then consumers may not shift their demand to that other country. Therefore PPP does not hold in the absence of substitutes for some traded goods (Madura, 2000).

**International Fisher Effect Theory:** The International Fisher Effect (IFE) theory explains the relationship between the interest rate differentials of two countries and the expected exchange rate changes. The derivation of this relationship according to the IFE is that the actual return to investors who invest in money market securities in their home country are the foreign interest rate and the change in the foreign currency value (Madura, 2000). According to IFE theory, if real interest rates are the same across countries, any difference in nominal interest rates could be attributed to the difference in expected inflation. IFE theory suggests that foreign currencies with relatively high

interest rates will depreciate because the high nominal interest reflects expected inflation. The nominal interest rate would also incorporate the default risk of an investment. The generalized version of the IFE theory specifies a relationship between interest rates differential of two countries and their inflation rates differential which eventually affects the value of currency of each country. Countries with high rates of inflation should have higher nominal interest rates than countries with lower rates of inflation.

### *Review of Empirical Literature*

Inflation is a situation in an economy where there is a persistent rise in the general level of prices of goods and services over a period of time. When the general price level rises, each unit of currency buys fewer goods and services. Inflation also reflects erosion in the purchasing power of money (Hagger, 1977). There are two main types of inflation differentiated by their causes; demand pull inflation and cost push inflation. Demand pull inflation is brought about by an increase in demand for commodities while the supply remains the same. The increase in demand arises mainly from an increase in incomes of the individuals. This leads to a situation where a lot of money is chasing for a few available commodities in the market resulting in increase in prices. Cost push inflation on the other hand is caused by an increase in the production cost of the commodities. When the price of raw materials, labor and power among others increases, the cost of production increases and the same is passed to consumers through pricing. Chhibber (1991), when analyzing a group of African countries, found out that inflation emanates from four major sources: Cost-push factors from discrete currency devaluations, demand-pull forces when there is excess demand created by excessive credit expansion in the economy, balance of payments crises and controlled prices widely deviating from market prices and whose re-adjustment creates an inflationary shock. The most common methods of measuring inflation discussed and referred to in the financial markets are the percentage increase or decrease of Consumer Price Indices (CPI) and Retail Price Indices (RPI). These monthly statistical indices are constructed from the price of a basket of goods and services deemed representative of the households' consumption patterns in a geographical area. The percentage change of the CPI over a period of time is what is usually referred to as inflation.

Foreign exchange rate is the rate at which one currency will be exchanged for another. It is the price of a nation's currency in terms of another currency. An exchange rate has two components, the domestic currency and a foreign currency, and can be quoted either directly or indirectly. In a direct quotation, the price of a unit of foreign currency is expressed in terms of the domestic currency. In an indirect quotation, the price of a unit of domestic currency is expressed in terms of the foreign currency. An exchange rate that does not have the domestic currency as one of the two currency components is known as a cross currency, or cross rate (Madura, 2000).

The systems used in foreign currency exchange have evolved from the gold standard, to fixed exchange rate to a floating exchange rate system. Under the gold standard system which operated from 1876 to 1913, each currency was convertible into gold at a specified rate. The exchange rates between two currencies were determined by their relative convertibility rates per ounce of Gold. The Bretton woods agreement of 1944 lead to the establishment of a fixed exchange rate system. The system which operated until 1971 allowed governments to intervene and prevent exchange rates from moving more than 1% above or below their initially established levels (Madura, 2000). To a large extent, the fixed exchange rate set by the Bretton woods agreements served as international monetary arrangements until 1971. In 1971, the United States and most other countries decided to abandon the fixed exchange rate system in favor of a floating or market-determined exchange rate. Although governments still intervene to ensure that exchange rate movements are orderly, exchange rates today are largely determined by the unregulated forces of supply and demand (Case et al, 2009). In a floating exchange rate regime, the exchange rate is a price freely determined in the market by forces of supply and demand. The dollar is purchased by foreigners in order to purchase goods or assets

from the United States. Likewise, U.S. citizens sell dollars and buy foreign currencies when they wish to purchase goods or assets from foreign countries. The exchange rate is determined by whatever rate clears these markets (Labonte, 2004).

