AN EVALUATION OF EFFECTS OF EXCHANGE RATE VOLATILITY ON KENYA'S FRENCH BEAN EXPORTS

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DECLARATION AND APPROVAL

This thesis is my original work and has not been presented for the award of a degree in any other university.

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DEDICATION

This thesis is dedicated to my wife Lucy and my children for their support, encouragement and

prayers during the course of my study.

Blessed be the name of the Lord.

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ACRONYMS AND ABBREVIATIONS

ADF   Augmented Dickey-Fuller

AIC   Akaike Information Criterion

ARCH   Autogressive Conditional Heteroscedasticity

ARDL   Autoregressive Distributed Lags

CBK   Central Bank of Kenya

CFA   *Communaute Financiere Africaine*

CPI   Consumer Price Index

CV   Coefficient of Variation

DF   Dickey-Fuller

DFID   Department for International Development

EAAPP   Eastern Africa Agricultural Productivity Project

ECM   Error Correction Model

EGARCH   Exponential Generalized Autoregressive Conditional Heteroscedasticity

EU   European Union

EUREPGAP   European Retailers Protocol for Good Agricultural Practices

EUROSTAT   European Statistical Database

EVAR   Extended Vector Autoregressive

FAOSTAT   United Nations Food and Agriculture Organization Statistical Database

GARCH   Generalized Autoregressive Conditional Heteroscedasticity

GDP   Gross Domestic Product

HCDA   Horticultural Crops Development Authority

HQIC   Hennan-Quinn Information Criterion

IFS	International Financial Statistics
IMF	International Monetary Fund
IV	Instrumental Variable
KARI	Kenya Agricultural Research Institute
KNBS	Kenya National Bureau of Statistics
KRA	Kenya Revenue Authority
KSHS	Kenya Shillings
LDC's	Least Developed Countries
LR	Likelihood Ratio
MoALF	Ministry of Agriculture Livestock and Fisheries
NACOSTI	National Commission for Science, Technology and Innovation
NARC	National Rainbow Coalition
OLS	Ordinary Least Squares
PP	Phillips-Perron
PML	Pseudo-Maximum Likelihood
SAP	Structural Adjustment Program
SCIC	Schwarz Information Criterion
US$	United States of America Dollar
(VAR)	Vector Autoregression

ABSTRACT

During the period after the adoption of a floating exchange rate regime in Kenya, there has been substantial volatility produced by the regime. In spite of the considerable foreign exchange contribution of Kenya's French beans subsector to the economy, the effects of exchange rate volatility on it remains unclear. This study evaluated the effects of exchange rate volatility on Kenya's French bean exports to major markets in the European Union. Monthly secondary data for the period January 1990 to December 2011 were used in the estimation of an export demand model. In measuring exchange rate volatility, this study employed the generalized autoregressive conditional heteroscedasticity (GARCH) model. The empirical results show a negative effect of exchange rate volatility on French bean exports and a stimulation of the exports by a shift in the exchange rate regime from fixed to floating. An increase in the level of income in the importing countries led to a rise in the volume of Kenya's French bean exports while an increase in the relative price led to a decrease in demand in the European Union. From these results, this study recommended that policy makers need to maintain a robust exchange rate regime that will ensure a non-volatile behaviour. Policy measures should be instituted aimed at mitigating the high exchange rate volatility to promote French bean exports from Kenya. In order to cushion exporters from high exchange rate volatility, the government could set up a export stabilization facility and develop forward market for French bean exports. There is need for policy makers to work towards increasing the volume of exports through diversification of market destinations by targeting local, regional and export markets as opposed to the current practice. This can be realized through regional and export market promotion initiatives as well as consistent compliance with quality standards. Innovative ways of meeting the standards and facilitation of smallholder farmers to meet these standards is required. In addition, French bean export

promotion incentives such as input subsidies and tax concessions need to be considered. To limit over-reliance on exporting as a major channel for French beans produce in Kenya, the government and key stakeholders in the industry need to be proactive in promoting utilization of French beans locally through value addition and creating awareness to the local consumers on the nutritive value of the vegetable coupled with research and extension initiatives. To reduce the relative price of French bean exports from Kenya, there is need for structural reforms that contribute to increased productivity and the enhancement of international competitiveness.

CHAPTER 1

INTRODUCTION

1.1. BACKGROUND

The horticultural sector in Kenya is among the leading contributors to the Agricultural Gross Domestic Product (AgGDP) at 33 percent. Being one of the major horticultural exports, French beans (*Phaseolus vulgaris*) therefore substantially contribute to the growth of the Kenyan economy by generating scarce foreign exchange earnings (Horticultural Crops Development Authority, 2011). It is estimated that more than 1 million people directly or indirectly benefit from the French bean sub-sector in Kenya (Lenne *et al.* 2005). About 34 percent of the Kenyan French beans produce is destined for the export market (Horticultural Crops Development Authority, 2011).

