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**THE IMPACT OF EXCHANGE RATE VOLATILITY ON FLOWER EXPORT
EARNINGS IN KENYA**

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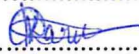
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LIST OF ABBREVIATIONS

ARCH	Auto Regressive Conditional Heteroskedasticity.
FDI	Foreign Direct Investment.
GARCH	Generalized Auto Regressive Conditional Heteroskedasticity.
GDP	Gross Domestic Product.
NEER	Nominal Effective Exchange Rate.
REER	Real Effective Exchange Rate.
VAR	Vector Auto Regression.
VREER	Real Effective Exchange Rate Volatility.

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ABSTRACT

This study looks at the relationship between Real Effective Exchange Rate Volatility and Flower export earnings in Kenya. It aims at establishing whether the relationship between these two variables is positive or negative. The data analyzed is quarterly between the years 1996 and 2013 for Kenyan flower exports and the real effective exchange rate of the US Dollar against the Kenya Shilling. The main model used in this study is the Vector Error Correction Model as used by Okoth & Suleiman (2014) in their study of the effect of exchange rate volatility on the flower export earnings in Uganda. Estimates used show that the relationship between the real effective exchange rate volatility on flower export earnings is in fact negative. This impact is in the short run meaning that the effect is immediate.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND INFORMATION

Kenya participates in international trade, mainly through exports and imports. One of Kenya's main exports is horticultural produce. Foreign countries form the base of the horticultural export industry in Kenya. According to the Chartered Institute of Horticulture (2015), "Horticulture is the Art, Science, Technology and Business of intensive plant cultivation for human use. It is practiced from the individual level in a garden up to the activities of a multinational corporation." In Kenya, the main horticultural produce we export includes: flowers, vegetables and fruits. Annual horticultural exports increased to 924 million US dollars in 2014 from 916 million US dollars in the year 2013. According to Workman (2015) Kenya is the fourth largest exporter of flowers, producing and exporting 7.6% of the World's flowers. Netherlands is the largest, exporting 45.2% of the World's flowers. Kenya exported 644 million US dollars' worth of flowers in 2014. The world's largest importers of horticultural produce include USA among others. The USA imported 44 billion US dollars' worth of horticultural products (United States Department of Agriculture, 2014).

The floriculture sub-sector in Kenya has recorded the highest growth in volume and value of flowers exported. Kenya also attained the lead supplier status to the European Union against competitors. The main European Union Markets include Holland, United Kingdom, Germany, France and Switzerland. Kenya contributes to 35% of all flower sales in the world flower market. Kenya is also the leading supplier of roses to Japan (Kenya Flower Council, 2015). Since 1990, the volume of cut flowers exported has been recorded as the highest in growth every year in the horticultural sector. In 2013, 124,858 tonnes were exported and 136,601 tonnes were exported in 2014 valued at 54.6 billion US dollars (Kenya Flower Council, 2015).

A fluctuating foreign exchange rate is defined as an international monetary exchange system in which prices of currencies are determined by competitive market forces. Exchange rate is the basis of international trading and thus showing that it has impacts on

various sectors in the economy. Exchange rates are constantly fluctuating due to various reasons.

The exchange rate volatility is brought about by the following different factors. These include: i) Inflation rates ii) Interest rates iii) Balance of payment/ country's current account iv) Government debt v) Terms of trade vi) Political instability and performance vii) Recession and viii) Speculation.

The dollar has been rising steadily in the year 2015 against the Kenyan shilling. As the year 2011 came to an end, the dollar was selling at Ksh106.21 on the 12th of October 2011 (Central Bank of Kenya, 2015). During this time, the value of horticultural exports went down. Between the months of November 2011 and January 2012, horticultural exports were valued at 5 billion shillings which was a decrease from the October 2011 value of 6.3 billion shillings (Central Bank of Kenya, 2015). Part of this decrease can be attributed to the exchange rate fluctuation of the Kenyan shilling.

However, in an article by Reuters, Jane Ngige, the chief executive officer of Kenya Flower Council, said that the weak Kenyan shilling helped push the flower revenues in 2011. It was noted that the flower export earnings rose by 25 percent to 44.4 billion shillings despite the decrease in overall Horticultural export values (Reuters, 2015).

According to Chambers & Just (1981) the impact of the devaluation of a currency affects a given sector in the economy, for example Agriculture. Majority of the associated impact must come through an adjustment in the given sector's balance of trade rather than through a portfolio adjustment. The exchange rate change has effects on both the foreign component as well as the domestic component of the sector. The effects of exchange rate fluctuations are more dramatic in the short term than in the long run.

According to Kandil & Mirzaie (2005), the exchange rate is decomposed into anticipated and unanticipated fluctuations whereby the unanticipated changes have a more significant effect on output growth and price inflation than anticipated changes. In order to determine

the changes brought about by exchange rate fluctuation, we need to look at the demand and supply channels. Also, exchange rate fluctuations are likely to determine economic performance of a country or economy.

1.2 PROBLEM STATEMENT

In literature, it is agreed that substantial exchange rate fluctuations create macroeconomic disequilibria on all exports earnings, including horticultural exports. The correction of this external balance requires both exchange rate devaluation and management policies. It is argued that an increase in exchange rate fluctuations leads to uncertainty which might have a negative impact on export earnings. The literature concerning export earnings in Kenya is mainly focused on horticultural exports as a whole. The gap in literature is that there is no research that addresses the impact that exchange rate volatility has on flower exports earnings in Kenya. This is despite the fact that Kenya supplies 35% of the world's flowers and is the third largest exporter of flowers in the world.

This can also be looked at as the research gap. Most of the literature looks at export earnings of a general sector, say agriculture. There is a need for specific exports to be examined, especially when that export is one of the main export earners in the country. The aim of this study is to investigate and determine the relationship between exchange rate volatility and flower export earnings in Kenya. This will be particularly important to policy makers in the country and exporters of this commodity.

Since the beginning 2015, the Kenyan shilling has been depreciating steadily against the US dollar. This has been attributed to factors such as increased insecurity as a result of terror attacks, decreased tourism, the closure of some forex bureaus in the country and a heavy reliance on oil imports (Wagacha & Aligula, 2015). The importance of this study is to determine the exact impact that such exchange rate fluctuations have on Kenyan flower export earnings; whether positive or negative. In determining the effects of exchange rate volatility on floricultural export earnings, policy makers will be able to devise strategies and policies geared towards reducing the negative effects. They shall also be able to devise strategies to curb depreciation of the Kenyan currency.

1.3 RESEARCH OBJECTIVES

1. To determine the impact of the real effective exchange rate volatility on flower export earnings in Kenya.

1.4 RESEARCH QUESTIONS

1. What impact does the real effective exchange rate volatility have on flower export earnings in Kenya?

1.5 SIGNIFICANCE OF THIS RESEARCH

The results and conclusions from this study will be important and significant to existing and prospective exporters in Kenya in understanding the effects of foreign exchange rate fluctuations on floricultural export earnings in Kenya. The key industries in the floricultural industry will also benefit from this study especially towards planning and coming up with strategies. The government and related agencies will be able to come up with policies with a deeper understanding so as to be able boost the floricultural sector.