Numerous factors determine exchange rates fluctuations and all are related to the trading relationship between two countries. Before considering why an exchange rate changes, it's important to realize that exchange rate at a given point in time represents the value of a currency. Like any other products sold in the market, the price of a currency is determined by the demand for that currency relative to supply. The equilibrium exchange rate will therefore change over time as supply and demand schedules change. The principal determinants of changes in demand and supply of a currency are as discussed below (Madura, 2000). An increase in inflation in a country, leads to an increase in demand for imports which appear cheaper. On the other hand, exports reduce as the domestic products become expensive in the international markets. The increase in demand for imports leads to an increase in demand for foreign currency and an increase in supply of local currency. The impact of higher interest rates is mitigated, however, if inflation in the country is much higher than in others, or if additional factors serve to drive the currency down. Other factors remaining the same, an increase in individual incomes in a country leads to an increase in demand for foreign currency which leads to a shift in exchange rate in favor of the foreign currency.

### *Problem of Research*

Previous studies in Kenya have attributed the fluctuation in the exchange rate to various macroeconomic factors. Kiptoo (2007) in his research thesis on real exchange rate volatility and misalignment in Kenya concluded that real exchange rate volatility was due to both external and internal fundamentals which include terms of trade and net capital flows as well as productivity growth and trade policy determined by the degree of openness. Musyoki et al (2012) on the other hand concluded that the volatility in exchange rate was as a result of adoption of the floating exchange rate regime in the country. On the other hand, a review of literature on inflation also reveals a variety of conclusions drawn Chhibber (1991) concludes that inflation is caused by demand pull and cost push factors. Rutasitara (2004) while studying on inflation in Tanzania shows that the major cause of inflation was the pricing arrangement which ranges from controls to free market. Other studies including; Chhibber and Shafik(1992), Barungi(1997) and Ndung'u and Duravall(1999) points at money supply, exchange rate and food supply as the key causes of inflation in developing economies.

Since the adoption of floating exchange-rate regimes by most countries, the effects of exchange-rate volatility on the volume of international trade have been the subjects of both theoretical and empirical investigations. This section deals with review of past studies relating to exchange rate fluctuation and inflation volatility. Burney & Akhtar (1992) in their study on government and exchange rate determination in Pakistan found that exogenous and policy induced shocks influence real exchange rates through four channels namely; absolute prices, relative prices, income and interest rates. The relative importance of each of the channels for a particular country depends on a number of country specific factors. In this context, government budget deficits through their linkages with price level, interest rates and growth of money supply are believed to have an indirect effect on the real exchange rate. Sebastian (2006), in his research paper on the relationship between inflation targeting and exchange rates addressed three specific issues: first, he analyzed the effectiveness of nominal exchange rates as shock absorbers in countries with inflation targeting. Secondly, he investigated whether exchange rate volatility is different in countries with an inflation targeting regime than in countries with alternative monetary policy arrangements. And thirdly, he discussed whether the exchange rate should play a role in determining the monetary policy stance under inflation targeting.

The main findings from this analysis were summarized as follows: First, countries that have adopted IT have experienced a decline in the pas-through from exchange rate changes to inflation. In many of the countries in the sample this decline in the pass-through has been different from CPI inflation than for PPI inflation. Secondly, the adoption of IT monetary policy procedures has not resulted in an increase in (nominal or real) exchange rate volatility. However, in three out of five countries the adoption of a floating exchange rate regime increased the degree of volatility of exchange rates. And finally, there is some evidence that IT countries with a history of high an unstable inflation tend to take into account explicitly developments in the nominal exchange rate when conducting monetary policy. Kamin & Klau (2003) empirically found that there is a relationship between inflation and the real exchange rates in most countries of Asia and Latin America. Furthermore, they found that the effect of exchange rates changes on inflation in Latin America was significantly higher than those in Asia and industrialized countries. Mohanty & Bhanumurlthy (2014) study focused on the impact of exchange rate regime on inflation in India during different episodes of exchange rate stability. The results from this study showed that the impact of exchange rate regime on inflation is not visible in Indian case, which could be because of the offsetting sterilization policy undertaken by Reserve Bank of India (RBI) during expansionary money supply growth resulting from its large scale intervention to even out exchange rate volatility.

Haderi et al. (1999) and Muço et al. (1999) in their study on inflation in Albania shows that, for the early transition years (1993-96), the exchange rate and remittances explained much more of the variation in inflation than changes in the money supply. Chhibber (1991), when analyzing a group of African countries, found out that inflation emanates from four major sources: Cost-push factors from discrete currency devaluations, demand-pull forces when there is excess demand created by excessive credit expansion in the economy, balance of payments crises and controlled prices widely deviating from market prices and whose re-adjustment creates an inflationary shock. Chhibber & Shafik (1992) developed a macroeconomic model of inflation which they used to study the impact of depreciation of currency to inflation in Ghana between 1965-1988. This study suggests that the growth of money supply is one key variable explaining the Ghanaian inflationary process. Such variables as official exchange rate and real wages could not exert any significant influence on inflation. However, significant positive relationship was found to exist between the parallel exchange rate and the general price level.