French bean is the second largest vegetable export in Kenya after the Asian vegetables and contributes to over 60 percent of all exported vegetables and approximately 21 percent by value of the horticultural export earnings (HCDA, 2011). In 2011 Kenya exported 18,725 tonnes of French beans valued at Kshs. 4.4 billion which accounted for 29 percent of foreign exchange earnings from vegetable exports of Kshs. 13.7 billion. This constituted 15 percent of the total value of fresh produce exports valued at Kshs. 91.4 billion (HCDA, 2011). The share of Kenyan French beans in the European Union market by volume was 19.2 percent, second to Morocco's 60 percent (HCDA, 2011).

The major export market for Kenyan French beans is the European Union, which takes 80 percent of the exports.; The United Kingdom (59%), France (20%), Germany

(7%), Netherlands (7%) and Belgium (3%) are the main markets of Kenya's French beans in Europe (Minot and Ngigi, 2004; HCDA 2011). Other markets include Middle East, South Africa, Norway, United States of America, Canada and Japan (HCDA 2011; Minot and Ngigi, 2004).

French beans are grown by both large-scale and small scale farmers in various parts of Kenya with the dominant areas being Central, Rift Valley and Eastern regions of the country. The production is mainly dominated by smallholder farmers, estimated at 50,000 growers, who are mainly households with less than 0.8 hectares of land (Minot and Ngigi, 2004). In 2011, the production of French beans in Kenya was 55,841 metric tonnes (MT) from 4,840 hectares, giving an average yield of 11.5 MT per hectare (HCDA, 2011). According to the Department for International Development (DFID) (2010), Kenyan smallholder farmers earn between $750 (Kshs. 67,500)[1] and $2,250 (Kshs. 202,500) per year from French beans. The average farm-gate price in 2010 was Kshs. 28.7 per kilogram, while the average export value of French beans per kilogram was Kshs. 235 (HCDA, 2010) in the same year. French beans were initially grown for export market, but over the years the vegetable has gained popularity in the domestic market with more than 66 percent of the produce being consumed locally. There is a huge demand for this vegetable in both fresh and processed form in European countries.

[1]The Kenya shilling average monthly exchange rate to the United States dollar was 90.00 in 2010.

However, in the local markets, there is limited but growing demand mainly in the urban areas where French beans are marketed through premium supermarkets, hotels, hospitals, children homes and other local institutions, or used as animal feed while some is hawked or retailed (Muriithi, 2008).

Exchange rate volatility is mainly a concern for firms that are linked to international markets and therefore exposed to currency risk (Raddatz, 2008). Thus, exchange rate volatility is an important factor in explaining the worldwide trade patterns. The exchange rate volatility creates risk in macroeconomic policy formulation, investment decisions and international trade flows (Musonda, 2008). Thus a volatile exchange rate is prone to sudden changes and is therefore unpredictable. High exchange rate volatility sends conflicting signals to investors as it creates vagueness and uncertainty about their profits.

Exchange rate volatility refers to the extent to which the prices of currencies tend to fluctuate over time (Cote, 1994). It captures the uncertainty due to unpredictable fluctuations in the exchange rates. Exchange rate volatility represents the short term fluctuations about their long term trends (Frenkel and Goldstein, 1989). It also entails short term (monthly, weekly, or even hourly) fluctuations in exchange rates as measured by their absolute percentage changes during a particular period (Williamson, 1985). Excess exchange rate volatility has been known to reduce the level of economic growth by creating uncertainty about the profits, employment, and poverty. It is also known to restrict the international flow of capital by reducing both direct investment in foreign operating facilities, and financial portfolio investment (McKinnon and Ohno, 1997). Additionally, increased exchange rate volatility may lead to higher prices of internationally traded goods by causing traders to add a risk premium to cover unanticipated exchange rate fluctuations (McKinnon and Ohno, 1997). Theoretically, exchange rate volatility is a source of risk and uncertainty which tend to impact negatively on risk-averse traders or exporters, thus reducing exports (Cote, 1994). Volatility in exchange rates cannot be ignored in the exchange

markets as both importers and exporters of goods and services are affected by exchange rate risk (Cote, 1994).

A floating exchange rate may or may not be volatile depending on how much it changes over time. Since floating exchange rates are free to change, they are generally expected to be more volatile (Clark *et al*. 2004). The floating exchange rates are described as volatile if they are fully consistent with fundamental economic variables, such as relative prices, and macroeconomic policies, while still responding excessively to shocks to those variables before adjusting gradually to new long term equilibrium levels (Dornbush, 1976). Exchange rate overshooting may occur because international capital markets adjust almost instantaneously to shocks, while goods and services markets adjust slowly (Dornbush, 1976). Although it is predictable, this type of exchange rate volatility is costly because increases the domestic impact of disturbances arising in foreign markets thereby worsening fluctuations in employment and domestic growth.