Researchers and students will also benefit from this study in that they will be in a position to get information that can help them while carrying out research work in related fields to advance their research papers and projects respectively. This research will also increase the knowledge base concerning the effects of foreign exchange rate fluctuations on horticultural export earnings in Kenya. Importers, exporters, investors and monetary authorities are all concerned with the behavior of the exchange rate, as it directly or indirectly affects them. The behavior of the exchange rate is, therefore, a useful indicator of economic export performance that needs to be understood.

CHAPTER 2: LITERATURE REVIEW

In this chapter, an analysis of the impact of exchange rate fluctuations and the factors affecting floricultural export earnings will be undertaken with an empirical review of past scholarly papers and studies carried out in this area. There will also be an analysis of the relationship between exchange rate fluctuations and floriculture export earnings and thereafter, an empirical analysis of the methodologies used in past studies will be carried out.

2.1 IMPACT OF EXCHANGE RATE VOLATILITY

Kandil & Mirzaie (2005) divide exchange rate volatility into two: i) anticipated changes and ii) unanticipated changes. Unanticipated changes have a larger or more significant effect on output growth and price inflation. The unanticipated currency fluctuations determine aggregate demand through exports, imports and the demand for domestic currency, and also determine aggregate supply through the cost of imported intermediate goods. Unanticipated exchange rate movements determine economic conditions in three directions: net exports, money demand, and output supplied. A depreciation of the domestic currency may stimulate economic activity through the initial increase in the price of foreign goods relative to domestic goods. When international competitiveness of domestic goods increases, it diverts spending from foreign goods to domestic goods thus appreciating the domestic currency.

Currency depreciation is a two-headed creature, with both an upside and a downside. According to Hirschman (1949), currency depreciation gives with one hand, by lowering export prices, while taking away with the other hand, by raising import prices. If trade is in balance and terms of trade are not changed, these price changes offset each other. But if imports exceed exports, the net result is a reduction in real income within the country.

However, Diaz-Alejandro & Carlos (1963) introduce a contradicting argument on devaluation. According to them, depreciation may raise the windfall profits in export and import-competing industries. If money wages lag the price increase and if the marginal

propensity to save from profits is higher than from wages, national savings will go up and real output will decrease.

Kandil & Mirzaie (2005) believe that currency depreciation increases net exports and increases the cost of production and that currency appreciation decreases net exports and the cost of production and therefore the combined effects of demand and supply channels are what determine the net results of exchange rate fluctuations on real output on prices.

2.2 DETERMINANTS OF EXPORT EARNINGS

Export earnings are regarded as one of the key indicators of an economy's performance. Research into export earnings has grown considerably during the past few decades. Some of the determinants are discussed below:

Foreign Exchange Rate Fluctuations

According to Otieno & Mudaki (2011), swings in foreign exchange rates determine export earnings of the exporting country. Exchange rates have been increasing posing challenges for macro management. Kiptui (2008) believes that there is need to monitor exchange rate fluctuations and to adopt appropriate monetary and fiscal policies to ensure stability in exchange rates and thereby stability in export earnings. Focus needs to shift to exchange rate fluctuations and support towards reforms that enable exporters to hedge against exchange rate risk such as developing forward and future markets, which basically represent long term solutions. However, in the short run, the need for appropriate fiscal and monetary policies to counter volatile short term capital inflows would help reduce the effects of such changes on the country's currency. While maintaining a stable exchange rate is important, strategies that lead to a relatively overvalued exchange rate could be a disincentive to exports, implying that flexibility in exchange rate movements, in line with the fundamentals of the economy might be beneficial. With the rising level of globalization, openness through an export led growth strategy is inevitable, particularly in consideration of other development constraints currently facing the country.

Inflation

According to Wamukhoma (2014), a difficulty in determining the impact of exchange rates movements on export earnings is that most of the important macroeconomic effects are indirect. There is importance in interactions between the exchange rate, inflation and export earnings.

High and rising inflation creates a problem in the context of sluggishly adjusting nominal exchange rates, which is managed by the central bank in order to maintain price stability. The resulting real over-valuation of the exchange rate impedes export growth and creates uncertainty about potential future movements in the exchange rate.

Foreign Direct Investment

From the study by the United Nations Conference on Trade and Development (2013), Foreign Direct Investment (FDI) is likely to affect export earnings positively. This is true for most levels of export earnings and for every period under consideration. The experience in a number of countries suggests that FDI strongly contributes to the transformation of the composition of exports. For instance, according to Fugazza (2004), it has been well documented that FDI inflows into Singapore or, more recently China, have helped to increase significantly the technological content of exports by supporting strongly the development of export supply capacity, including knowledge based industries thereby improving the export earnings. From the analysis of China, it was found that a positive and significant relationship between export performance and FDI contribution to capital formation is found at all levels of export performance. Overall, the analysis points to the conclusion that supply capacity constraints could also be addressed by improving the technological advances of the export sector as indicated by the positive influence of FDI contribution to capital formation on export earnings (Fugazza, 2004)

The Macroeconomic Environment

Included in the macroeconomic environment is the real exchange rate which is the topic of study. According to Fugazza (2004), the real exchange rate proves to have a significant effect on export performance. The results from a study and regression carried out showed that in the lowest quantile, the real exchange rate had a very significant effect on export

performance. Fugazza (2004) conducted a study on China and Singapore. It was also indicated that an overvalued currency is detrimental to export performance and could lead to direct loss of price competitiveness for exporting firms. Basically, good export performers are more likely to be in a stronger position in more capital intensive differentiated product markets and may face less aggressive competitors than exporters in more labor intensive product markets.

Domestic Transport Infrastructure

Export earnings critically depend on the infrastructure, including roads and ports to energy and telecommunication. Internal transport facilitation has significant impact on export earnings seeing as it plays an important role across all regions in explaining export earnings in later periods and it is more marked among better performing exporters. According to (Wamukhoma , 2014), most African countries are characterized by poor transport infrastructure and due to this they are found to be poor export performers in all periods. This is an indicator that Kenya could do more to raise its supply capacity by investing in transport infrastructure (Wamukhoma , 2014).

2.3 EFFECT OF EXCHANGE RATE VOLATILITY ON EXPORT EARNINGS

The share of global trade in total world output has almost tripled since World War II which ended in 1945. Furthermore, in the last 25 years, the global economy has witnessed a growing prominence of dynamic emerging economies¹ on the global trade landscape along with a rapid expansion in international trade (Cheung & Sengupta, 2013). When analyzing export earnings and exchange rate movements, there are some specific sectors one is to look at. There are many dominant players in the market that can influence both of these areas. According to Cheung & Sengupta (2013), the overall trade activity of a country is an aggregation of decisions of individual firms. Thus, in order to understand

¹ An emerging market economy describes a nation's economy that is progressing toward becoming more advanced, usually by means of rapid growth and industrialization. These countries experience an expanding role both in the world economy and on the political frontier.

the effects of exchange rate changes on trade balance, it calls for an analysis of how exchange rate fluctuations affect the decisions of individual firms. This analysis provides insight into heterogeneous responses across the firms to exchange rate movements which has policy implications in management and stabilization of foreign exchange fluctuations. Cheung & Sengupta (2013), believe that, compared to other firms, exporting firms are usually associated with higher levels of productivity and profitability. High export earnings bring about economic growth due to spillovers into other sectors from the exporting sector. According to Cheung & Sengupta (2013) the relationship between Real Effective Exchange Rate (REER) and exports is that there is a positive relationship between exchange rate depreciation and exports. However, the study on the Indian economy by Cheung & Sengupta (2013) showed that after 1993, the relationship defied the traditional expectations. Indian exports grew rapidly after the year 2000 even despite the appreciation of their REER.