Similarly, Moser (1995) concluded that the devaluation of the Nigerian currency (Naira) was an important variable in the inflationary process in Nigeria. He found out that concurrency fiscal and monetary policies had a major influence on the impact of the depreciation of the Naira on inflation. Kiptui & Kipyegon (2008) study which investigated the effect of external shocks on the real exchange rate in Kenya showed that oil prices and openness have significant effects on the real exchange rate. The study also found that though external shocks have major effects on the real exchange rate, domestic shocks also play a part. The results show that the interest rate differential has significant negative (appreciating) effects in the short and long run. On the other hand, government spending has significant positive (depreciating) effects on the real exchange rate in the short-run and long-run while real GDP growth has positive (depreciating) effects in the short-run but negative (appreciating) effects in the long-run.

According to purchasing power parity theory, in the absence of transportation costs, the price of same commodities should be the same in both the domestic and foreign country. The exchange rate between the two countries would then be determined simply by the relative prices in the two countries. A high inflation rate in one country relative to the other would in this case put pressure on the exchange rate leading to depreciation in value of the currency of the country with higher inflation.

### *Research Focus*

A review of literature reveals few studies have been conducted to establish the effect of inflation on exchange rate. Moreover, very few studies attempts to establish statistical relationship between inflation and exchange rate fluctuation as theoretically proposed through purchasing power parity theory. Most of the studies also differ on the most ideal causes of exchange rate fluctuation and inflation volatility.

For instance, while Moser (1995) argues that the precipitous depreciation of the parallel exchange rate was the principal determinant of inflation in Nigeria, Chibber (1991) found that excess demand created by excessive credit expansion, balance of payment crisis and controlled prices were the main causes of inflation in Ghana. On the other hand, Duvarall & Ndung'u (1999) concluded that the proximate determinants of prices in the long run are exchange rate, foreign price level and the terms of trade.

Rose (1996) argues that exchange rate regime does matter in explaining exchange rate volatility, on the other hand, Burney & Akhtar (1992) in their study on government and exchange rate determination in Pakistan found that exogenous and policy induced shocks influence real exchange rates. Oriavwote (2012) in the research paper on the relationship between the real exchange rate and inflation in Nigeria showed that there is a long run relationship between inflation and the real exchange rate. The result showed that both domestic and imported inflation appreciated the real exchange rate. The ARCH result indicates the persistence of volatility between the rate of inflation and the real exchange rate. He concludes that the real exchange rate in Nigeria has been susceptible to fluctuations in the rate of inflation. The research paper by Imimole & Enoma (2011) examined the impact of exchange rate depreciation on inflation in Nigeria for the period 1986–2008. The research found that exchange rate depreciation, money supply and real gross domestic product are the main determinants of inflation in Nigeria, and that Naira depreciation is positive, and has significant long-run effect on inflation in Nigeria. The paper also found that inflationary rate in Nigeria has a lagged cumulative effect. The research paper therefore concludes that although Naira depreciation is relevant in ensuring an improvement in the production of exportable commodities, it must not be relied upon as a potent measure for controlling inflation in Nigeria.

Oyejide (1989) observed that exchange rate depreciation often leads to increased local currency cost of imported inputs (raw materials and intermediate capital goods) and final goods via the cost-push inflation channel. He noted that since non tradable goods cannot be imported, an excess demand for them would translate into increased prices given the fixed nature of domestic supply in the short-run. This price increase according to him feeds directly into domestic inflation via the demand-pull route. Barungi (1997) in his research on exchange rate policy and inflation in Uganda found that inflation in Uganda was persistently a monetary phenomenon. The monetary financing of the fiscal deficit was found to be the main cause of sustained inflation in Uganda. In addition to the links between fiscal deficit and monetization, the study also investigated the causal relationship between exchange rate and fiscal balance. The major conclusions are that monetary expansion as denominated by the financing of the fiscal deficit is instrumental in determining the pace of inflation.

