

**THE EFFECTS OF CHANGES IN EXCHANGE RATE ON HORTICULTURAL
EXPORTS EARNINGS IN KENYA**

BY

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DECLARATION

I hereby assert that this proposal is my own work, and it has not been given to any other institution of learning for the award of any form of degree. Secondary sources employed herein have been acknowledged as borrowed ideas from authors and scholars in its completion.

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DEDICATION

I dedicate this work to my parents Mr & Mrs. Kosgei for the immense support they have provided me throughout my studies. Special appreciation to my siblings as well, they have always challenged me to scale higher.

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Sincere thanks to my supervisor Dr. Japheth Awiti for the guidance throughout the project period. I appreciate my friends for the prayers and the words of encouragement. I recognize and thank the school of Economics for the support you accorded me throughout the study period.

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LIST OF ABBREVIATIONS

ADF – Augmented Dickey Fuller

ARDL- Autoregressive Distributed Lag Model

CBK – Central Bank of Kenya

GDP – Gross Domestic Product

ECM – Error Correction Model

ECT – Error Correction Term

FDI - foreign direct investment

KES – Kenya Shillings

LR – Long run

RER – Real Exchange Rate

SR – Short Run

ABSTRACT

The study evaluated the effect of real exchange rate (RER) on the horticultural exports. Empirical evidence revealed that when the RER increases, it implies that the domestic currency depreciates against the foreign currency causing the Kenyan horticultural exports to be cheaper in the international market. As a result, the exports earners more. The study employed the ARDL model after finding that the series were integrated bot at level while other at first order. After conducting the ARDL bound test, the study established that real exchange rate had no co-integration among the other variables in the model. Having establish absence of long run relationship, the study settled for the ARDL in the short run. However, the results were statistically insignificant in line with the Fountas and Aristotelous, (2005)'s findings that more often than not the short run effect of the real exchange rate on the exports in general is usually insignificant. Theoretically, the insignificant findings is not a surprise especially for the risk averse exporters. Increasing the utility of export by increasing the average profits among the risk averse exporters can be approximately offset by te utility decline forllowing the increased uncertainitoes in profits. As a result, a change in the exchange rate volatility can lead in no effect on the trade and in this case horticultural exports. The study also established that for this particular data, there was no unidirectional causality from exchange rate to horticultural. However, the study established the the horticultural exports granger caused the real exchange rate. The study recommendated the gorvernment to put in place monotoring measures to ensure stability in the real exchange rate that would insitil confidence among the riskl averse exporter.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Kenya's horticultural sectors has largely transformed for the half a decade. Currently, it is the third largest foreign exchange earner after tourism and tea exports. The sector contributes over 150 billion of shillings annually and has created over 350,000 employment opportunities boosting livelihood of millions of Kenyan households. The horticultural produce mainly comprises of fruits, vegetables, and flowers. Within the floriculture sector, 95 percent of the local produced is exported to the international markets (Dincera & Kandilb, 2011). The production has also been steadily increasing due to several factors such as the technical training available to farmers, use of advanced technologies and increased accessed to external markets. The growth within the floriculture sector has remained steady despite the challenges resulting from the COVID-19 pandemic. For instance, in 2020, Kenya earned a total of ksh 108 billion from the flowers out of ksh 151 billion worth of export in the horticultural sector (FPEAK, 2021). The sector registered an increase of 4.8% in export earnings from 104 billion registered in 2019 despite a decrease in the production volume, where the sector produced 142 million Kilogram in 2020 from 173 million kilogram in 2019.

In this study the researcher is interested in understanding if the fluctuations in the foreign exchange may have played increasing the amount of export registered by the floriculture sector. The fluctuation of exchange rate mainly occurs in prices of currency whose monetary value system allows prices to be dictated by the competitive market forces. Among these currencies the exchange rate system is controlled by the demand and supply market forces, a system that is also called flexible or floating exchange rate. The interaction between exports and the exchange rate is critical from a policy perspective. The country exchange rate in any country forms a core determinant for the export earning along with other cross-border trading activities.

The rate of exchange rate remains an area of interest among researchers despite the increased number of literatures largely because it signals a country's level of competitiveness with respect to the rest of the world. It also serves as an anchor towards creation of a sustainable macroeconomic balances both internally and externally for the purpose of both medium- and long-term development. When a country has a high exchange rate, it tends to decrease the number of receipts received by exporters, which tends to decrease the value of exports earned. Contrarily, the exchange rate tends to raise the amount of receipt thereby increase the value of the export earning received. Hence, the value of exports is likely to be negatively or positively impacted depending in the direction of the exchange rate fluctuations. Furthermore, understanding the impact of exchange is critical since it can lead to adverse effect on the exporters by discouraging them from investment, trade, and innovation. It can also lead to hindrances of other potential firms from joining the export market. Besides, increase in unexpected fluctuation in exchange rates can results in risk-averse agents reducing their international trade activities and switching to other non-tradeable sectors. Hence, a presumption of the negative impact that can results from exchange rate on the export tends to be routinely employed by the proponents of fixed or managed exchange rates.

1.2 Exchange rate in Kenya

The principal mandates of the CBK under Section 231 of the constitution involves formulating and implementing monetary policies that derived stability in general prices including the exchange rate. After gaining the independence, Kenya began using the fixed exchange rate and transitioned to the crawling peg regime in 1980. Later the government opted for the floating exchange rate to offer effective signals to the economic agents both in the domestic and international markets (Central Bank of Kenya, 2020).

Despite the global financial markets uncertainties following the outbreak of the COVID-19 pandemic, the foreign exchange rate market has remained relatively stable. The foreign exchange stability was supported by the adequate reserve buffers along with narrowing of the current account deficits in Kenya from 5.4 percent of GDP to 4.7 percent of GDP November 2020. The reduction in the current account deficit resulted from improved exports from tea and horticulture, decrease oil imports and resilient remittances. The CBK statistics show that as at the end of calendar year 2020, the Kenya foreign exchange reserves were approximately USD 7.7 billion equivalent to 4.76 months of import cover. The inflation rate during December 2020 was 5.6 percent within the inflation target which was an indication of muted demand within the economy.