2.4 EMPIRICAL ANALYSIS

Cheung & Sengupta (2013) first determine the firm-level export shares which they defined as the exports to sales ratio of firm i at time t . They achieve this using a baseline regression with variables such as: 1) the change in REER with an increase in domestic currency appreciation; 2) the level of foreign income (which is measured by trade-share-weighted average of incomes of top five trading partners of the country); and 3) the volatility of REER (which is measured using standard deviation of monthly REER indices of the year. A fixed-effects variable is included to capture a firm's specific attributes due to a limitation imposed by the data set used which is brought about in the effort to control for as many firm-level variables as possible due to the problem of classical omitted variable problem which is caused by unobserved firm characteristics. The results from this test showed that the exchange rate effects based on the Indian firm-level data was largely in line with standard trade theory. Then, they estimated the effect of the macro economic conditions on the firm's exporting decisions where they included the same variable in the baseline regression plus a variable which included 1) percentage change in nominal wage index, 2) percentage change in world export to GDP ratio, and 3) real per capita GDP growth rate.

Tariq & Najeeb (1995), in a study on the Pakistan economy used time series data in the study. The authors defined export instability as the short-run fluctuations in export earnings corrected for trend. The trend correction is needed because in its absence a country with a rapid growth rate (even if constant) will show a very high instability. It is due to this reason that they first find a trend of export earnings in the data. The trend lines are linear and exponential respectively and that is what the authors used in their study, seeing as countries plan in terms of their growth rates and not in terms of their absolute increments. In order to get the trend values for each year, they had to take the antilog of the exponential trend where each year's instability is measured by taking the percentage of each year's actual value.

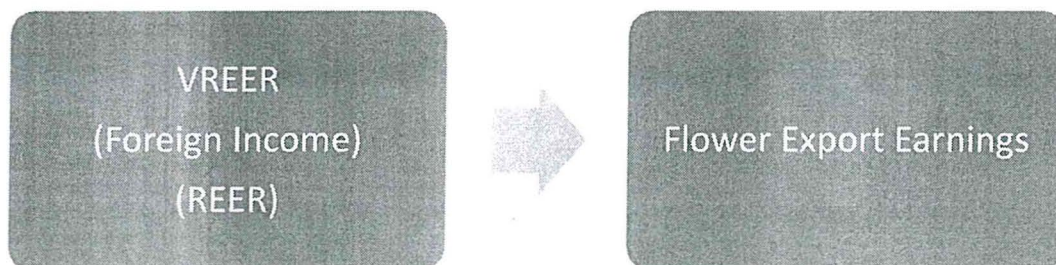
In order to measure the export earnings instability, they used all the factors that affect instability in the multiple regression analysis as explanatory variables. And thus in the case of the study, the exchange rate shall also be used as an explanatory variable.

Massel (1964) states the observable changes in the value of exports result from the interaction of a variety of market forces, but on the supply and the demand sides. There was the use of an arbitrary procedure to distinguish between long-run forces, which can be said to determine the trends, and short-run forces, which can be viewed as determining fluctuations around the trend. Massel (1964) measured annual fluctuations along the trend. In order to achieve this, a regression line was fit to export earnings as deviations from this estimated trend. This is used to estimate for each country, which in this study, was 36 countries for the years 1948-1959 with a defined money value (in current monetary units) of the earnings received by the country from the sale of merchandise exports. He also measured the export concentration using the Gini coefficient. The Gini coefficient is a measure of inequality usually used to measure income inequality but can be used to measure any form of uneven distribution. It is a number between 0 and 1 where 0 corresponds with perfect equality (where everyone has the same income) and 1 corresponds to perfect inequality. In his conclusion, he noted that the relationship between instability of export earnings and concentration of a country's exports is a tenuous one

and that as the degree of concentration of a country's exports explains such a small proportion of the inter-country variation in export instability, one would not expect a policy aimed at diversification generally to result in a marked reduction in fluctuations – although such a policy may well be effective in certain individual cases.

Okot & Suleiman (2014) use the following variables: flower exports, foreign income, REER, and REER volatility. There are several ways of measuring volatility for variables. In the paper, two methods were used as a robustness check for the results on effects of REER volatility on exports. The methods are the conditional standard deviation of the log of REER and the Auto Regressive Conditional Heteroskedasticity model. The authors introduced an export demand function which is a two-country model of international trade developed by Savvides. The model assumes that demand for a country's export depends on real foreign income and relative (foreign) prices. Okoth & Suleiman (2014) were studying Uganda.

2.5 CONCEPTUAL FRAMEWORK



This study seeks to determine and examine the relationship between VREER and Flower Export Earnings in Kenya. VREER is the independent variable along with REER and

Foreign Income which are chosen based on theory while the Flower Export Earnings variable is the dependent variable. Seeing as VREER and Flower Export Earnings are the main variables, this study focuses on their relationship.

Once the relationship between flower export earnings and VREER is determined, it shall be looked at in the light of either positive or negative. Based on past literature, the relationship between REER Volatility and Flower Export Earnings is expected to be negative.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

In this section, the overall methodology adopted in conducting this study shall be discussed. It is divided into the following sections: Research Design, Target Population, Data collection and Data analysis. The methodology adopted in this study is drawn from (Okot & Suleiman, 2014) which was a study on the flower export earnings in Uganda.

3.2 RESEARCH DESIGN

This study is explanatory in nature as it seeks to assess the effect of Real Effective Exchange Rate Volatility (VREER) in Kenya on floricultural exports earnings. The explanatory design was further selected based on previous studies such as Okot & Suleiman (2014) that show that REER volatility contribute greatly to export earnings and in specific floricultural export earning earnings. Therefore, a hypothesis can be formulated on the relationship between floricultural exports earnings, foreign income and REER volatility. The null hypothesis is that there is no relationship between VREER and Flower Export Earnings and the alternative hypothesis is that there is a relationship between the two variables.

3.3 TARGET POPULATION

The study's target population is the Kenyan economy. It was selected as a country of interest because of its fast growing economy compared to other East African countries that export flowers such as Uganda.

3.4 SAMPLING DESIGN

This study analysis the floricultural export earnings fluctuations resulting from real effective exchange rate volatility of the US dollar against the Kenya shilling using quarterly data for (18 years) for the period January 1996 to December 2013. This period was chosen due to the fact that the only data on flower export earnings available was from 1995 and due to this fact, this paper had to restrict the period of the other variables for uniformity.

Interpolation had to be done in order to obtain quarterly data and since there was no data from 1994, then 1995 data was used to interpolate. As such, it was not possible to get the quarterly data of 1995 since there was no reference point (1994) data for this period thus the data is analyzed from the year 1996.