Rutasitara (2004) in the study on the exchange rate regimes and inflation in Tanzania concludes that the impact of foreign prices and exchange rate depends on the existing pricing arrangements, which in Tanzania ranged from controls to free market. In an economy with price controls, they have a restraining effect on inflation and therefore suppress inflation. However in a market driven economy, fluctuations in exchange is easily transmitted to domestic prices. Rutasitara (2004), in the study on the exchange rate regimes and inflation in Tanzania concludes that the impact of foreign prices and exchange rate depends on the existing pricing arrangements, which in Tanzania ranged from controls to free market while Musyoki et al (2012) in the study on Real Exchange Rate (RER) Volatility in Kenya concluded that government policy of adopting floating exchange rate regime has not achieved the intended purpose for which it was established, namely to reduce RER misalignment.

As seen from the conclusions above, despite purchasing power parity theory hypothesizing the existence of a theoretical relationship between exchange rate and price of commodities, empirical studies in Kenya has been minimal. Moreover, the few studies done in Kenya and elsewhere have arrived at different contradicting conclusions as shown above.

The aim of this research is to fill this gap by providing empirical evidence through data analysis to show the impact of inflation on exchange rate fluctuation in a freely floating exchange rate regime in Kenya. This study aimed at determining the relationship that exists between inflation and foreign exchange rate fluctuation in Kenya. The study used figures for CPI to establish the impact of inflation on foreign exchange rates in Kenya

## **Methodology of Research**

### *General Background of Research*

A research design is the plan, structure and strategy of investigation, conceived so as to obtain answers to research questions (Kerlinger, 1973). Descriptive research is very common in business and other aspects of life and it's used to determine relationships between variables. The research design has been applied in this study to establish the relationship between inflation and foreign exchange rate. The design was appropriate because the study involved an in depth study of two variables: inflation and exchange rate. The purpose of this research was to explain the correlation between inflationary volatility and exchange rate fluctuation in Kenya for the period 2005 up to 2013.

### *Sample of Research*

As Fricker (2013) stated, a population is the total collection of elements about which we wish to make some inferences. It is the collection of all possible observations of a specified characteristic of interest.

The population for exchange rates was the foreign exchange rates of Kenya shilling against all currencies of the other countries in the world. On the other hand, the population for inflation was the CPI for all commodities in Kenya for the period of the research. A sample is a group of people, objects, or items that are taken from a larger population for measurement. The sample should be representative of the population to ensure that we can generalise the findings from the research sample to the population as a whole. In this research, the sample exchange rate selected was the Kenya Shilling against the US dollar. The reason for sampling the US dollar against other currencies is that most of the international commercial transactions in Kenya are done using the US dollar. It's therefore most likely that if inflation has any effect on exchange rate, then, this can be clearly shown through Changes in exchange rate between Kenya Shilling and the US dollar. The research covered the period between 2005 and 2013. Statistics from the KNBS and CBK shows that during the sampled period, there was an increasing trend in inflation coupled with depreciation of the Kenya shillings in relation to the US dollar. This is therefore the ideal period for establishing if the inflation had any impact on the exchange rate.

### *Instrument and Procedures*

The data employed in this study was time series secondary data. The exchange rate figures that were used are the average monthly exchange rate of Kenya shillings per US dollar. The inflation figures used in the study are the average monthly inflationary rates as reported by the KNBS. The data for exchange rate figures was obtained from the CBK website while the inflationary trend figures were obtained from K.N.B.S. These are credible institutions which compile the above economic data on behalf of the government. The data provided is therefore unbiased, accurate and reliable.

### *Data Analysis*



In order to find the relationship between inflation and exchange rate, monthly data of the same variables were used from 2005 to 2013. Pearson product moment correlation and trend analysis was used in the analysis of the data. Abnormal figures were catered for by ignoring the specific periods during data analysis.

This research was based on the following simple linear regression model:

$$Y = a + \Delta INF (Et-1) + \epsilon$$

Where

- Y = is the current exchange rate
- a = exchange rate at the base period.
- $\Delta INF$  = is the change in Kenya inflation rates within the year.
- Et-1 = is the exchange rate at the end of the previous year.
- $\epsilon$  = is the error term. Represents changes in exchange rate caused by the other factors like interest rates, individual income, government policy and expectations.

The data was entered into the Statistical Package for Social Sciences (SPSS) and analyzed using correlation and regression analyses.

### Results of Research

This chapter presents the data analysis, results and discussion of the study. The data was analysed using the SPSS package where descriptive statistics and regression analysis were used to analyse and measure the degree of association between the variables under consideration. The findings in this chapter helped in fulfilling the objective of the study.