Floating exchange rates are volatile if they are primarily influenced by factors unrelated to fundamental economic variables. In this case, exchange rate movements would be largely unpredictable, especially, in the short term. Furthermore, the short term independence of exchange rates from fundamental variables can lead to long term exchange rate volatility that have a negative impact on growth. Theoretical and empirical work shows that volatile economic environments such as fluctuations of terms of trade, exchange rates, money supply and productivity have detrimental effects on economic performance (Frenkel and Goldsten, 1989).Conversely, given that fixed exchange rates are not supposed to change as per definition,

they have no volatility. Nevertheless, fixed exchange rates are frequently devalued or revalued, implying that they can change over time and may also be volatile.

Exchange rate volatility creates an unfavourable climate for exports because of the associated risk. An exchange rate risk implies that a business operations or an investment value will be affected by changes in exchange rates (Pugel, 2007). For example, if money must be converted into a different currency to make a certain investment, changes in the value of the currency relative to another currency will affect the total loss or gain on the investment when the money is converted back (Pugel, 2007). This risk usually affects businesses, but it can also affect individual investors who make international investments. This brings about uncertainty about the value of an asset, liability, or commitment due to uncertainty about the future value of an exchange rate.

Unless they cover themselves in the forward market, traders with commitments to pay or receive foreign currency in the future bear exchange rate risk. So do holders of assets and liabilities denominated in foreign currency (Pugel, 2007). Exchange rate volatility leads to change in export earnings and is therefore detrimental to growth of exports (Kiptui, 2008). The exchange rate predictability is of interest to investors, exporters, importers, retailers and consumers. These agents ultimately decide their actions based on the value of domestic currency and also on their volatility.

The exchange rate policy is important to a country's economic development and is a measure of international competitiveness. Kenya's exchange rate system has gone through various regimes over the years, largely determined by economic events prevailing in the country at a given time and particularly during balance of payments crisis. In the 1960s the country pursued a fixed exchange rate regime. In the 1970s the currency was moderately over-valued (Njuguna, 2000). Exchange rate controls were maintained from the early 1970s until 1990 when the exchange rate was liberalized. The choice of exchange rate regime a country implements is determined by factors such as the objectives pursued by the policy makers, sources of shocks affecting the economy, and the structural characteristics of the economy (Cooper, 2000). When the choice is made the government is required to adjust macroeconomic policies to fit the chosen exchange rate regime (Cooper, 2000).

During the period of fixed exchange rate regime, Kenya, like many developing countries, had to frequently devalue its currency in an attempt to reduce the negative effects that exchange rate volatility had on its economy (Kiptui, 2007). The adoption of a floating exchange rate system was an effort to make the exchange rate more aligned to the market determined equilibrium exchange rate, and thus eliminate exchange rate volatility (Kiptui, 2007). There is, however, no available evidence that success has since been achieved in realizing the objective for which the foreign exchange market was liberalized. High volatilities in nominal exchange rates have since characterized the Kenyan financial market (Kiptui, 2007).

Exchange rate volatility is a crucial element that needs to be considered for small countries like Kenya that depend extensively on trade. Kenya's main exports of tea, horticulture and coffee have been vulnerable to exchange rate volatility, but exchange rate risk hedging facilities in

Kenya are virtually nonexistent (Kiptui, 2008). As a result, exporters bear the consequences of unexpected changes in the exchange rates.

Existing empirical literature provides contradictory evidence on the effects of exchange rate volatility on exports. Some of the available empirical literature has argued that exchange rate volatility has a negative effect on exports. This group of studies purport that higher exchange rate volatility leads to reduction in exports by creating uncertainty on expected future profits from export trade. The studies consider traders to be risk-averse and hedging to be either expensive or impossible. Thus, exchange rate volatility leads to decrease profit from exports.

Other empirical studies contend that exchange rate volatility has a positive effect on exports. This group of studies provides empirical evidence in support of the opinion that increased exchange rate volatility leads to an increase in expected profits, therefore explaining a positive relationship between exports and exchange rate volatility. A few empirical studies argue that exchange rate volatility does not have any effect on the volume of exports. Therefore, available literature shows mixed results on the effects of exchange rate volatility on exports. The controversy is compounded by paucity of such studies in developing countries. Thus there exists a knowledge gap on the effects of exchange rate volatility on exports. Owing to the existing controversy in literature on the effect of exchange rate volatility on exports, there is need for further research to improve understanding of the effects of exchange rate volatility on exports.

The research problem addressed in this study is the controversy in literature on the effects of exchange rate volatility on exports. This study is an attempt to resolve the controversy in

literature on the effects of exchange rate volatility on exports, by evaluating the effects of exchange rate volatility on Kenya's French beans exports to the European Union market. The results from this study contribute to the body of knowledge on the effects of exchange rate volatility on exports and are useful to policy makers in designing appropriate exchange rate and trade policies.

1.2. STATEMENT OF THE PROBLEM

From the time when the fixed exchange rate system collapsed among the major industrial countries and the resultant adoption of the flexible exchange rate system, economists and policy makers have been concerned about the resultant volatility. Exchange rate volatility creates uncertainty with regard to the prices exporters would have to pay and receive in the future and therefore the knowledge of the effect of exchange rate volatility on exports is very important for the design of both exchange rate and trade policy.