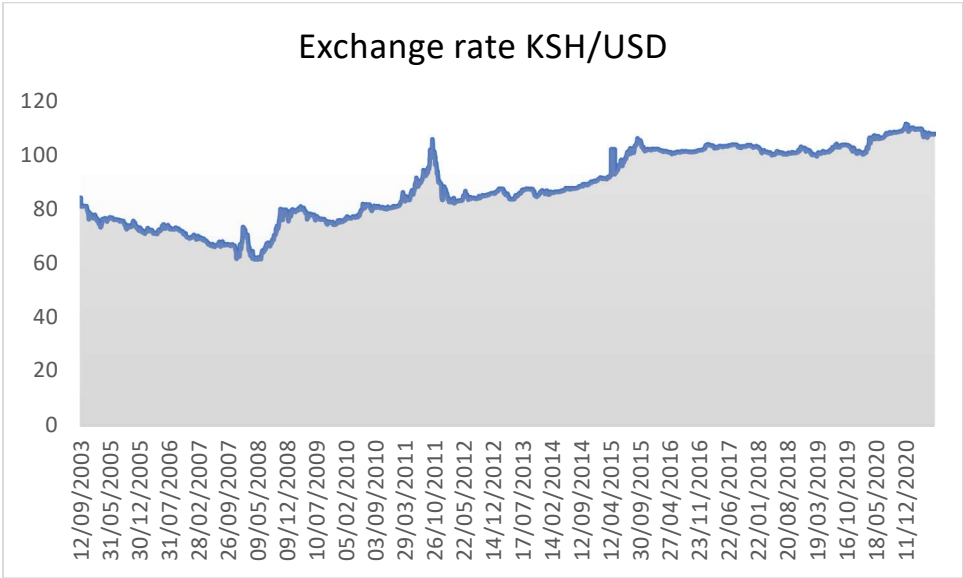


Figure 1: Exchange rate for Ksh/USD adopted from the CBK statistics.

However, during the period under the study, the Kenyan shilling has experienced fluctuations against the USD dollar. The exchange rate variations expose the country to the exchange rate risk that has the potential of loss or gain depending on the movement of the RER (International Monetary Fund, 2019). Previous researchers have employed the several theories to analyse the

effect of the RER fluctuations. The models include the International Fisher Effect, the purchasing power parity theorem, the Balassa-Samuelson model, and Mundell-Flemings model.

1.3 Horticultural export in Kenya

Exports play a significant role in stimulating the economy through several ways. Foremost, the access to larger international markets allows export to induce economies of scale since more production can take place at a reduced price. Secondly, horticultural exports provide a link between the producers and the consumers of the commodity. In Kenya, 95 percent of the floriculture produced is exported to the international markets, which implies that without exports, the demand for the floricultural produce in Kenya would be low. Thirdly, exporting commodities requires higher standard of production calling for the need to adopt superior technologies that enable the produces to match the quality required to compete in the international markets. The higher return obtained from the exports has also led to improved productivity in terms of human resources through specialisation which increases efficiency with time (Obayelu, & Salau, 2010).

Kenya has the potential to increase its horticultural production given the favourable climate and the technical knowledge among other resources such as land. Hence, fluctuations in the exchange rate can affect the horticulture in two main ways. From the production side, reduction in Kenya exchange rate can result in reduction in resources allocated towards horticulture production since the goods will be expensive to the foreigners leading to reduction in both exports volume and earnings. From the consumption side, reduction in production will cause the foreigners to spend

more on the substitute of the commodities, leading to further decline in export earnings. Based on the statistics in figure 2, the value of horticulture exports has been increasing over time.

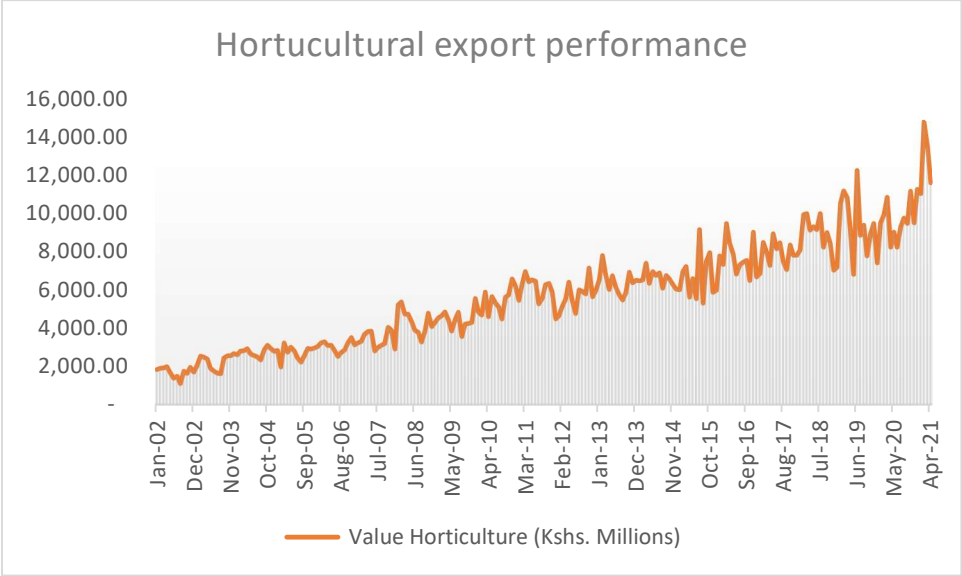


Figure 2: Horticulture export performance adopted from the CBK statistics.