This is a set of brief descriptive coefficients that summarizes the characteristics of the data for both inflation and exchange rate. The measures used to describe the data set are measures of central tendency and measures of variability or dispersion. The results are as summarized in table one below.

**Table 1: Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
<b>Inflation</b>	102	3.09	31.50	12.0950	7.69985
<b>Exchange Rate</b>	102	61.90	87.48	76.8467	6.87412
<b>Valid N (listwise)</b>	102				

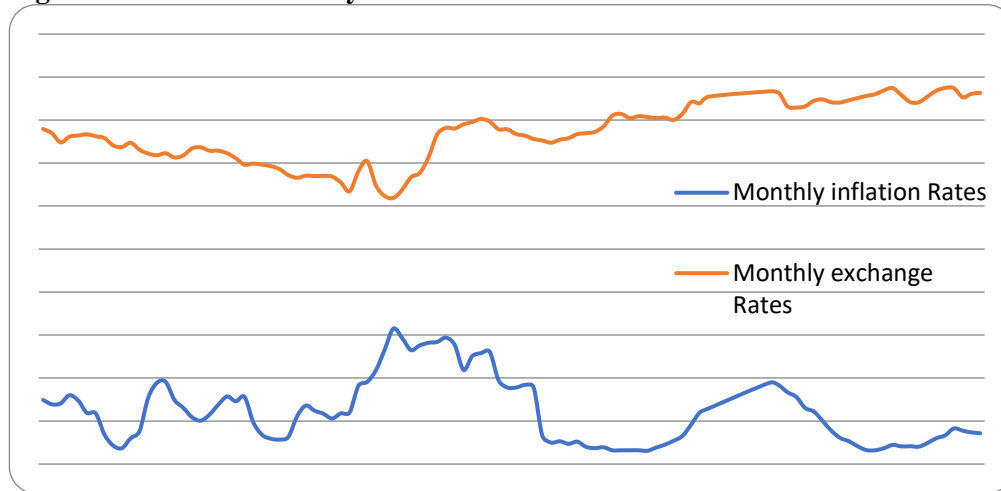
Source: Research Data (2014)

Results of descriptive statistics analysis shown in table one above shows that the minimum value of inflation during the period was 3.09% while the maximum value was 31.50%. The mean inflation was 12.1% while the standard deviation was 7.7%. This low standard deviation indicates that inflation in Kenya did not fluctuate too much from an average of 12.1% during the period under study.

The minimum value of exchange rate during the period was 61.9 while the maximum value was 87.48. On average exchange rate in Kenya during the period under study was 76.85 with a standard deviation of 6.87%. This low standard deviation implies that exchange rate in Kenya did not deviate so much from the mean of 76.8467 during the period of study.

Although the movement in both variables appears to have been stable during the period as indicated by the low standard deviation, we can however conclude that on average the fluctuation in inflation from the mean during the period was high as indicated by the standard deviation of 7.7% as compared to fluctuation in exchange rate from the mean which stood at 6.87%.

**Figure 1: Time Series Analysis.**



Source: Research Data (2014)

The correlation between variables measures the degree of linear association between them. Regression analysis on the other hand shows the effect of the independent variable (inflation) on movement in the dependent variable(exchange rate).The results from the data analysis for both correlation and regression are as summarized in tables two to five below.

**Table 2: Correlation Matrix**

Coefficients					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	81.183	1.171		69.348	.000
1 INFLATION	-.358	.082	-.402	-4.384	.000

**Dependent Variable: Exchange rate**

Source: Research Data (2014)

Data analysis results in table 2 above shows that the correlation coefficient between inflation and exchange rate during the period was -0.402. This coefficient indicates that there is a moderate negative correlation between inflation and exchange rate. The standardized coefficient of -0.402 also implies that the negative correlation between the two variables is not very strong but average.

**Table 3: Analysis of Variance (ANOVA)**

ANOVA					
Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	769.533	1	769.533	19.224	.000b
1 Residual	4003.074	100	40.031		
Total	4772.607	101			

a. Dependent Variable: EXCHANGERATE  
b. Predictors: (Constant), INFLATION

Source: Research Data (2014)

Sum of squares measures the variability of data around the mean. The sum of squares of 769.533 is smaller than the residual value of 4,003.074 indicating that the model does not account for most of the variation in the dependent variable. The movement in exchange rate is therefore majorly caused by other factors other than inflation volatility.