3.5 DATA COLLECTION

This study shall be conducted using secondary data. The study will use the following variables: Flower exports, foreign income (GDP per Capita of the European Union), Real Effective Exchange Rate of the US Dollar against the Kenya Shilling (REER) and Real Effective Exchange Rate volatility (VREER) which are all observable variables except for REER volatility. These variables have been chosen based on the anchor paper by Okot & Suleiman (2014). Annual data on floricultural export earnings was obtained from the Kenya Council of Flowers website from the period of January 1996 to December 2013. Seeing as the only data available on flower export earnings is annual, interpolation will have to come in play in order to obtain the quarterly data.

Exchange rates were collected from the World Bank and the Central Bank of Kenya website. Foreign income data however was drawn from the International Monetary Fund's International Financial Statistics (IMF-IFS). The foreign income and flower export earnings data was gotten as annual thus interpolation came into play to turn into quarterly because the quarterly data couldn't be found. The Foreign Income, Flower Export Earnings and Real Effective Exchange Rate were logged and thus the data analyzed was the natural logarithm of the variables in order to make the data uniform.

3.6 DATA ANALYSIS

3.6.1 METHOD SPECIFICATION

3.6.1.1 REER VOLATILITY MEASUREMENT

There are several ways of measuring volatility for variable. In this paper, two methods of robustness check for the results on effect of REER volatility on export earnings. These methods include the conditional standard deviation of the log of REER and the ARCH and GARCH.

3.6.1.1.1 CONDITIONAL STANDARD DEVIATION OF LOG OF REER

The REER used is the trade weighted exchange rates with the trading partners adjusted for price differential. To compute REER volatility, we assume that inflation is constant during each month since domestic inflation is officially disseminated once in a month. This implies that the volatility of the REER will be exactly the same as that of the daily Nominal Effective Exchange Rate (NEER). The study thus measures Volatility of REER as;

$$VREER_t = std(Log(NEER_t)) \quad (1)$$

Where $NEER_t$ is the daily nominal effective exchange rate in month t as computed by Central Bank of Kenya. This method mathematically produces volatility measurement which is very close to the coefficient of variation.

3.6.1.1.2 GARCH MODEL FOR ESTIMATION OF REER VOLATILITY

The Auto- Regressive Conditional Heteroskedastic (ARCH) model characterizes the observed correlation in asset price volatility. The REER is assumed to follow a first order autoregressive or AR(1) and can be estimated using the following equation:

$$REER_t = \lambda_0 + \lambda_1 REER_{t-1} + \varepsilon_t \quad (2)$$

Where REER is the natural logarithm of the Real Effective Exchange Rate, λ and λ_1 are the parameters to be estimated, and ε_t is an error term that is distributed normally and follows white noise. This ARCH (1,1) specification is used to determine whether the REER follows the first order autoregressive process using the estimates of the LM test and F-statistic. The ARCH model assumes that this dependence can be captured by an autoregressive process of the form:

$$\delta_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \varepsilon_{t-2}^2 + \dots + \alpha_m \varepsilon_m^2 \quad (3)$$

Where δ_t^2 is the conditional variance of the real exchange rate ε_{t-i}^2 for $I = 1, 2, \dots, m$ denotes the squared residual derived from equation (8) and α_i for $i=0, 1, \dots, m$ are the parameters to be estimated. The restriction $\alpha_1 \geq 0$ ensure that the predicted variance I always non-negative. The ε_{t-i}^2 which represents the ARCH term, is a measure of information on the REER volatility in the previous period. This specification illustrates how current levels of REER volatility will be influenced by the past and how periods of high or low REER volatility will tend to persist:

If the REER follows ARCH(1, 1) process, then we use the GARCH(k, m) series as a measure of REER volatility on the assumption that the error term is not autocorrelated. The variance in the GARCH process is specified as:

$$\delta_t^2 = \alpha_0 + \beta_1 \delta_{t-2}^2 + \dots + \beta_k \delta_{t-k}^2 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \varepsilon_{t-2}^2 + \dots + \alpha_m \varepsilon_{t-m}^2 \quad (4)$$

Where δ_{t-j}^2 for $j=1, 2, \dots, k$ is the GARCH term representing last period's forecast variance. The simplest specification in this class, and the one most widely used, is referred to as GARCH(1, 1) model and is given by:

$$\delta_t^2 = \alpha_0 + \beta_1 \delta_{t-1}^2 + \alpha_1 \varepsilon_{t-1}^2 \quad (5)$$

Where δ_t^2 is the time variant conditional variance of the REER (The GARCH term), ε_{t-1}^2 is the squared residuals obtained from equation (4) (The ARCH term), and the parameters $\alpha_0, \beta_1,$ and α_1 are estimated. Equation (6) gives the conditional variance about the REER volatility of the previous period measured as a lag of the squared residuals for the GARCH process. This study therefore employs equation (6) as the GARCH process.

The results of equation (6) may be interpreted as exporter's predictions of current period's REER variance, which is measured as a weighted average of the long-term average (the constant term), the GARCH and ARCH terms. Thus, the predicted values of δ_t^2 from equation (6) provides the measure of the REER volatility.

3.6.1.2 UNIT ROOT TEST

An important element of time series data analysis is testing for unit root in the variable under study. Unit root is tested using the commonly used univariate tests of Phillip Peron and Augmented Dickey Fuller (ADF). Since ADF is parametric and the Phillip Peron is non-parametric, they offer different power for rejection of the unit root. As such, using the two may reduce the risk of committing type II error.

The ADF test constructs a parametric correction for the higher-order correlation by assuming that the y series follows an AR(p) process, of the form:

$$\Delta y_t = \alpha y_{t-1} + x_t' + \sum_{i=1}^p \beta \Delta y_{t-1} + \varepsilon_t \quad (6)$$

While the Phillip Peron is non-parametric method of controlling for serial correlation when testing for a unit root using the t-statistics.

3.6.1.3 COINTEGRATION ANALYSIS

Although the variable may be non-stationary, linear combinations of two or more variables may be stationary. The purpose of cointegration analysis is to establish, which variables form an equilibrium long-run relationship. Johansen cointegration test is used. The standard equation for testing cointegration in Johansen's methodology is:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Pi_i \Delta y_{t-1} + Bx_t + \varepsilon_t \quad (7)$$

Where $\Pi = \sum_{i=1}^p A_i - I$ and $\Pi_t = -\sum_{j=t+1}^p A_j$

In equation (7), if the coefficient matrix Π has reduced rank $r < k$, then there exists $k \times r$ matrices α and β each with rank r such that $\Pi = \alpha \beta'$ and $\beta' y_t$ is $I(0)$. The rank r is the number of cointegrating relations and each column of β is the cointegrating vector. Johansen's method estimates the Π matrix from an unrestricted VAR using maximum likelihood and the test for no-cointegration can be rejected using the maximum Eigen value.

3.6.1.4 VAR MODEL

The VAR model to be estimated within this framework will be given as:

$$Y_{1t} = \alpha_{10} + \alpha_{11}Y_{1t-1} + \dots + \alpha_{1k}Y_{1t-k} + \beta_{11}Y_{2t-1} + \dots + \beta_{1k}Y_{2t-k} + \dots \quad (8) \\ + \delta_{11}Y_{3t-1} + \dots + \delta_{1k}Y_{3t-k} + \varepsilon_{1t} + U_{1t}$$

$$Y_{2t} = \alpha_{20} + \alpha_{21}Y_{2t-1} + \dots + \alpha_{2k}Y_{1t-k} + \beta_{21}Y_{1t-1} + \dots + \beta_{2k}Y_{2t-k} + \dots \quad (9) \\ + \delta_{21}Y_{2t-1} + \dots + \delta_{2k}Y_{3t-k} + \varepsilon_{2t} + U_{2t}$$

Where U_{1t} and U_{2t} are white noise which is identically independent distributed and k is the lag length. Y_{1t} is the REER volatility and Y_{2t} is the Flower Export Earnings while Y_{3t} is the foreign income. REER has been excluded because it is assumed that it is not an exogenous variable and it is related to REER volatility and thus including it will bring about the problem of autocorrelation.