1.4 Research Problem

Kenya has a floating exchange rate that is determined by the market forces. Intuitively, this exchange rate allows the currency to appreciate or depreciate depending on the demand and supply of the currencies. When the Kenyan shillings depreciate against the other currencies in the world, the Kenya exports becomes competitive since the prices of the export reduces offering the need to export diversify. Conversely, a depreciation in the RER causes the exports to be uncompetitive and thus discourages the need for diversification of the exports. For a long time, countries have identified export diversification as a way of mitigating themselves from the vulnerability resulting from exchange rate volatility. Export diversification involves value addition on the existing goods and introduction of new ones along with identification of new export markets. The need for diversification emanates from the recent slump in the international process of the export goods and

services. However, the fluctuations in exchange rate causes uncertainties in the exports earnings leading to a severe disequilibrium in the economy.

As a result, exporters have different reaction to the exchange rate volatility. Most of the previous studies assume that exchange rate and export earnings have a linear relationship, which implies that exchange rate depreciation or appreciation will impact the export earning with the same magnitude. However, researchers have questioned the linearity assumption (Bahmani-Oskooee & Mohammadian, 2016). A study by Shin et al. (2014) found that Australian's dollar real effective exchange rate had asymmetric effects on domestic production in both the short run and long run. The study also found that both the depreciation and appreciation of the Australia dollar had an effect on domestic production in the short run but only the appreciation of the Australia dollar had a long run effect, a unique finding that formed the basis for this study.

Besides, previous literature have not found a conclusive effect of the exchange on exports. For instance, according to Khalighi & Fadaei (2015) study, real exchange rate and the Iranian dates export has a positive relationship. However, Baldwin, Skudelny and Taglioni (2005) study found that exchange rate fluctuations resulted in a negative effect on export earning, which implied that increasing the exchange rate resulted in decrease in export earnings. Hence, this study will seek the effect of exchange rates using Kenya specific data and determine whether the effect is symmetric or asymmetric since to the best of my knowledge no research has investigated the latter using the most recent data in Kenya.

1.5 Research Questions

- a) What is the effect of RER on horticultural export earnings in the short run?
- b) What is the effect of RER on horticultural export earnings in the long run?

- c) Does RER granger cause horticultural export earnings?

1.6 Research objective

The study mainly aims to determine the effect of RER on the export earnings from the horticultural sector.

The specific objectives of the study will be:

- a) To find out the effect of RER on horticultural export earnings in the short run and long run.
- b) To establish whether the effect of RER on horticultural export is symmetrical or asymmetrical.
- c) To find out the granger causality between RER and horticultural export earnings.

1.7 Significance of the study

The seventeenth goal on the United Nations' Sustainable Development Goal (SDG) is on partnership and its eleventh target is to double the export from developing countries. Kenya falls under the developing or emerging countries and the SDG 17 aligns with its Vision 2030 on export promotion and diversification (International Monetary Fund, 2019). Insight from the study will play a key role on developing policies that impact not only horticultural export but also the total exports in the effort to increase the Kenya's global share of exports and actualise eleventh target of the SDG. Besides, the study finding will assist in shaping the decision of the investors in horticulture by boosting their confidence when making decision when faced with the exchange rate uncertainties. Finally, the study will add to the existing body of literature for the benefit of both researchers and scholars.

1.8 Organisation of the study

The study comprises of five chapters, namely the introduction, literature review, methodology, data analysis, conclusion. The introduction provides the background of the study establishes the problem the study will seek to solve. The report will proceed to establish previous studies related to this research that have been conducted and possible thoughts that brings insights to paper under chapter two. In chapter three, the paper will define the method or approach that the study will used to transform the raw data along with the methods to obtain the data. In chapter four, the report will reveal the analysis of the data and provide the finding. Finally, the paper will offer a conclusion based on the study's objectives and possibly offer recommendations regarding policy formulation along with possible area to undertake research related to the study objective.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This section describes both the theoretical and empirical reviews from past researchers on the effects of changes in RER and the exports earnings.

2.2 Theoretical Review

Several theories can explain the movement in the RER and their effects on exports and the economy as whole. This study chooses to elaborate on four of them which are the International Fisher Effect, Purchasing Power Parity theorem, Balassa-Samuelson model, and the Mundell-Fleming model.

2.2.1 The Mundell Fleming Model (MFM)

MFM also referred to as the IS-LM- BoP model was developed by Marcus Fleming and Robert Mundell in the early 1960's is an extension of the IS-LM model. The model incorporates the role of capital flows in the open economy Keynesian model, thus offering a comprehensive understanding on determining the exchange rate. MFM directs that the effect of economic policy such as monetary, fiscal or trade depend on the country's exchange rate system in operation (Hsing, 2020). It also reveals the interaction between the money market and the good markets and assumes a fixed price level.

The model considered perfect capital mobility in a small open economy where small economy references a country that cannot change the global interest rates through its lending and borrowing activities. Hence, the adjustment in the macroeconomic environment occurs due to fluctuations in the exchange rate. The model predicts that a country's economic behaviour depends on the adopted exchange rate system. In a floating exchange rate system, where the central bank does not

influence the foreign exchange market, the net export depends on the exchange rate, or the price of the foreign currency based on the domestic currency (Hsing, 2020). Since the MFM assumes a fixed price levels both in the abroad and home market, the nominal and RER are the same. Therefore, increasing the RER lowers the net exports, creating a further domino effect by reducing the planned expenditure and consequently the income falls.

2.2.2 Purchasing Power Parity Theorem

The Purchasing Power Parity (PPP) model can be traced back in 16th century to the Salamanca School in Spain, however its modern use in determining the exchange rate was proposed by Gustav Cassel's work in 1918 (Schembri & Lafrance, 2002). Cassel proposed the model to be used as a means of returning the gold standard systems from the pre-World War I exchange rate since the hostility had ended. The adjustment was necessary to control the variations in inflation rates experienced by some of the countries that had left the gold standard systems during and after the war.

The simplest and strongest form of PPP is the absolute PPP that predicts that adjusting the exchange rate is necessary to equate the prices of goods between countries (Schembri & Lafrance, 2002). The absolute PPP assumes that the real exchange rate is constant although this concept does not hold in practice due to transactions costs and assets and money market shocks. Besides, the aggregate price levels are sticky. Hence, the relative PPP, which is regarded as a weaker version of PPP, posits that the exchange rate should be adjusted in the end to account for the varying inflation rates between countries. The relative PPP, thus, becomes useful when explaining the movement of exchange rate in countries where the monetary shocks and not the real shocks predominate.