However, the existing empirical literature provides conflicting evidence on the effects of exchange rate volatility on exports. It has been argued by some empirical researchers that exchange rate volatility has a negative effect on the level of exports. These empirical studies support the view that higher exchange rate volatility will reduce exports by creating uncertainty about future profit from export trade. According to these studies, traders are risk-averse and hedging is expensive or impossible. Therefore, exchange rate volatility will reduce profit from foreign trade.

On the other hand, other empirical researchers argue that exchange rate volatility has a positive effect on exports. These empirical studies provide evidence in support of the view that increased exchange rate volatility may lead to increased expected profits, thus explaining a positive relationship between exports and exchange rate volatility. In addition, a few empirical studies have found that exchange rate volatility does not have a significant effect on trade.

In the view of the existing controversy in literature on the effect of exchange rate volatility on exports, policy makers and market stakeholders continue to operate in poorly informed environments. Thus, there is need for research that can improve the understanding on the effects of exchange rate volatility on exports. The research problem addressed in this study is the controversy in literature on the effects of exchange rate volatility on exports. This study evaluates the effects of exchange rate volatility on Kenya's French beans exports to the major trading partners in the European Union using the export demand model and recent disaggregated time series data. The results from this study will contribute to knowledge on the effects of exchange rate volatility on exports and assist policy makers in Kenya and other countries in designing appropriate exchange rate and trade policies to boost their export sectors.

1.3. PURPOSE AND OBJECTIVES OF THE STUDY

The purpose of this study was to evaluate the effects of exchange rate volatility on Kenya's French bean exports. The specific objectives were to:

1. Assess and describe the trends in the volatility of Kenya's exchange rate since 1990.
2. Quantify the effect of exchange rate volatility on Kenya's French bean exports.

1.4. HYPOTHESES TESTED

The following hypotheses are tested:

1. That there is no volatility of the Kenya's exchange rate.

2. That volatility of exchange rates has no effect on Kenya's French bean exports.

1.5. JUSTIFICATION OF THE STUDY

French beans contribute substantially to the value of Kenyan vegetable exports. Despite the critical importance that French beans play in Kenya's economic development and concerns raised by exporters and policy makers the effect of exchange rate volatility on these exports is unclear. Exchange rate volatility is important it creates gains or losses to farmers and exporters. Unexpected losses discourage investment in production and affect traded volumes thereby reducing economic growth. Further, exchange rate volatility affects international price competitiveness of exports leading to loss of market share and backward linkages.

This study is an empirical analysis of the nature and magnitude of the relationship between exchange rate volatility and French beans exports in Kenya. Most of the previous studies have focused on the effects of volatility on aggregate trade flows, ignoring potentially different effects that may be observed at a more disaggregated level of analysis. Bini-Smaghi (1991) suggests that there may be different export demands and price elasticities across sectors and this may be a reason why aggregate studies have found little evidence of the effects of exchange rate volatility on trade.

Knowledge of the impact of exchange rate volatility on exports is of major importance for economists and policymakers in a small open economy, like Kenya's, which depends heavily on its trade with the outside world. Additionally, Kenyan exporters have faced rather volatile exchange rates during the last decade (Kiptui, 2008).The disaggregated focus is appealing because exchange rate volatility may affect export commodities differently so that aggregate effects may crowd out the effects in individual products, or perhaps cancel out different effects across sectors which would otherwise provide information as to how individual products are affected by exchange rate volatility (Bini-Smaghi, 1991). The findings of this study are useful in decision making on the appropriate exchange rate and trade policies to be implemented in order to improve Kenya's export performance. The study evaluates both the existence and the degree of exchange rate volatility that is crucial to consider for the implementation of appropriate trade policies to improve Kenya's trade balance. The study is important to exporters whose competitiveness is determined by the fluctuation in exchange rates.

More importantly, the study contributes to knowledge by shedding more light on the theoretical and empirical ambiguity on the effects of exchange rate volatility on exports. An understanding of the effects of exchange rate volatility on French beans exports from Kenya is of interest to researchers, farmers, exporters and policy makers. Indeed, producers and exporters of French beans in Kenya are not only concerned with the magnitude of the price they receive but also about how stable these prices are as it affects their earnings and long term investment decisions. However, the extent to which exchange rate volatility affects French bean exports from Kenya is not clear. This study contributes to macroeconomic research on for French bean exports in

Kenya using an export demand model. It adds to existing body of knowledge on effects of exchange rate volatility on exports.