The optimal number of lags to be included in the model will be determined by the information criteria: Akaike's Information Criteria (AIC), Schwarz Information Criteria (SIC) or the Hannan Quinn Information Criteria (HQIC). The VAR model will be used to determine the long run relationship between the REER volatility and the Flower Export Earnings. This is because it treats all variables as endogenous and it captures more features of the data and thus provides good results that can be used to make inferences about the data. However, if it is proven that there is cointegration in the variables, then the **Vector Error Correction Model** will be used seeing as VAR cannot be used if there is cointegration.

CHAPTER 4: DATA ANALYSIS AND INTERPRETATION

In this chapter, the data that was collected for the various variables will be analyzed using various tests and models as described in chapter 3. The results are then interpreted.

4.1 DESCRIPTION OF KEY VARIABLES

The key variables to be described are Flower Export Earnings, REER volatility, REER and Foreign Income.

4.1.1 FLOWER EXPORT EARNINGS

These data are the natural logarithm of flower export earnings.

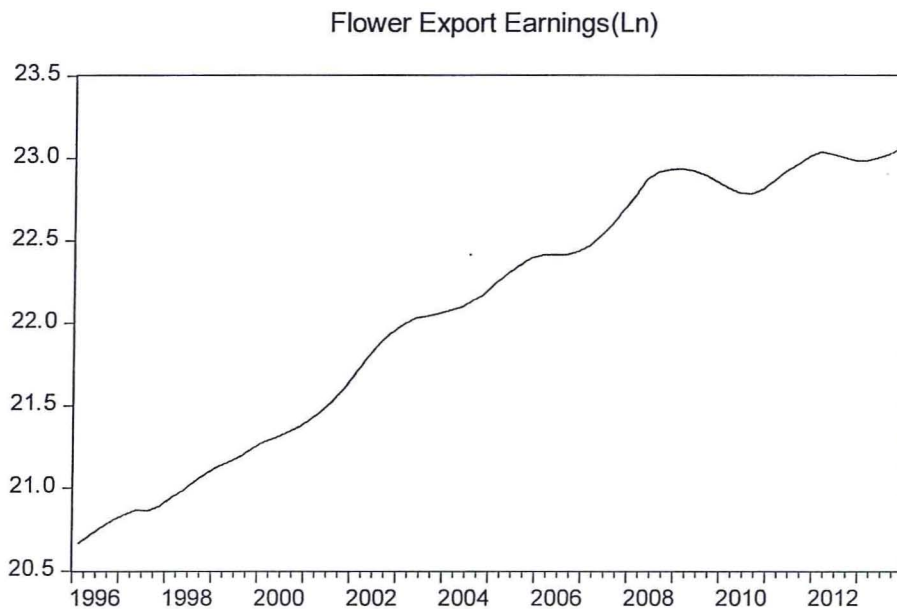


Figure 1: Flower Export Earnings

This figure represents the earnings obtained from Flower exports, which was measured between 1996 and 2013. It seems to portray an upward trend overtime which is fairly even apart from a small jump between the years 2008 to 2009 with a small dip in the year 2007 which coincides with the election period.

4.1.2 REER VOLATILITY

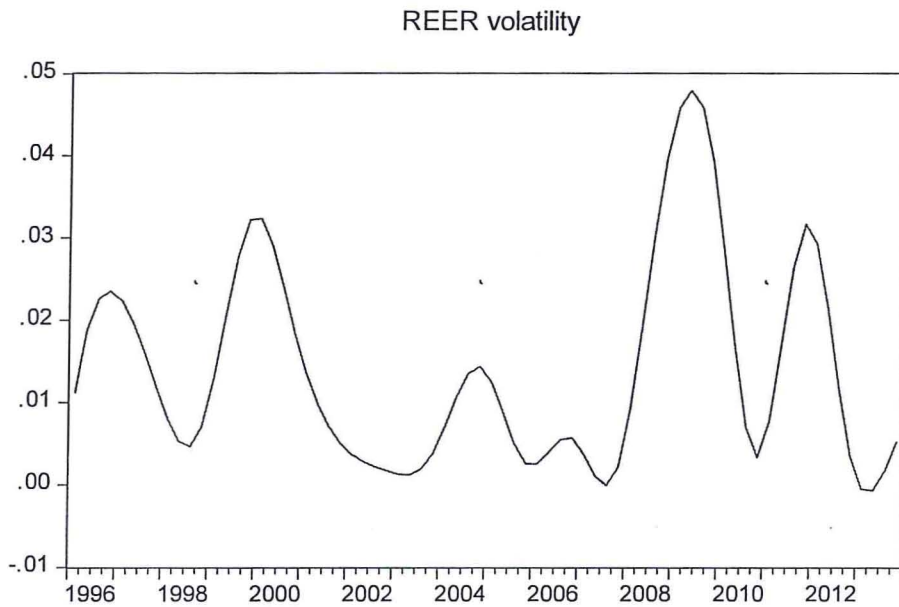


Figure 2: *VREER*

This graph represents the trend of the REER volatility, measured between 1996 and 2013. The data represents a volatile trend overtime.

4.1.3 FOREIGN INCOME

The data used in this study are the natural logarithm of the GDP per Capita of the European Union because the European Union is the largest importer of Kenyan flowers.

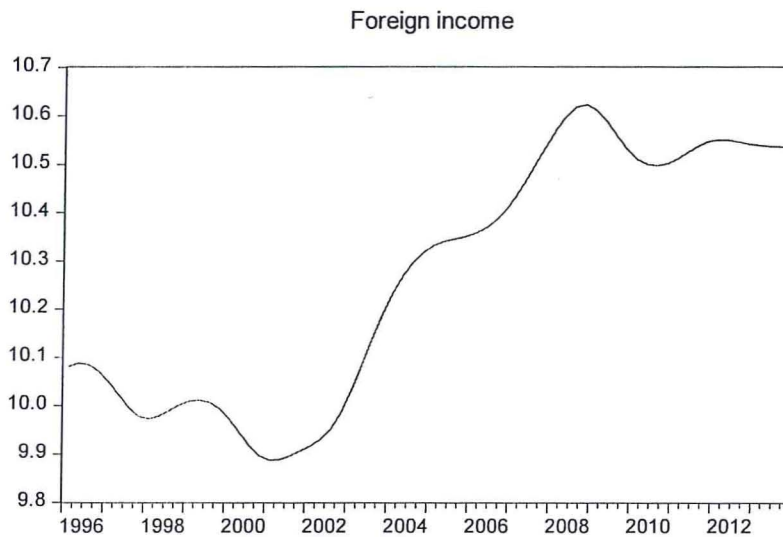


Figure 3: *Foreign Income*

The graph represents the trend of foreign income from European Union which is its GDP. The data represents a generally upward trend with a small dip in the year 2008 which can be attributed to the Financial Crisis in the year 2008.