2.2.3 Balassa Samuelson Model

The Balassa-Samuelson effect, developed by economists Paul Samuelson and Bela Balassa in the 1960s, proposes the “Penn effect” which implies that prices of consumer goods tend to be systematically higher in countries that are more developed compared to the less developed countries. The variation in prices can be explained by the differences in productivity levels in the two countries especially on the sectors with tradable goods which affects that prices and wages of the sectors with non-tradable goods (Devereux, 2014). Therefore, the productivity gains within the tradable sector increase the real wages not only in the tradable sector but also in the non-tradable sectors leading to the overall increase in the price levels in the economy and as a result the real exchange rate appreciates.

2.2.4 International Fisher Effect (IFE)

IFE also refers to as Fisher’s open hypothesis was developed by the Irving Fisher, an American Economist in 1930. The theory suggests that the spot exchange rate changes equally but in opposite direction with the interest rate differential. According to the model, the different interest rates occurring in various market can lead to a flow of funds from markets with low interest rate to those markets with higher interest rates. Hence, a country’s currency with a higher nominal interest is likely to have higher inflation and therefore likely to depreciate against another country’s currency whose nominal interest rate is low since higher interest rates reflect the country’s inflation.

2.3 Empirical Review

Several studies have shown the effect of the exchange is to horticultural exporters and the exporters at larger but still there has been no consensus. Some have found a positive relationship between

RER and exports (Khalighi & Fadaei, 2015; Dube, Ozkan, & Govindasamy, 2018). Other studies have found a negative relationship (Oiro, 2015; Mwangi, 2015)

Changes in the exchange can deteriorate the value of the export earnings and hence call for the need of appropriate exchange rate stabilization policies. Khalighi & Fadaei (2015) analysed the effects of exchange rate on the Iranian dates exports using the data 1991 to 2011. The study noted that the Iranian government introduced exchange rate unification policy in 2003 after suspended the outsourcing the foreign policy. Although the study employed the Ordinary Least Squares in their analysis, they also accounted for the structural changes. The study established that RER had a positive relationship with the Iranian exports since the coefficient of exchange rate was 0.87 and significant at 1 percent confidence level. Further the study, establish that the introduction of the exchange rate unification policy resulted in reduction in Iranian exports, against that belief that fixing the exchange rate can lead to certainty among the exports and promote trade. In this study, the cost of fixing the exchange rate may have discouraged the exporters and directed the resources away from their most efficient use due to distortion of the market signals.

Sheldon, Mishra, Pick, & Thompson (2013) found that uncertainty in exchange rate resulted in a negative effect on the US bilateral trade involving the fresh fruits, but no effect was evidenced for the fresh vegetables using the moving standard deviation. The study used a panel data for 26 countries that accounted for eighty percent of US fresh fruit trade for the period between 1976 and 1999. Application of the export gravity equation nullified the no effect on the fresh vegetables and concluded that uncertainty in exchange rate led to a negative effect on US fresh vegetable trade just like the fresh fruits.

Dincer and Kandil (2011) investigated how changes in exchange rate affected the export sectors based on monthly data for two separate periods in 1996-2002 and 2003-2008. The first period data

was a representative of the performance of the export and RER after the integration of the Turkey to the EU custom union while the second period was a representative of the structural changes to enhance the recovery process following the 2001 crises. The study anticipated that the competitiveness of the export is highly dependent on the exchange rate fluctuations. For instance, when the currency depreciated unexpectedly, it could stimulate the growth of exports due to induced competitiveness. The study found that unanticipated appreciation of the currency led to a negative cumulative effect on exports representing nine percent. As a result of decreasing level of competitiveness, the exports growth was reduced as producers contracted their activities. For the period 1996 to 2002, the study found that there was no significance evidence on export reduction with respect to uncertainty in currency depreciation. The study also found that there was no evidence for significant negative effect on export due to anticipated appreciation of the currency. However, during the second period, in 2003 to 2008, there was significant adjustments in exports following the random shocks in exchange rate. Overall, the random changes in the equilibrium exchange rate resulted asymmetric effect on the export growth in Turkey.

Dube, Ozkan, & Govindasamy (2018) analyzed the performance of exports within the horticultural sub-sector in Ethiopia. The country, just like many other Africa countries relied heavily on primary agricultural commodities and were highly affected by the changes in the market prices that exposed them to instability in their foreign earnings. The study was conducted to justify the need to diversify exports and transition from traditional to high value horticultural commodities. Dube, Ozkan, & Govindasamy (2018) proposed to analyze the factors affecting the horticultural exports using time series data for the period between 1985 and 2016. The study employed the ARDL test to analyze both the short run and long run relationships where the ECM coefficient revealed a negative and significant confirming presence of cointegrating equations. The study registered a

coefficient value of 0.42 indicating that 42 percent of the disequilibrium would be adjusted within the first year and the total equilibrium would reach after 2.12 years.

Based on the study finding, FDI, real effective exchange rate, GDP and structural breaks significantly affected the horticultural earnings both in the short and long run. The long run coefficient for the real effective exchange rate was 9.232 implying that one percent increase in the real effective exchange resulted in a 9% increase in export earnings. Similarly, the short run responsiveness of the horticultural exports shown that one present increase in RER resulted in 14% increase in export earnings. Generally, the study revealed that depreciation of the Ethiopia currency affected the exports positively by increase in export earnings.

Oiro (2015) study observed that a mixed results on the effect of RER on the exports where the study revealed a negative and significant effect on horticulture, positive and significant effect on tea exports but negative and insignificant effect on coffee effects. The study employed a bilateral approach by examining the exports responses from a sample of 136 countries and analysed the results using the Bounds testings and ARDL model. The study found that the changes in exchange rate increased the uncertainty with the exporters and discourages trade. Based on the finding, a unit increase in the changes with the exchange rate reuted in reducing the hortucultural exports by 0.1 percent in the long run. Furthermore, the study established that increase in importers income resulted in an increase in the export earning of the horticulture.