1.6. ORGANIZATION OF THE THESIS

This thesis is presented in five chapters. Chapter one contains the background information on importance of French beans and controversy on effects of exchange rate volatility on exports. The chapter also covers the research problem, objectives of the study, hypotheses tested and justification. . Chapter two provides a literature review on the approaches to analyze exchange rate volatility and empirical studies on exchange rate volatility and trade. This chapter provides a guide in the identification of the knowledge gap and the choice of model used in the analysis of the effects of exchange rate volatility on French beans exports in Kenya. Chapter three presents the research methodology used in this study. It provides the theoretical framework and specifies the empirical model used. This chapter also describes the estimation procedure, sources of data, methods of data collection and analysis. Chapter four provides the results of the study and discussion of findings. In this chapter the descriptive statistics, unit root tests, cointegration and the error correction representation of the export demand model results are discussed. Finally, chapter five gives the conclusions and recommendations. This chapter gives a summary of major conclusions, recommendations and suggests areas for future research.

CHAPTER 2

LITERATURE REVIEW

2.1. INTRODUCTION

In this chapter, the literature review presented summarizes the approaches used in the analysis of exchange rate volatility and empirical studies on exchange rate volatility and trade flows. The purpose of this review was to identify the research gap and the appropriate analytical approach to adopt in the analysis of the effects of exchange rate volatility on exports. The review of literature finds a gap in terms of lack of empirical evidence on the effects of exchange rate volatility on French beans exports in Kenya. In addition, the literature shows the appropriateness of the export demand model compared with other trade modeling approaches in the analysis of the effects of exchange rate volatility on exports.

2.2. APPROACHES TO MEASURE VOLATILITY

The various approaches used to measure exchange rate volatility include standard deviation method, autoregressive conditional heteroscedasticity (ARCH) model and generalized autoregressive conditional heteroscedasticity (GARCH) model.

2.2.1. Standard Deviation Method

Most of the previous empirical studies have measured exchange rate volatility using the standard deviation method (Enders, 2010). The characteristic of this measure is that it gives large weight to extreme volatility. In addition, this measure will equal zero when the exchange rate follows a constant trend. Implying that it could be perfectly anticipated and therefore not a source of exchange risk (Enders, 2010). One of the major criticisms of the different variants of standard

deviation as a measure of exchange rate volatility is that they ignore the stochastic process generating the exchange rates. They are unconditional measures of volatility that ignore relevant information on the random process generating the exchange rate (Engle, 1982). This method is also arbitrary in choosing the order of exchange rate movement and noted for underestimating the effects of volatility on decisions (Pagan and Ullah, 1988).

Furthermore, standard deviation measure of volatility is characterized by skewed distribution. Exchange rates are typified by volatility clustering, implying that future exchange rate changes are not independent of the past and current changes. Therefore, the standard deviation method has two distinct drawbacks. First, it wrongly assumes that the empirical distribution of exchange rate volatility is normal. Second, it ignores the distinction between predictable and unpredictable elements in the process. Use of the standard deviation approach, therefore, could lead to overstating volatility (Enders, 2010).

2.2.2. ARCH Model

To correct for the deficiencies of the standard deviation model, the ARCH model was introduced by Engle (1982). The ARCH model is non-linear and relates the conditional variance of the error term to the immediately previous value of the squared error. The model is employed commonly in modeling economic time series that exhibit time-varying volatility clustering and characterizes the way variance changes over time (Enders, 2010). One of the superiorities of the ARCH model over the standard deviation measure is its ability to distinguish between predictable and unpredictable elements in the real exchange rate formation process. The ARCH model therefore is not prone to overstating volatility (Arize, *et al.* 2000; and Darrat and Hakim, 2000).

Engle (1982) developed the ARCH model to characterize the observed correlation in asset price volatility. Assuming that price risk is generated by first order autoregressive, process that is specified as:

$$P_t = \beta_0 + \beta_1 P_{t-1} + v_t \tag{2.1}$$

where P is the natural logarithm of the price, β_0 and β_1 are the parameters to be estimated, and v_t is an error term that is distributed normally with mean 0 and variance σ_t^2. The variance of the error term depends upon time t, The objective of the model is to characterize the way in which the variance changes over time (Enders, 2010). The ARCH model assumes that this dependence can be captured by an autoregressive process of the form:

$$\sigma_t^2 = r_0 + r_1 v_{t-1}^2 + r_2 v_{t-2}^2 + \ldots\ldots + r_m v_{t-m}^2 \tag{2.2}$$

where σ_t^2 is the conditional variance of the exchange rate, v_{t-i}^2, for $t = 1, 2 \ldots m$ denoting the squared residuals derived from equation (2.1), and r for $i = 0, 1 \ldots m$ are the parameters to be estimated. The restrictions $r_i \geq 0$ ensures that the predicted variance is always non-negative. σ_{t-i}^2 represents the ARCH term, which is a measure of information about volatility in the previous period. This specification illustrates clearly how current levels of volatility will be influenced by the past and how periods of high or low exchange rate fluctuation will tend to persist.