4.1.4 REER

The data used are the natural logarithm of the real effective exchange rate.

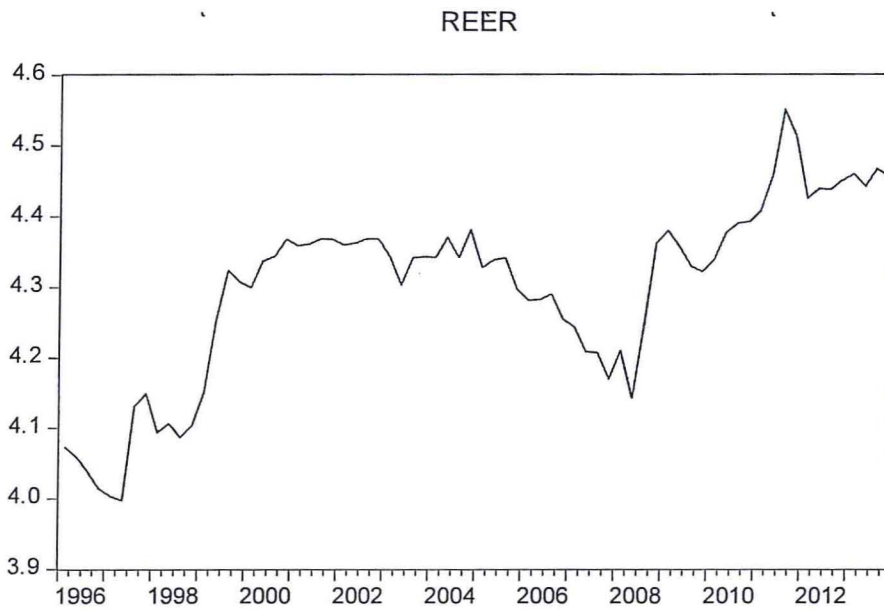


Figure 4: REER

This graph represents the trend of the REER of the US Dollar which is measured between the years 1996 to 2013. The data represents a general upward trend with a sharp dip between 2007 and 2008 which can be attributed to the Post election violence in this period. It could also be attributed to the Financial Crisis that affected the USA.

4.2 STATIONARITY TESTS

4.2.1 FLOWER EXPORT EARNINGS.

Table 1: Flower Export Earnings (ADF)

Null Hypothesis: D(FLOWER_EXPORT_EARNINGS_L) has a unit root

Exogenous: Constant

Lag Length: 2 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.478418	0.0005
Test critical values:	1% level	-3.530030	
	5% level	-2.904848	
	10% level	-2.589907	

*MacKinnon (1996) one-sided p-values.

Table 2: Flower Export Earnings Phillip Perron Test.

Null Hypothesis: D(FLOWER_EXPORT_EARNINGS_L) has a unit root

Exogenous: Constant

Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.158886	0.0268
Test critical values:	1% level	-3.527045	
	5% level	-2.903566	
	10% level	-2.589227	

The above tables show that the variable flower export earnings is stationary at 1st difference. This is evident due to the fact that the T-statistic is more negative than the critical value at the 5% level of significance in both cases thus we can reject the null hypothesis that the data is non-stationary at first difference.

4.2.2 REER VOLATILITY

Table 3: VREER (ADF)

Null Hypothesis: D(VREER) has a unit root

Exogenous: Constant

Lag Length: 11 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.992145	0.0414
Test critical values:		
1% level	-3.546099	
5% level	-2.911730	
10% level	-2.593551	

Table 4: VREER Phillip Perron

Null Hypothesis: D(VREER) has a unit root

Exogenous: Constant

Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-3.693032	0.0062
Test critical values:		
1% level	-3.527045	
5% level	-2.903566	
10% level	-2.589227	

We can conclude from the above tests that the variable REER Volatility is stationary at first difference seeing as the t-statistic is more negative than the critical value at the 5% level of significance in both cases thus we can reject the null that the variable is non-stationary.

4.2.3 FOREIGN INCOME

Table 5: Foreign Income (ADF)

Null Hypothesis: D(FOREIGN_INCOME) has a unit root

Exogenous: None

Lag Length: 3 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.242764	0.0250
Test critical values:	1% level	-2.599934	
	5% level	-1.945745	
	10% level	-1.613633	

Table 6: Foreign Income Phillip Perron

Null Hypothesis: D(FOREIGN_INCOME) has a unit root

Exogenous: None

Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.312206	0.0211
Test critical values:	1% level	-2.598416	
	5% level	-1.945525	
	10% level	-1.613760	

We can conclude from the above tests that the variable Foreign Income is stationary at first difference seeing as the t-statistic is more negative than the critical value at the 5% level of significance in both cases thus we can reject the null that the variable is non-stationary.

4.2.4 REER

Table 7: REER (ADF)

Null Hypothesis: D(REER) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.306633	0.0000
Test critical values:		
1% level	-3.527045	
5% level	-2.903566	
10% level	-2.589227	

*MacKinnon (1996) one-sided p-values.

Table 8: REER Phillip Perron

Null Hypothesis: D(REER) has a unit root

Exogenous: Constant

Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-7.246394	0.0000
Test critical values:		
1% level	-3.527045	
5% level	-2.903566	
10% level	-2.589227	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.001603
HAC corrected variance (Bartlett kernel)	0.001109

We can conclude from the above tests that the variable REER is stationary at first difference seeing as the t-statistic is more negative than the critical value in both cases thus we can reject the null that the variable is non-stationary.

4.3 JOHANSEN COINTEGRATION TEST

Having tested for stationarity of each time series, the next step is to establish the cointegration relationship among the four variables (i.e. Flower export earnings, REER volatility, REER and Foreign Income) to test for existence of a stable long-run relationship. In this paper, the Johansen Cointegration test is used. The third option under the cointegration test which is 'Intercept (no trend) in CE and test VAR' shall be used.

The results are as follows:

Table 9: Cointegration test

Date: 11/13/15 Time: 20:33

Sample (adjusted): 1996Q4 2013Q4

Included observations: 69 after adjustments

Trend assumption: Linear deterministic trend

Series: FLOWER_EXPORT_EARNINGS_L FOREIGN_INCOME REER VREER

Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.498700	103.1466	47.85613	0.0000
At most 1 *	0.378717	55.49864	29.79707	0.0000
At most 2 *	0.202842	22.65676	15.49471	0.0035
At most 3 *	0.096661	7.014326	3.841466	0.0081

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.498700	47.64792	27.58434	0.0000
At most 1 *	0.378717	32.84188	21.13162	0.0007
At most 2 *	0.202842	15.64244	14.26460	0.0301

At most 3 *	0.096661	7.014326	3.841466	0.0081
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Max-eigenvalue test indicates 4 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

From table 9, it is evident that there is cointegration of at most 4 equations. There are two tests, the Trace test and the Max-Eigen Value test. The trace test shows indicates 4 cointegrating equations and the max-eigen value test indicates 4 cointegrating equations at the 0.05 level which means that the p-value is less than 5%.

This means that all the variables are co-integrated or that in the long run, they have association thus meaning that in the long run, the variables move together. This thus allows the running the Vector Error Correction Model (VECM).