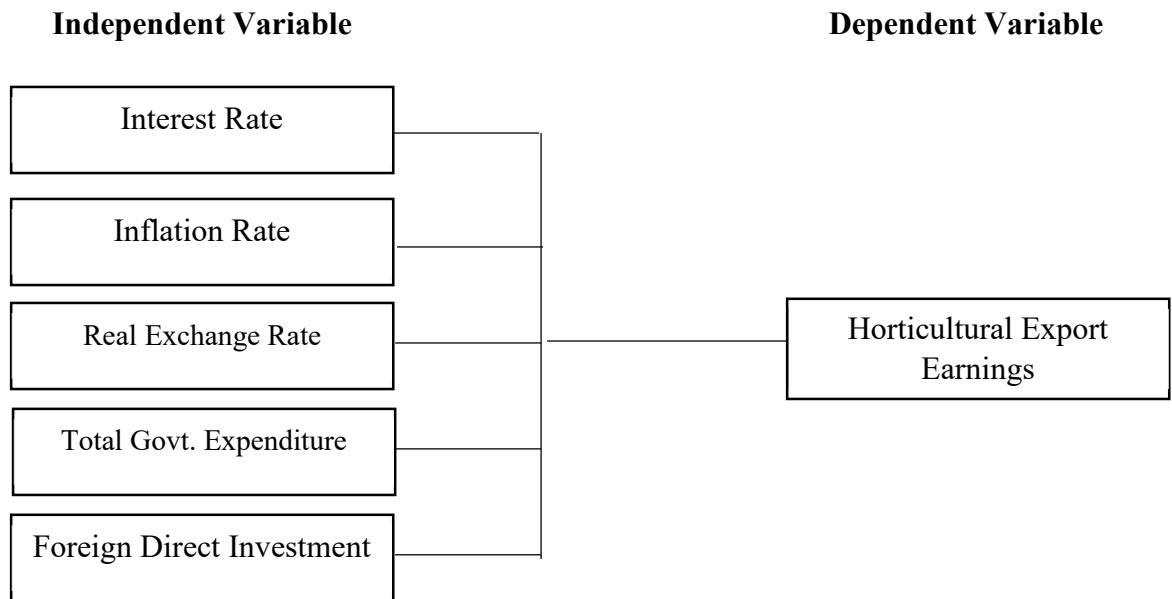
Mwangi (2014) found that changes in RER had a negative long run effects on the Kenyan French beans exports to European Union Market, with an elasticity of 2.3. The elasticity implied that an increase in the changes of RER resulted to more than proportion rediction in the French beans exports to the EU market. The study was modelled using the generalised autoregressive conditional heteroskedasticity based on the data for the period between 1990 and 2011. The coefficient of the

short run coefficient was negative 0.77 and statistically significant which confirmed the stability of the equilibrium long run relationship. Further study found that hedging the currency exposure would safeguard Kenyan's exports firms against the risks emanating from exchange rate volatility.

In another study, Karuraa (2017) performed a research study on how the changes in exchange rate were affecting the export earning using times series data from Kenya for the period between 1970 and 2015. The study established a unique long run relationship between the export earnings and RER using the Vector Autoregressive model with elasticity of 0.71. The study concluded that the responsiveness of export earning to the exchange rate was positive and inelastic. The findings of the short run dynamics revealed that the speed of adjustment to the equilibrium level was 56 percent from the coefficient of the vector error correction model, which implied that 56 percent of the disequilibrium would be corrected and eliminated in one year.

2.4 Conceptual Framework

The study formulated its conceptual framework based on both theoretical and empirical underpinnings that determine the effect of RER on the export earnings. Most of the studies evaluated the impact of RER on export along with independent variables such interest rates, inflation rates, and foreign exchange. The study also established that introducing the foreign direct investment was also likely to intensifying the finding of the model.



2.4 Overview of the Literature and Research Gap

Khalighi & Fadaei (2015) study used dynamic approach to address the problem by introducing the lagged variables of the exports yet proceeded to use OLS, a statistic approach. Hence, the finding may have had spurious results. Karuraa (2017) study would have been generalised for Kenya however, the study used the market liberalisation as a proxy for exchange rate yet the data for the exchange rate is available. Hence this study will employ the available RER data from the CBK to conduct the study. The previous studies have also shown a mixed finding on the effect of exchange rate where some have shown a negative while others registering a positive effect of exchange rate on exports. Hence, these studies seek to bridge the gap by conducting a Kenyan specific study with the most recent data to find out the effect of exchange rate fluctuations on horticultural exports.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter will cover the research methodology employed in conducting the study. It will represent background information on the components involved in conducting the research. Among these components will be the research design for the research, sample size, data collection and the technique employed to analyse the data.

3.2 Research Design

The study employs descriptive research design to evaluate that study's objectives. The descriptive design offers a detailed phenomenon of a station based on the characteristics and data presented. The researcher chooses the descriptive design since it allows for generalisation of the findings of the selected sample to the population. For this study, the approach will employ a quantitative analysis due to the data generation process.

3.3 Target population

The study will use secondary data collected from mainly from the CBK statistics and publications for the period between 2000 and 2021. The time series data will be collected on monthly bases so as to generate a series over 200 that enables a conclusive and representation analysis of multiple periods.