**Table 4: Correlations**

		Inflation	Exchange rate
Inflation	Pearson Correlation	1	-.402**
	Sig. (2-tailed)		.000
	N	102	102
Exchange Rate	Pearson Correlation	-.402**	1
	Sig. (2-tailed)	.000	
	N	102	102

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

Source: Results from data analysis in SPSS

The Pearson correlation coefficient between exchange rate movement and inflation volatility for the research period was -0.402. This coefficient indicates that, there is a moderate negative correlation between inflation and exchange rate.

**Table 5: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.402a	.161	.153	6.32699

Predictors: (Constant), Inflation

Source: Research Data (2014)

The result in table 5 above shows that the correlation coefficient of determinant also known as the R square based on a total of 102 observations was 16.1%. R square measures the proportion of variability in the dependent variable that is explained by the model. The R square of 16.1% implies that 16.1% of the variation in the exchange rate can be explained by the model. The remaining 83.9% percent can be attributed to the other variables. This implies that inflation is not the major cause of changes in exchange rate. Other factors largely influence the movement in exchange rate.

## Discussion

Exchange rate is one of the most important macroeconomic variables in both the developing and developed countries. It affects the exports and imports of a country thereby determining the balance of trade of a country. Prior to the 1970's vast majority of countries had fixed exchange rate regimes. In the 1970's, most countries decided to abandon the fixed exchange rate system in favor of a floating or market-determined exchange rate. This has led to constant fluctuation in exchange rate in response to changes in the underlying macro economical variables. The most common theories of exchange rate are the fisher's effect and the PPP theories which have hypothesized that interest rate and inflation have a negative effect on inflation respectively. The aim of this study was to establish the relationship between inflation volatility and exchange rate fluctuation in Kenya. The

study relied on the hypothesis of purchasing power parity theory of existence of a negative relationship between inflation and exchange rate movement. The research covered a period of nine years from January 2005 to December 2013. The study was inspired by the fact that despite the hypothesis by PPP theory and the general observation in the market where exchange rate tends to follow inflation though in an opposite direction, very few studies had been conducted both in general and specific to Kenya to establish whether empirically there is any relation between the two variables. Moreover, the few studies done had varied conclusions on the relationship between these two variables.

This being an explanatory type of research, it relied on secondary data obtained from Central Bank of Kenya and the Kenya National Bureau of Statistics. The data collected was entered into excel and SPSS computer packages for analysis.

The data for both variables for the period of study was collected and input into the SPSS computer package for analysis. Result from descriptive analysis indicates that fluctuation in inflation during the period was high with a standard deviation of 7.7% as compared to movement in exchange rate which had a standard deviation of 6.9%. The result for correlation and regression analysis shows that there is a moderate negative correlation between inflation volatility and exchange rate movement with a Pearson correlation coefficient of -0.402%. The findings also indicate that movement in inflation accounts for about 16.1% of the movement in exchange rate. This therefore implies that inflation is not the only factor influencing movement in exchange rate, other factors seem to contribute largely to the movement in exchange rate.

The findings of this research tend to agree with the findings of other studies carried elsewhere about causes of exchange rate movement. A review of literature on exchange rate as discussed earlier revealed that the causes of exchange rate fluctuation are complex, dynamic and intertwined. In line with the findings of this study, Inflation has been shown in most of the studies as having a negative correlation and effect on exchange rate. Moreover, like this study, the other studies also conclude that inflation is not the sole factor which influences movement in exchange rate.

For instance, Karim and Klau (2003) established that there was a negative relationship between inflation and the real exchange rates in most countries of Asia and Latin America. Similarly, Danjuma (2013) also found that exchange rate and inflation had a negative relation in Nigeria and an increase in inflation lead to depreciation in the exchange rate of the Naira. Moreover, Ndung'u (2000) research on monetary and exchange rate policy in Kenya shows that monetary shocks drive real exchange rate movements. This implies that when money supply or domestic credit growth is excessively out of line with the growth in economic activity, it feeds into the real exchange rate movements. In addition real income and inflation are negatively associated with the nominal exchange rate movements.

## Conclusions

As stated earlier, exchange rate is one of the most important macroeconomic variables in a country. Exchange rate affects the prices of both imports and exports thereby determining the direction of international trade. It is therefore very important for the government policy makers, the trades and the general public to understand the factors that affect the movement in exchange rate. This will enable them to make appropriate decisions during exchange rate fluctuations.