4.4 VECTOR ERROR CORRECTION MODEL (VECM)

Since the variables are co-integrated as has been established by the Johansen Test of Cointegration above, we can then proceed to the Vector Error Correction Model (VECM) which has three steps involved in developing it. The steps before the actual VECM model are explained in appendix 1. The results from the VECM have been summarized below:

Table 10: Vector Error Correction Model

Vector Error Correction Estimates

Date: 11/14/15 Time: 00:12

Sample (adjusted): 1996Q4 2013Q4

Included observations: 69 after adjustments

Standard errors in () & t-statistics in []

Cointegrating Eq:	CointEq1			
FLOWER_EXPORT_EARNINGS_				
L(-1)	1.000000			
VREER(-1)	-9.515592			
	(4.21363)			
	[-2.25829]			
FOREIGN_INCOME(-1)	-2.996619			
	(0.11235)			
	[-26.6718]			
REER(-1)	-1.884141			
	(0.19560)			
	[-9.63245]			
C	16.89357			
Error Correction:				
	D(FLOWER_EXPORT_EARNINGS_L)	D(VREER)	D(FOREIGN_INCOME)	D(REER)
CointEq1	0.002033	-0.001036	0.004453	0.048843
	(0.00772)	(0.00061)	(0.00174)	(0.02968)
	[0.26319]	[-1.68996]	[2.55503]	[1.64589]
D(FLOWER_EXPORT_EARNING				
S_L(-1))	1.774413	-0.001227	-0.019255	-0.001851
	(0.11948)	(0.00949)	(0.02696)	(0.45902)
	[14.8511]	[-0.12935]	[-0.71434]	[-0.00403]*

D(FLOWER_EXPORT_EARNING S_L(-2))	-0.941361 (0.13438) [-7.00537]	0.015308 (0.01067) [1.43473]	0.003058 (0.03032) [0.10088]	-0.305095 (0.51625) [-0.59098]*
D(VREER(-1))	-2.365947 (0.63562) [-3.72225]	1.577667 (0.05047) [31.2604]	-0.300463 (0.14340) [-2.09529]	7.546526 (2.44195) [3.09036]*
D(VREER(-2))	1.748656 (0.70098) [2.49460]	-1.016847 (0.05566) [-18.2697]	0.173214 (0.15814) [1.09530]	-4.528160 (2.69303) [-1.68144]*
D(FOREIGN_INCOME(-1))	0.410542 (0.29228) [1.40461]	-0.046569 (0.02321) [-2.00668]	1.682660 (0.06594) [25.5180]	-2.465211 (1.12289) [-2.19541]
D(FOREIGN_INCOME(-2))	-0.231546 (0.28482) [-0.81297]	0.068095 (0.02261) [3.01111]	-0.776142 (0.06426) [-12.0789]	1.704581 (1.09421) [1.55781]
D(REER(-1))	0.425438 (0.04415) [9.63664]	-0.001913 (0.00351) [-0.54561]	-0.002388 (0.00996) [-0.23978]	0.007837 (0.16961) [0.04621]*
D(REER(-2))	-0.163903 (0.04475) [-3.66270]	0.001406 (0.00355) [0.39567]	0.004163 (0.01010) [0.41238]	-0.285749 (0.17192) [-1.66212]*
C	0.002838 (0.00286) [0.99124]	-0.000656 (0.00023) [-2.88749]	0.001225 (0.00065) [1.89623]	0.023787 (0.01100) [2.16255]*
R-squared	0.915192	0.978652	0.990283	0.227577
Adj. R-squared	0.902255	0.975395	0.988801	0.109749
Sum sq. resids	0.005921	3.73E-05	0.000301	0.087393
S.E. equation	0.010018	0.000795	0.002260	0.038487
F-statistic	70.74327	300.5231	668.1068	1.931444

Log likelihood	225.1286	399.9230	327.8674	132.2580
Akaike AIC	-6.235611	-11.30212	-9.213548	-3.543712
Schwarz SC	-5.911827	-10.97833	-8.889765	-3.219928
Mean dependent	0.033333	-0.000251	0.006537	0.006048
S.D. dependent	0.032043	0.005071	0.021357	0.040790
<hr/>				
Determinant resid covariance (dof adj.)		4.80E-20		
Determinant resid covariance		2.57E-20		
Log likelihood		1164.630		
Akaike information criterion		-32.48203		
Schwarz criterion		-31.05738		
<hr/>				

For the VECM estimated of the cointegrating series, results show that the coefficients of the estimation are significant except for the error correction coefficient and the foreign income. The star alongside the values shows that the variable is significant. The significance test is the test for long run relationship in table 11.

The estimated error correction coefficient indicates that 0.002033 deviation of the flower export earnings from its long run equilibrium level. This value however is not significant. It is also observed that the coefficient of VREER is negative which shows that VREER has a negative effect on flower export earnings. It can also be observed that given that the coefficient of VREER (-2.365947) is significant, a 1% positive change in VREER can be attributed to a negative 2.365947% change in flower export earnings. It can also be observed that the coefficient -0.001036 represents the error correction parameter that measures how the deviation of the VREER changes from its long run equilibrium is corrected at each period in the short run.

4.4.1 LONG RUN RELATIONSHIP

Table 11: P-value

Dependent Variable: D(FLOWER_EXPORT_EARNINGS_L)

Method: Least Squares

Date: 11/14/15 Time: 00:28

Sample (adjusted): 1996Q4 2013Q4

Included observations: 69 after adjustments

$$\begin{aligned}
 D(\text{FLOWER_EXPORT_EARNINGS_L}) = & C(1) * (\text{FLOWER_EXPORT_EARNINGS_L}(-1) - 9.5155919514 * \text{VREER}(-1) - 2.99661942078 \\
 & * \text{FOREIGN_INCOME}(-1) - 1.88414128242 * \text{REER}(-1) + 16.8935663058 \\
 &) + C(2) * D(\text{FLOWER_EXPORT_EARNINGS_L}(-1)) + C(3) \\
 & * D(\text{FLOWER_EXPORT_EARNINGS_L}(-2)) + C(4) * D(\text{VREER}(-1)) + C(5) \\
 & * D(\text{VREER}(-2)) + C(6) * D(\text{FOREIGN_INCOME}(-1)) + C(7) \\
 & * D(\text{FOREIGN_INCOME}(-2)) + C(8) * D(\text{REER}(-1)) + C(9) * D(\text{REER}(-2)) + \\
 & C(10)
 \end{aligned}$$

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.002033	0.007724	0.263193	0.7933
C(2)	1.774413	0.119480	14.85114	0.0000
C(3)	-0.941361	0.134377	-7.005371	0.0000
C(4)	-2.365947	0.635622	-3.722255	0.0004
C(5)	1.748656	0.700976	2.494603	0.0154
C(6)	0.410542	0.292281	1.404614	0.1654
C(7)	-0.231546	0.284815	-0.812970	0.4195
C(8)	0.425438	0.044148	9.636645	0.0000
C(9)	-0.163903	0.044749	-3.662697	0.0005
C(10)	0.002838	0.002863	0.991239	0.3256

In order to establish a long run relationship between the variables, we look at the C(1) constant. C(1) is the coefficient of cointegrating model. It can be referred to as the error correction term or the speed of adjustment towards equilibrium. If its coefficient has a negative sign, and is significant, then we can say that there is long run relationship running from VREER, Foreign Income and REER to Flower Export Earnings. As is seen above, the coefficient of C(1) has a positive sign and the p-value is more than 5% thus is not

significant. This establishes that there is no long run relationship between the variables to the flower export earnings.