The ARCH model has several drawbacks. One, it is asymmetric between positive and negative values and assumes that positive and negative shocks have the same effects on volatility. This is in contrast to reality because exchange rate volatility responds differently to positive and

negative shocks (Engle, 2003). Another shortcoming of the model is that there is no clear best approach to decide the number of lags of the squared residual in the model. The number of lags of the squared error that are required to capture all of the dependence in the conditional variance might be very large resulting in a large conditional variance model that is not robust. As a result, the non-negativity constraints might be violated. The more parameters there are in the conditional variance equation, the more likely it is that one or more of them will have negative estimated values (Enders, 2010). The model is restrictive, thus does not allow for a more flexible lag structure and provides no explanation of volatility (Engle, 2003). In addition, the model requires the estimation of a large number of parameters as a high order of ARCH terms has to be selected for the purpose of improving the goodness of fit (Engle, 2003).

2.2.3. GARCH Model

A natural extension which overcomes the problems of the ARCH model is the GARCH model. In contrast with ARCH, GARCH models are vastly employed in practice. The GARCH model allows exchange rate volatility clustering, which means large variances in the past generate large variances in the future (Matei, 2009). The underlying idea is that part of the exchange rate volatility is conditional upon historical information from previous period. Hence, the volatility can be predicted based on the past movements of exchange rates. In a GARCH model, the log difference of monthly exchange rates is assumed to follow a process of a random walk with drift (Matei, 2009).

The advantages of the GARCH model are that it is more flexible, accurate and most appropriate for large numbers of observations. It solves the autocorrelation problem in long enough time series. This is important because the quality of the results is seen as the chosen model's ability to

comprehend the relationship between exogenous and endogenous variables, by taking into account autocorrelation and interaction effects that may exist within the data (Matei, 2009). The appropriateness of the GARCH model is seen through a unidirectional perspective of the quality of volatility forecast provided when compared to other alternative models (Matei, 2009). The disadvantages of the model are that financial time series often exhibit high probability for extreme values and thus the model sometimes fails to capture this fat-tail property of financial data. Also the non-negativity conditions of the variance may be violated by the estimated model (Matei, 2009).

The GARCH model allows the conditional variance to be dependent upon previous own lags (Enders, 2010). Bollerslev (1986) extended the ARCH class to produce the GARCH model, in which the variance is given by:

$$\dagger^2 = r_0 + s_1\dagger^2_{t-1} + s_2\dagger^2_{t-2} + \dots + s_k\dagger^2_{t-k} + r_1\dagger^2_{t-1} + r_2\dagger^2_{t-2} + \dots + r_m\dagger^2_{t-m} \qquad \textbf{(2.3)}$$

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

$$\dagger^2_t = r_0 + s_1\dagger^2_{t-1} + r_1 v^2_{t-1} \qquad \textbf{(2.4)}$$

This variance is measured as a weighted average of the long-term average (the constant term) and the GARCH ($s_1\dagger^2_{t-1}$) and ARCH ($r_1 v^2_{t-1}$) terms. Thus, the conditional variances of the exchange rates as represented by the predicted values of $\dagger^2_t$ from equation (2.4) provide with a measure of the exchange rate volatility. Using the GARCH model, it is possible to interpret the

fitted variance, information about volatility during the previous period and the fitted variance from the model during the previous period (Enders, 2010).

Furthermore, empirical evidence has shown that whilst relatively long lags are required in ARCH models, the GARCH (1, 1) is adequate in describing volatility in many financial time series because it relies on a parametric model for time varying variance (Bollerslev *et al.* 1992). The GARCH-based volatility measure is more suitable in measuring the volatility of high frequency data such as monthly exchange rate movements (Baum *et al.* 2004; Klaassen, 2004).

2.3. EMPIRICAL STUDIES ON EXCHANGE RATE VOLATILITY

Most of the recent studies on exchange rate volatility and trade flows emphasize obtaining appropriate estimation techniques for exchange rate volatility (Ilhan, 2006). The findings from these studies show that the long-run measures based on ARCH or GARCH models are better than the standard deviation method (Ilhan, 2006). Some of the studies use short-term volatility measures based on standard deviation of the exchange rate while others use long-term measures. GARCH models are estimated in a few cases. A larger number of studies conclude that exchange rate volatility tends to reduce exports, but when the effect is measured it is relatively small. Further, the studies show that a sectoral approach is more appropriate than an aggregate approach and that the absence of strong effect is related to the use of aggregate data (Cote, 1994). The difficulty in obtaining good quality disaggregated data has limited research of sectoral approach in studies on effects of exchange rate volatility on exports (Cote, 1994). However, there is no consensus on the effect of exchange rate volatility on exports (Ilhan, 2006). The studies do not allow one to draw any strong conclusion about the relationship between exchange rate volatility and exports.

Since the adoption of floating exchange rates in the developing countries in the 1970's, the effect of exchange rate changes on exports has attracted a lot of attention in literature. For instance Adubi and Okunmadewa (1999) evaluated the effects of price and exchange rate volatilities on aggregate Nigeria's agricultural trade flows using an Extended Vector Autoregressive (EVAR) model on quarterly data for the period from 1986 to 1993. The study found that exchange rate volatility had a direct but negative effect on the volume of agricultural exports in Nigeria, which caused a decline in exports. The authors reported that Structural Adjustment Program (SAP) period resulted in a high level of exchange rate volatility, which negatively affected Nigeria's exports.