The aim of this study was to establish the relationship between inflation volatility and exchange rate fluctuation in Kenya. The study covered a period of nine years from January 2005 up to December 2014. The results obtained from data analysis indicate that inflation had a moderate negative effect on exchange rate during the period of study with a Pearson correlation coefficient of -0.402%. The findings also indicate that inflation is not the major factor influencing movement in exchange rate, other factors contribute largely to movement in exchange rate at 83.1%.

The result of this study tends to confirm the proposition of the PPP theory that inflation has a negative relationship with exchange rate. The study also agrees with the findings of other previous studies which conclude that although the causes of exchange rate fluctuation are dynamic and complex. Since fluctuation in exchange rate can be caused by many factors, it is therefore important for policy makers to understand all the factors which contribute to movement in exchange rate in a country. This will enable them to apply appropriate measures to counter the fluctuation and stabilize the exchange rate.

### **Limitations of the Study**

The research utilized data for exchange rate between the Kenya Shilling and the US dollar. The results obtained from this study are therefore true for one foreign currency only i.e. US Dollar. Although the US dollar is the main currency used in international trade in Kenya, other currencies including the Euro, the sterling pound, the Yen, the Rand as well as the Tanzania and Uganda shillings among others are also used. The exchange rate variation in response to movement in inflation with respect to these other foreign currencies may be different and give different results. Movements in exchange rate were seen to be high especially for the years of National Elections in Kenya. It is then possible that to a greater extent, movement in exchange rate was due to political reasons rather than inflation. Similarly, there was a high fluctuation in exchange rate between June 2011 and December 2011 which was far beyond the normal. Due to time and resource limitations, the research accounted for this by ignoring the figures for this period during data analysis, it was not therefore clear what caused the fluctuation in exchange rate.

Due to lack of adequate information and limited time, the research was also one sided in the sense that it only considered the volatility in inflation in Kenya and not in both Kenya and USA. The assumption taken by the research that inflation in the USA was static during the period of research is not true and this could have affected the results. Finally, as discovered during empirical literature review, the causes of movement in exchange rate and inflation are intertwined. Movement in inflation has been identified as a reason for movement in exchange rate and similarly, movement in exchange rate has also been found to be leading to inflation in some countries. A more advanced data analysis technique than linear regression analysis therefore needed to be applied in analyzing the effect of the variables on each other.

### **Recommendations and Suggestions for Policy**

This research was conducted with the aim of establishing the effect of inflation on exchange rate fluctuation in Kenya. The results obtained from data analysis indicate that there is a negative relationship between these two variables. It is therefore recommended that the government should put in place appropriate policies and strategies that will ensure the maintenance of a stable inflation rate as this has been found to be an important factor influencing exchange rate movement. In line with the above, the government should direct its expenditure to the key productive sectors of the economy such as agriculture and manufacturing which will go a long way in increasing the production of goods and services thereby stabilizing the prices of commodities in the domestic market. Government should also adjust its monetary policy accordingly in order to avoid increase of money supply to the economy which increases the individual incomes and eventually leads to inflation. This will go a long way in stabilizing inflation and consequently contribute to having a stable exchange rate.

In line with the findings of this study, it is also recommended that although volatility in inflation has been established to have a negative relationship with exchange rate movement, it is not the sole factor causing movement in exchange rate. It is therefore suggested that policy-makers should employ inflation stabilization as a measure to compliment other macro-economic policies to stabilize the fluctuation of exchange rate. The research therefore recommends that the government

should set put in place appropriate measures to stabilize inflation. Policy makers should also keenly monitor the other factors influencing movement in exchange rate such as market interest rates and income levels in order to stabilize exchange rate. Finally, the government can also directly intervene to stabilize the exchange rates by increasing or reducing the supply of the foreign currency.

### Recommendations and Suggestions for Future Studies

The research study only relied on the exchange rate of Kenya Shilling and the US dollar. The results from this research are therefore only true for the US dollar and may not be true for all foreign currencies. A comprehensive research on the same variables involving all major currencies used in international trade in Kenya can be conducted in order to get result that is all inclusive.

As established during empirical literature review, the causes of fluctuation in exchange rate are dynamic, complex and intertwined. A more advanced research can be conducted involving all the factors identified as causing fluctuation in exchange rate such as interest rate, inflation, government controls, income levels and market expectations can be undertaken. The research can then identify the extent to which each factor contributes to movement in exchange rate. 3-The data collected during this study were analyzed using simple linear regression techniques. However, as explained before, causes of movement in exchange rate and inflation are intertwined. It is therefore possible that changes in inflation may lead to changes in exchange rate and similarly, changes in exchange rate can lead to movement in inflation. Research on the same variables can be done but the data analyzed using an advanced statistical technique to identify the effect of each variable on each other.