3.4 Model Specification

Based on the literature reviewed, the study will use a structural relationship to evaluate the effects of RER fluctuations on the horticultural exports. The study borrows from the Khalighi & Fadaei (2015) model that suggests a long run relationship between exchange rate volatility and horticultural

exports. Based on the literature reviewed and the gaps identified , the study proposed to modify and adopt an export demand model, written as follows:

$$\ln \text{EXP} = \alpha + \beta_1 \ln \text{INTR} + \beta_2 \ln \text{MONS} + \beta_4 \ln \text{INFR} + \beta_5 \ln \text{RER} + \beta_3 \ln \text{TDS} + e_t \dots\dots(7)$$

Where,

$\ln \text{EXP}$ represents the natural logarithm of the horticultural export's earnings

$\ln \text{INTR}$ represents the natural logarithm of interest rate

$\ln \text{MONS}$ represents the natural logarithms of money supply

$\ln \text{INFR}$ represents the natural logarithms of inflation rate

$\ln \text{RER}$ represents the natural logarithm of RER

$\ln \text{TDS}$ represents the natural logarithms of total debt stock in Kenya

α represents the intercept coefficient that shows the value that the dependent variables assumes when the value of the independent variable is zero.

e_t represents the error terms that accounts for all the unknown variables that may have impacted the horticultural export earnings.

The study proposes to use the log linear form of the model to analyse the data using the ARDL to examine cointegration and reveal if there a short run and a long run relationship. The advantage of using ARDL is the ability to handle variables with mixed order of integration. Besides, it is also easy to perform and integrate with a single equation arrangement and can assigned different lags to the variables. A dynamic ECM was employed to find out the long run and SR effect using the ARDL model.

3.5 Data Analysis

In analysis the data, the study will perform the pre-tests analysis to ensure that the results will not be spurious. Such tests and analysis will include the correlation tests and the stationarity tests. The study will the conduct a cointegration tests and establish the suitable model for the time series data. Afterwards, the study will perform several diagnostic tests to establish the reliability and suitable of the model and the results.

3.5.1 Pre-test analysis

The study will test trend stationarity of the data on variables in the specified model using ADF test. If the test statistics falls below the critical values of the Dickey-Fuller test, the study will fail to reject the hypothesis of the unit root. Hence, this indication of non- stationarity in data will imply that the study will not need to employ the convection method of ordinary least square (OLS) technique but necessitate the need to employ the ECM.

3.5.2 Statistical model selection

If the unit root results reveal that the series are integrated at level and at first difference. The study will opt for the ARDL model. The study will further perform a cointegration test and establish whether the variables have either a short run and a long run relationship or both. For the independent variables do not have cointegration, the study will perform a short run analysis using the ARDL. However, for the variables exhibiting presence of cointegration, the study will perform an Error Correction Model. For variables with no cointegration, the ARDL (p, q₁, q₂) model will be specified as follows:

$$\Delta \ln hort_t = a_{01} + \sum_{i=1}^p a_{1i} \Delta \ln hort_{t-1} + \dots + \sum_{i=1}^p a_{6i} \Delta \ln debt_{t-1} + e_t$$

For the variables exhibiting cointegration, the error correction model will be mathematically specified as follows:

$$\Delta \ln hort_t = a_{01} + \sum_{i=1}^p a_{1i} \Delta \ln hort_{t-1} + \dots + \sum_{i=1}^p a_{6i} \Delta \ln debt_{t-1} + \lambda ECT_{t-1} + e_t$$

Where the λ will represent the speed of adjustment parameter and will be expected to be with a negative sign.

The ECT will be extracted from the residuals based on the regression of the long run equation.

The coefficients of the model are represented by the a_{1i} , a_{2i} , a_{3i} etc.

3.5.3 Causality Checks

The study will also evaluate the causal effect between the value of horticultural exports and the real exchange rates within the ARDL model. The mathematical representation of the two equations will be as follows:

$$\ln hort_t = a + \sum_{i=1}^k \beta_i \ln hort_{t-i} + \sum_{j=1}^p \phi_j \ln exchange_{t-j} + \dots + v_{1t}$$

$$\ln exchange_t = \sigma + \sum_{i=1}^k \beta_i \ln exchange_{t-i} + \sum_{j=1}^p \phi_j \ln hort_{t-j} + \dots + v_{2t}$$

Where the dependent variable is a function of its lagged variable and the variables of the lagged of the exogenous variables. The 'k' and 'p' represents the optimal lag length of the dependent and independent variables while 'a' and σ represents the intercepts. β_i and θ_j represents the short run dynamic coefficients of the model's adjustment long run equilibrium while v_{it} were the equation's residuals.

3.5.3 Diagnostic Tests

The model was tested by several diagnostics to test its validity in explaining the empirical goal of the study. The test included serial correlation LM test that was performed to determine whether the model had serial correlation, autoregressive conditional heteroskedasticity that tested whether the model conformed to the assumption of homoskedasticity.

CHAPTER FOUR: DATA ANALYSIS

4.1 Introduction

The data was collected and cleaned in Excel before subjecting it into the STATA software. The study findings are presented using tables and figures in this chapter.

4.2 Descriptive statistics

The variable description for this study is as follows: Value of horticultural exports (Hortexp), Lending interests' rate (Interestr), and Inflation rates (Inflationr), Real exchange rate (exchanger), and Debt to GDP (debtog) presented in table 1.

Table 1: Descriptive Statistics

	Mean	Maximum	Minimum	Std. Dev.	Obs
hortexp	4,974.62	14,800.37	815.32	2,818.90	271
interestr	15.99	29.77	11.75	3.60	271
inflationr	7.69	19.72	1.59	4.16	271
exchanger	43.16	147.34	0.39	21.58	271
debtog	0.68	1.31	0.34	0.23	271

Source: Central Bank of Kenya and author calculations

The study evaluated 271 observations with 5 variables where the value of Horticultural exports was the dependent while the other four were independent variables. The difference between maximum variables and the minimum variables resulted to the range of all the variables. For instance, the maximum value of the value of horticultural exports was found to be 14,800 while its minimum was recorded at 4,974 leading to a range of 9,825.75. For the comparison purposes, the standard deviation of the value of horticultural exports was 2,818.90 which reveal the spread

of the variable's value from the mean was also analyzed. However due to the disparity in the units employed when gathering the data, the study opted to use their natural logarithms to standardize the variable units.