Were *et al.* (2002) evaluated Kenya's export performance using an Error Correction Model (ECM). The study found that, in general, the real exchange rate had a marked influence on export performance. The results from Were's study indicate that supply response to real exchange rate depreciation for export of goods and services was positive and significant. The study concluded that while sustaining a stable exchange rate is important, strategies that maintain a highly overvalued exchange rate could be a disincentive to exports. It also revealed that flexibility in the exchange rate movements in line with the fundamentals of the economy is beneficial.

Yuan and Awokuse (2003) evaluated the effect of exchange rate volatility on United States' poultry meat exports to 49 trading partners and yearly panel data over the period 1976 to 2000 using the gravity model. The results from the gravity model indicated that exchange rate

volatility had a negative effect on the United States' poultry exports. However, the results were only statistically significant for the model in which variance of spot exchange rate was used as proxy for volatility. The study concluded that export volume is affected by real foreign incomes and price changes.

Minot and Ngigi (2004) found that an appropriate exchange rate gives exporters the full value of the foreign exchange they generate and is a critical factor in stimulating horticultural exports. The study used descriptive statistics to establish whether horticultural exports are a replicable success story in Kenya and Côte d'Ivoire. The study concluded that a liberalized market for foreign exchange currency facilitates the purchase of imported seed, agricultural chemicals and specialized equipment for the horticulture industry. However, the study did not carry out any further analyses to evaluate the effect of exchange rate volatility on exports of French beans, a horticultural produce of national importance in Kenya.

Todani and Munyama (2005) on exchange rate volatility and exports in South Africa goods, services and gold exports using an Autoregressive Distributed Lag (ARDL) approach proposed by Pesaran *et al.* (2001). It found a significant relationship between South African export flows and exchange rate volatility. The study found no evidence of long run gold and services export supply relationships. The results of Todani and Munyama (2005) study are not robust as they show great amount of sensitivity to different definitions of variables used.

Kemal (2005) used a simultaneous equation model to evaluate the effect of exchange rate volatility on exports and imports in Pakistan for the period 1982 to 2004. . The study used the GARCH model to measure exchange rate volatility. The effect of exchange rate volatility on

imports was found to be negative but significant. The study recommended a future study to be carried out using quarterly or monthly data which would give better and more comprehensive results.

Bittencourt *et al.* (2006) examined the impacts of exchange rate volatility on sectoral trade in the Mercosur, a South American trading bloc. Using a sectoral gravity model the study found that exchange rate volatility increased bilateral trade. The authors argue that trade among agribusiness firms can increase due to stability of exchange rates as well as from tariff reductions and economic growth.

The impact of real exchange rate depends on export and import patterns and the magnitude of liberalization (Fidan, 2006). This was the finding of a study on the impact of real exchange rate on Turkish agricultural trade using a linear regression model. The study used annual data from 1970 to 2004. In the short run, the real exchange rate has smaller effects on agricultural exports and imports compared with the long-run effects (Fidan, 2006).

There is no harm to export flows as a result of exchange rate volatility. This was shown in a study by Tenreyro (2006) on the trade impact of nominal exchange rate volatility using an Instrumental Variable (IV) version of the Pseudo-Maximum Likelihood (PML) estimator. In addition, the elimination of exchange rate volatility alone does not create any significant gain in trade. Tenreyro (2006) reveals the problems associated with techniques typically used in empirical applications of the gravity model.

Kiptui (2007) evaluated whether exchange rates matter for Kenya's exports using an export demand model. The study used bounds testing and Autoregressive Distributed Lags (ARDL) approaches to assess the long-run relationships and error correction modeling. The study found that the dominant role played by economic prosperity of the export destination countries as demonstrated by significant positive long run and short run elasticities. The short-run income elasticities were close to one for tea, horticulture and coffee. The long-run income elasticities were high, ranging from 1.0 for tea to 2.4 for horticulture and 2.8 for coffee. The study concluded that foreign economic activity was the most important factor explaining export growth. Further, the effects of real exchange rate are more likely to be long-run than short-run and that there exists threshold levels at which exchange rate fluctuations harm exports. However, the study used aggregate horticultural crops data and failed to quantify the threshold level at which exchange rate fluctuations harm exports.

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In another study, Kiptui (2008) evaluated whether exchange rate volatility harms exports of Kenya's tea and horticulture exports using an export demand model. The real exchange rate volatility was found to have a negative effect on exports of both tea and horticulture both in the short-run and long-run. However, the horticultural exports were more sensitive to exchange rate volatility than tea while foreign income and the relative price variables were highly significant. The study concluded that the boom in exports was to some extent driven by external factors that fell outside the sphere of local policy makers. Nonetheless, the study did not determine whether the cause of exchange rate movements have any impact on exports. Further, the study utilized aggregated data and covered the post liberalization period while the current study covers both the period prior to and after the liberalization of Kenya's exchange rate.