4.4.2 SHORT RUN RELATIONSHIP

In order to test for short run relationships, we need to use the two tests to establish the short run relationship. There is the Wald test and the Block Exogeneity test. Both tests are used in order to reduce the probability of error.

1. Block Exogeneity test

Table 12: Box Exogeneity test

VEC Granger Causality/Block Exogeneity Wald Tests

Date: 11/14/15 Time: 00:36

Sample: 1996Q1 2013Q4

Included observations: 69

Dependent variable: D(FLOWER_EXPORT_EARNINGS_L)

Excluded	Chi-sq	df	Prob.
D(VREER)	13.89293	2	0.0010
D(FOREIGN_INCOME)	5.945738	2	0.0512
D(REER)	92.92275	2	0.0000
All	113.1753	6	0.0000

The null hypothesis above for the test is that there is no short run causality. It is evident that the p-value of VREER and REER clearly leads us to reject the null hypothesis which is that there is short run causality in REER and VREER towards the flower export earnings. Also, in the overall p-value, the value is less than 5% which is significant. The null hypothesis is therefore rejected showing that there is short run relationship.

2. Wald Test

Seeing as the main variables of this study are VREER and flower export earnings, we shall be focusing on that specific one thus we shall only run the Wald test on the VREER to test for short run relationship with the flower export earnings. The results are shown below:

Table 13: Wald test

Wald Test:

Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	6.946463	(2, 59)	0.0020
Chi-square	13.89293	2	0.0010

The null hypothesis is that $C(4)=C(5)=0$ which is rejected seeing as the p-value is significant because it is smaller than 5%. From the results in table 13, we can see that the p-value is less than 5% thus is significant thus we reject the null and in doing so, prove that there is short run relationship between the VREER and flower export earnings. Thus, in conclusion, there is no long run relationship between the variables but there is a short term relationship between VREER and flower export earnings.

4.5 DIAGNOSIS TESTING

In order to test for the appropriateness of the model, we look at the R-squared value which in this case is large (0.915192) thus proving the model is appropriate. Though there are other tests to be conducted:

1. Normality test:

This is whereby the residuals are tested for normality. The null is that there is normality.

Table 14: Normality test

VEC Residual Normality Tests

Orthogonalization: Cholesky (Lutkepohl)

Null Hypothesis: residuals are multivariate normal

Date: 11/14/15 Time: 02:12

Sample: 1996Q1 2013Q4

Included observations: 69

Component	Skewness	Chi-sq	df	Prob.
1	-0.337953	1.313438	1	0.2518
2	-0.163518	0.307487	1	0.5792
3	-0.172997	0.344173	1	0.5574
4	-0.063481	0.046343	1	0.8296
Joint		2.011442	4	0.7337

Seeing as the p-value is more than 5%, we fail to reject the null hypothesis thus there is normality.

2. Test for Heteroskedasticity:

To test for this, White test is used. The results are:

Table 15: White test

VEC Residual Heteroskedasticity Tests: Includes Cross Terms

Date: 11/14/15 Time: 02:18

Sample: 1996Q1 2013Q4

Included observations: 69

Joint test:

Chi-sq	df	Prob.
592.1269	540	0.0596

The null hypothesis in this test is that there is no heteroskedasticity. The p-value is more than 5% thus is not significant thus we do not reject the null hypothesis.

CHAPTER 5: CONCLUSION

5.1 CONCLUSION AND RECOMMENDATIONS

The study analyzed the relationship between Flower Export Earnings and the Real Effective Exchange Rate Volatility in the Kenyan economy and the impact of the volatility on the flower export earnings. The study used quarterly data from 1996 to 2013. In measuring exchange rate volatility of the Kenyan Shilling against the U.S dollar, this study employed the GARCH methodology to estimate the volatility.

The study then employed the Vector Error Correction Model in its analysis and the results revealed that there is a negative short run relationship between the flower export earnings and VREER. This means that changes in Real Effective Exchange Rate do have a significant impact on the Flower Export Earnings. From the study, it is also established that there is no significant relationship between the foreign income and the flower export earnings. This could be attributed to the fact that foreign income is the GDP of the area importing the flowers, which in this case is the European Union thus it does not have much of an influence on the export earnings of Kenya. The study also establishes a positive relationship between flower export earnings and REER. It is also established that both VREER and REER have a short run causality relationship with the dependent variable which is the flower export earnings.

The Wald test and the Block Exogeneity test were used to establish the short run relationship and it is also seen that there is no long run relationship between the variables. This is due to the fact that the changes in the exchange rate cause an immediate change in the export earnings due to the fact that the commodities are traded with these currencies thus the effect is immediate as compared to other factors.

To smoothen the impact of the exchange rate volatility on Kenyan exports in the short run, it is important for the monetary authorities to intervene to stem excessive volatility which is harmful to exports. The exportation of flowers should be sensitized on the importance of derivative contracts with their importers to hedge the impact of the exchange rate

volatility. Finally, an export-oriented economic policies policy should be pursued and supported by modernization of the flower production and flow chain.

5.2 LIMITATIONS OF THE STUDY

Though the study was successful, there were a few problem encountered and limitations which include the following:

1. Initially, the study was to use the REER of the Euro against the Kenya Shilling but there was insufficient data on the Euro seeing as the Euro was formed in 1999.
2. There was no data before the year 1995 concerning Flower Export Earnings because the Kenya Flower Council only has data going back to 1995.
3. Variables such as flower exports and foreign income had to be interpolated to become quarterly due to the fact that the only data available is annual.

5.3 FUTURE AREAS OF RESEARCH

Scholars could investigate the reason why the relationship between the VREER and flower export earnings is negative. Also, it could be researched further what the effects of VREER are on the economy as a whole.

APPENDICES

APPENDIX 1.

Steps involved in developing VECM model.

1. Lag selection:

Table 16: Lag selection

VAR Lag Order Selection Criteria

Endogenous variables: FLOWER_EXPORT_EARNINGS_L VREER

FOREIGN_INCOME REER

Exogenous variables:

Date: 11/14/15 Time: 02:04

Sample: 1996Q1 2013Q4

Included observations: 70

Lag	LogL	LR	FPE	AIC	SC	HQ
1	782.3050	NA	3.64e-15	-21.89443	-21.38049	-21.69028
2	993.3544	373.8590*	1.39e-17*	-27.46727*	-26.43938*	-27.05898*

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

This shows that according to all the lag length criteria (LR, FPE, AIC, SC and HQ), the optimum lag recommended is 2 as seen by the star next to the values on the 2nd lag column. Thus we shall use lag 2 in the VECM model.

2. Johansen Test of Cointegration

There are preconditions to carrying out this test which are that the variables must be non-stationary at level but when we convert all the variables into first difference, then they will become stationary and all the variables must be integrated of the same order which has already been proven in the unit root test.

Seeing as the cointegration test has already been done in table 9 and there is indeed cointegration, then we do not run the test again.

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