4.3 Correlation Matrix

Table 2: Correlation Matrix

	lnhortexp	lninterestr	lninflationr	lnexchanger	debttog
lnhortexp	1				
lninterestr	-0.4923	1			
lninflationr	-0.1681	-0.0294	1		
lnexchanger	0.2442	-0.1239	-0.0532	1	
lndebtog	0.6258	-0.4105	-0.2271	0.1361	1

Source: *Central Bank of Kenya and author calculations*

In Table 2, the study analyses the relationship that exists between different variables employed for this study. Presence of high correlation would be evidence in these variables if any two variables have a correlation coefficient that is 0.8 or above. According to table 2, all the variables had a coefficient below 0.7 which indicated that they did not have high correlation. Besides, while the lending interest rates and inflation rate registered a negative correlation with the value of horticultural exports, the real exchange rate and the debt to GDP were positively correlated to the value of GDP.

4.4 Unit Root Test

The unit root test also known as the stationarity test determines whether the regression series have their mean and variance being time invariant. In cases where the series are non-stationary at level,

a step wise differencing is conducted to transform them into stationary, where the series are integrated of order (d). This study employed the test of Augmented Dickey Fuller on all the variables individually and established that a unit root was present in in all the four variables apart from the natural log of real exchange rate which was stationary at level.

Table 3: Test for stationary (At Level)

ADF Test at Level					
series	t-statistic	p- value	1% level	5% level	10% level
lnhortexp	-2.4910	0.1176	-3.4580	-2.8790	-2.5700
lninterestr	0.3990	0.9815	-3.4580	-2.8790	-2.5700
lninflationr	-3.4960	0.0081	3.4580	-2.8790	-2.5700
lnexchanger	-10.3890	0.0000	-3.4580	-2.8790	-2.5700
lndebtog	-2.2890	0.1757	-3.4580	-2.8790	-2.5700

Source: *Central Bank of Kenya Statistics and author calculations*

For the four variables that were nonstationary, a step wise differencing was performed for the variables to remove the unit root and the results displayed in the table 4. The four variables became stationary at the first difference.

Table 4: Test for stationary (First Difference)

ADF Test (First Difference)					
series	t-statistic	p- value	1% level	5% level	10% level
lnhortexp	-11.9770	0.0000	-3.4580	-2.8790	-2.5700
lninterestr	-10.9530	0.0000	-3.4580	-2.8790	-2.5700
lninflationr	-10.9530	0.0000	-3.4580	-2.8790	-2.5700
lndebtog	-11.9770	0.0000	-3.4580	-2.8790	-2.5700

Source: *Central Bank of Kenya Statistics and author calculations*

4.5 Cointegration

To establish whether the time series had cointegration, a bound test was conducted, and the results displayed below. There are 5 independent variables in the equation. The decision criterion was to accept the null hypothesis of no level relationship if the F statistic was less than the critical value of the lower bound regressor and to reject the null hypothesis if the F statistic was greater than the critical value of the upper bound regressor. These results implied that a long-term relationship existed in the inflation and exchange rate variables used in the model between 1998 Augusts and 2021 March in Kenya.

Table 5: Results of Pesaran/Shin/Smith (2001) ARDL Bounds Test

Dependent Variable	F- statistics	Cointegration	Model
lnhort _t	F _{lnhort} = 1.518	No	Estimate ARDL (Short-run model)
	I ₀ = 2.45		
lninterest _t	F _{lninterest} = 1.278	No	Estimate ARDL (Short-run model)
	I ₀ = 2.45		
lninflation _t	F _{lninflation} = 4.28	Yes	Estimate ECM (Error correction model)
	I ₀ = 2.45		
lnexchanger _t	F _{lnexchanger} = 49.973	Yes	Estimate ECM (Error correction model)
	I ₀ = 2.45		
lndebt _t	F _{lndebt} = 1.684	No	Estimate ARDL (Short-run model)
	I ₀ = 2.45		

Source: *Central Bank of Kenya Statistics and author calculations*

4.5 Regression Analysis

The optimal number of lags to be used in the ARDL model was chosen based on the chosen through **Akaike information criterion (AIC)**. Since the variables of interest for this study were the value of horticulture exports and real exchange rates. The study evaluated only their regression output. From the bounds test, the value of horticultural exports as a independent value no cointegration hence the study opted for the ARDL as shown below.

Table 6: Equilibrium relationship analysis for ARDL model with the natural logarithm of the value of horticultural exports as dependent variable.

ARDL (1,0,2,0,0) regression			Number of obs:	269		
			F (7, 261):	487.12		
			Prob > F:	0.0000		
			R-squared:	0.4289		
			Adj R-squared:	0.827		
Log likelihood:	89.50216		Root MSE:	0.1761		
Inhort	Coef.	t	P>t	[95% Conf. Interval		
Inhort						
	L1.	0.9429	44.6	0.000	0.9013	0.9845
lninterest		-0.0999	-1.53	0.128	-0.2288	0.0289
lninflation						
	0--.	0.0023	0.06	0.955	-0.0761	0.0806
	L1.	0.0177	0.33	0.740	-0.0873	0.1227
	L2.	-0.0090	-0.22	0.824	-0.0883	0.0704
lndebt		0.0428	0.75	0.456	-0.0700	0.1556
ln2exchange		0.0002	0.62	0.538	-0.0004	0.0008
_cons		0.6760	2.18	0.030	0.0668	1.2853

Source: *Central Bank of Kenya Statistics and author calculations*

Based on the finding, it was evident that a percentage change in the first lag of value of horticultural exports was associated with 0.95 percent points increase in the value of horticultural exports on

average *ceteris paribus* at a one percent statistical significance level. Further, the study also analyzed the long run effect of the RER since based on the bound test results, the independent variable had co-integration. The results of the ECM are shown below:

Table 7: Equilibrium relationship analysis for ARDL model with the natural logarithm of the value of RER as dependent variable.