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<b>APPENDIX 1: Exchange rates: Central Bank of Kenya</b>		
<b>Month &amp; Year</b>	<b>Monthly inflation Rates</b>	<b>Monthly exchange Rates</b>
Jan-2005	14.9	77.93
Feb-2005	13.9	76.94
March-2005	14.1	74.8
April-2005	16	76.15
May-2005	14.8	76.4
June-2005	11.9	76.68
July-2005	11.8	76.23
Aug-2005	6.9	75.81
Sept-2005	4.3	74.1
Oct-2005	3.7	73.72
Nov-2005	6.0	74.73
Dec-2005	7.6	73.12
Jan-2006	15.4	72.21
Feb-2006	18.9	71.8
March-2006	19.1	72.28
April-2006	14.9	71.3
May-2006	13.1	71.76
June-2006	10.9	73.41
July-2006	10.1	73.66
Aug-2006	11.5	72.87
Sept-2006	13.8	72.87
Oct-2006	15.7	72.29
Nov-2006	14.6	71.13
Dec-2006	15.6	69.63
Jan-2007	9.7	69.88
Feb-2007	6.8	69.62
March-2007	5.9	69.29
April-2007	5.7	68.58
May-2007	6.3	67.19
June-2007	11.1	66.57
July-2007	13.6	67.07
Aug-2007	12.4	66.97
Sept-2007	11.7	67.02
Oct-2007	10.6	66.85
Nov-2007	11.8	65.49
Dec-2007	12	63.42
Jan-2008	18.2	68.08
Feb-2008	19.1	70.47
March-2008	21.8	64.81
April-2008	26.6	62.34
May-2008	31.5	61.9
June-2008	29.3	63.78
July-2008	26.5	66.7
Aug-2008	27.6	67.69
Sept-2008	28.2	71.3
Oct-2008	28.4	76.66
Nov-2008	29.4	78.18
Dec-2008	27.7	78.04
Jan-2009	21.9	79.0
Feb-2009	25.1	79.53
March-2009	25.8	80.26
April-2009	26.1	79.63
May-2009	19.5	77.86
June-2009	17.8	77.85
July-2009	17.8	76.75

<b>APPENDIX 1: Exchange rates: Central Bank of Kenya</b>		
<b>Month &amp; Year</b>	<b>Monthly inflation Rates</b>	<b>Monthly exchange Rates</b>
Aug-2009	18.4	76.37
Sept-2009	17.9	75.6
Oct-2009	6.6	75.24
Nov-2009	5.0	74.74
Dec-2009	5.3	75.43
Jan-2010	4.7	75.79
Feb-2010	5.2	76.73
March-2010	4.0	76.95
April-2010	3.7	77.25
May-2010	3.9	78.54
June-2010	3.2	81.02
July-2010	3.2	81.43
Aug-2010	3.2	80.44
Sept-2010	3.21	80.91
Oct-2010	3.09	80.71
Nov-2010	3.84	80.46
Dec-2010	4.51	80.57
Jan-2011	5.42	80.02
Feb-2011	6.54	81.47
March-2011	9.19	84.21
April-2011	12.05	83.89
May-2011	12.95	85.43
June-2011	14.49	89.05
July-2011	15.53	89.9
Aug-2011	16.67	92.79
Sept-2011	17.32	96.36
Oct-2011	18.91	101.27
Nov-2011	19.72	93.68
Dec-2011	18.93	86.67
Jan-2012	18.31	86.34
Feb-2012	16.69	83.18
March-2012	15.61	82.9
April-2012	13.06	83.19
May-2012	12.22	84.46
June-2012	10.05	84.79
July-2012	7.74	84.14
Aug-2012	6.09	84.08
Sept-2012	5.32	84.61
Oct-2012	4.14	85.11
Nov-2012	3.25	85.63
Dec-2012	3.2	86.0
Jan-2013	3.67	86.9
Feb-2013	4.45	87.45
March-2013	4.11	85.82
April-2013	4.14	84.19
May-2013	4.05	84.15
June-2013	4.91	85.49
July-2013	6.02	86.85
Aug-2013	6.67	87.48
Sept-2013	8.29	87.41
Oct-2013	7.76	85.31
Nov-2013	7.36	86.1
Dec-2013	7.15	86.31

Data Source: Inflation: KNBS website.

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