ARDL (1,0,2,0,0) regression		Number of obs:		269		
		R-squared:		0.4926		
		Adj R-squared:		0.479		
Log likelihood: -1351.7924		Root MSE:		37.3902		
D.						
Ln2exchange	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
ADJ						
Ln2exchange						
L1.	-0.98427	0.062016	-15.87	0.000	-1.10639	-0.86216
LR						
lnhort	-11.75812	4.48647	2.62	0.009	2.923836	20.5924
lninterest	-0.93585	14.5679	-0.06	0.949	-29.6214	27.74972
lninflation	-0.24765	4.359687	-0.06	0.955	-8.83229	8.336985
lndebt	3.66811	12.45941	0.29	0.769	-20.8656	28.20186
SR						
lninterest						
D1.	-54.101	78.72859	-0.69	0.493	-209.125	100.9231
LD.	-7.84101	79.51626	-0.1	0.922	-164.416	148.734
_cons	-15.4537	66.00647	-0.23	0.815	-145.427	114.5193

Based on the regression results, the study found that a percentage change in the value of horticultural exports was associated with 11 percent decline in the RER ceteris paribus. The study concluded that increased the horticultural exports would result in the appreciation of the currency.

4.6 Granger Causality

The ARDL model on table 6 found that there was no short run granger causality of the RER on the horticultural exports because the probability value was above 5 percent which implied that the coefficient was not statistically significant. The same results were inferred through the Wald Test where both the F statistics and the Chi statistics were not statistically significant. However, the study established that there was a unidirectional causality in the short run of horticultural exports on real exchange rate since the probability value were statistically significant at 0.009 as shown in the table 7. Similarly, the F statistics and Chi statistics also confirmed the results by showing statistically significant p-values.

4.6 Diagnostic Test

The study conducted two diagnostic tests to verify the validity of the results: autocorrelation test and heteroscedasticity test.

4.6.1 Heteroskedasticity Test

The study used heteroscedasticity test of white to examine whether square of residuals could be explained by exogenous variables in the model.

time series do not show serial correlation is important because it shows that the error terms are not correlated to avoid infringements of the assumptions of classical OLS.

Table 8: Autocorrelation Test

Durbin-Watson d-statistic (8, 269) = 1.992301			
Breusch-Godfrey LM test for autocorrelation			
lags(p)	chi2	df	Prob > chi2
1	0.008	1	0.9306
H0: no serial correlation			

Source: Results from STATA

The results indicated absence of serial correlation, which was also confirmed by the Breusch – Godfrey LM test for autocorrelations.

CHAPTER FIVE: INTERPRETATION AND DISCUSSION AND CONCLUSION

5.1 Introduction

In this chapter, the study offers a summary of the study, interprets the finding and makes recommendations on areas for further research.

5.2 Research Summary

Empirical evidence reveal that when the RER increases, it implies that the domestic currency depreciates against the foreign currency causing the exports to be cheaper, causing the importers to buy more. As a result, the volume of the exported goods increases along with the export earnings. According to Khaklighi and Fadaei (2015) found that a percentage increase in real exchange rate caused the Iranian exports to increase by 0.87 percent. However, Dincer and Kandil (2011) found that when unanticipated appreciation of the currency led to a negative cumulative effect on exports representing nine percent. The study implied that anticipating a decreasing of the exchange rate caused a reduction on the exports, which may be largely contributed by the decreased level of competition. Furthermore, Oiro (2015) revealed that increasing the exchange rate resulted in decreased in the horticultural exports on the long run. The varying finding on the effects of RER on horticultural exports necessitate a Kenya specific study using the Autoregressive Distribution Lag model.

Based on the ARDL Bound Test, the study found absence of co-integration for the horticultural exports. Absence of the long run effects implied that there was a likely that the RER had a short run effect on the horticultural exports. Upon conducting the ARDL short run effects, the study establish that results were insignificant which was in line with the Fountas and Aristotelous, (2005)'s findings that more often RER on the exports in general is usually insignificant. Based on

their studies using the panel data approach, they found that the impact of RER volatility on Denmark, Italy and France was statistically insignificant regardless of the manner in which they measured the volatility. Besides, the overall model had statistically insignificant effects. Theoretically, the insignificant findings is not a surprise especially for the risk averse exporters. Increasing the utility of export by increasing the average profits among the risk averse exporters can be approximately offset by the utility decline following the increased uncertainties in profits (De Grauwe, 2000). As a result, a change in the RER volatility can lead in no effect on the trade and in this case horticultural exports.

In addition, the study performed the granger causality test using both the t statistics of the ARDL model and the Wald test. The study confirmed that in Kenya, horticultural exports in 1999 to 2021, were largely impacting the exchange rate. The study found no causal effect of exchange rate on the horticultural since both test proved statistically insignificant. Further, the study analyzed the impact the horticultural exports had on the RER using the error correction model and established that a percentage change in the value of horticultural exports was associated with 11 percent decline in the RER *ceteris paribus*.

5.3 Conclusion and recommendations

Since the study established that changes in RER did not necessarily have an effect on the horticultural exports, which is explained by the uncertainty among the risk averse exporters, the study proposes that the government of Kenya should ensure adequate monitoring of the RER to ensure stability. A stable exchange rate will not only instill confidence among the exporters but also among the investors who will assist in booting the Kenyan horticultural exports.

5.4 Study Limitations and Recommendations for Further Research

Hence, one of the limitations of this study is data reliability since the study used the estimates from the CBK database which only captures horticultural exports that are sold through the official channels. Besides, the use of secondary data is a limitation to the study because it tends to be subject to dependability, errors, accuracy credibility, obsolescence, and validity issues. The objective of the study was to establish the effect that RER had on horticultural exports. Future studies can establish the effects of RER on horticultural exports by comparing between countries using a panel data approach. Furthermore, future studies can also determine the effect of RER on specific segments of the horticultural export using the primary data approach. Alternatively, future research can establish whether there exists misalignment of exchange rate and the impact the misalignment if it exists has on the horticultural exports. Future studies can also aim to use other foreign exchange rate since the current study focused of the conversation rate of US dollar on the Kenya shilling.

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