Adjasi *et al.* (2008) examined the effect of exchange rate volatility on the stock market in Ghana using an Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) model. The study found a negative relationship between exchange rate volatility and stock market returns. Further, the depreciation in the local currency led to an increase in stock market prices in the long run while in the short run it reduced stock market returns. The study is a useful guide in risk management since it shows that there is a predictable trade-off between risk and return.

Hayakawa and Kimura (2008) analysed the effects of exchange rate volatility on international trade and the implication on production networks in East Asia using a gravity model. The study found that intra-East Asian trade is reduced by exchange rate volatility more seriously than trade in other regions. The study concluded that the source for the reduction is that intermediate goods trade in international production networks, which is quite sensitive to exchange rate volatility compared with other types of trade, occupies a significant fraction of East Asian trade. Nonetheless, the study used the gravity model despite its weaknesses when compared with the export demand model.

Gertz (2008) evaluated the effects of Kenya's trade liberalization using descriptive statistics. The study found that the horticulture and apparels sub-sectors benefitted from trade

liberalization. The study concluded that foreign exchange restrictions were a great burden on export of horticulture. The industry has realized growth since the adoption of floating exchange rate system, including the end of government controls in the air freight rates. These findings suggest that trade liberalization failed to produce sustained growth, did not promote decent employment opportunities, nor did it reduce the incidence of poverty and inequality. Overall, the study recommended the need to incorporate trade into a comprehensive development strategy, diversify the economy through balancing between regional and global trade and focus on employment to realize economy-wide success.

Ahmed (2009) used the export supply model to assess the impact of exchange rate volatility and bilateral export growth in Bangladesh. The study found that exchange rate volatility has a negative and major effect both in the short and long run with important trading partners in Western European and North American countries. A similar pattern was observed in case of few countries such as Singapore, Japan, Malaysia and China. However, the study found no empirical relationship of exchange rate volatility and export growth between Bangladesh and Iran and other Gulf countries.

Moghaddasi and Hosseini(2010) examined the impact of exchange rate volatility on aggregate and sectoral Iranian export flows to the rest of the world, as well as on agriculture and industry sectors exports. The ARDL bounds testing procedures were

employed on annual data for the period 1970 to 2006. The study used both the moving average standard deviation and GARCH (1, 1) model as measures of exchange rate volatility. The results suggested that, depending on the measure of volatility used, either there exist no statistically significant relationship between Iranian exports flows and exchange rate volatility or when a significant relationship exists, it is positive. However, the study found strong evidence of a stationary long run cointegrating aggregate, agriculture, minerals, transport means, fats and oils exports demand functions but no evidence of a long run chemical exports demand relations were found. Nonetheless, the results of the study were not robust because they showed a great amount of sensitivity to different definitions of the variables used.

Maana *et al.* (2010) applied the GARCH model in the estimation of the volatility of the daily foreign exchange rates in from January, 1993 to December, 2006. The Kenya shilling was considered against the US dollar, Sterling pound, Japanese Yen, and Euro, because all official reserves and foreign currency transactions in Kenya were held in these currencies. The study found that exchange rate depreciation was preferred in the period of 1993-2006, to ensure that the Kenya's exports remained competitive. The estimated models fit the data well, thereby confirming the empirical evidence in Bollerslev *et al*. (1992), that the GARCH (1, 1) is adequate in describing volatility in many financial time series. Therefore, Maana *et al.* (2010) study illustrates the appropriateness of the GARCH model in analyzing exchange rate volatility.

Omojimite and Akpokodje (2010) carried out a comparative analysis of the effect of exchange rate volatility on exports in the Communaute Financiere Africaine (CFA) and Non-CFA countries of Africa using an export supply model. Findings showed the exchange rate volatility to have a negative effect on the exports of both CFA and Non-CFA countries, with the effect being higher in the Non-CFA panel of countries. The conclusion was that there was need to take appropriate monetary and fiscal policy measures to stem the increasing exchange rate volatility. Another conclusion was that trade policy actions aimed at stabilizing the export market are likely to generate uncertain results if policy makers ignore the stability as well as the level of real exchange rate. Thus, trade adjustment programs focusing on export expansion may lose appeal to policy makers during the periods of high exchange rate volatility.

Kiptui and Kipyegon (2008) used cointegration and error correction model (ECM) to capture the long-run and short-run dynamics of the impact of external shocks in Kenya on the real exchange rate, including terms of trade, net foreign exchange flows and openness, using monthly data for the period 1996-2007. The study used the oil prices as a proxy for the terms of trade shocks. Improvement in the terms of trade implied more favorable export prices. The results from cointegration and error correction estimations showed that oil prices and openness had significant effects on the real exchange rate. Oil price increases, being a proxy for terms of trade deterioration, cause a depreciation of the real exchange rate in the short and long run.

The study concluded that external shocks to a large extent influence real exchange rate as demonstrated by the significance of the terms of trade and openness in the long run and short run

estimations. The finding of the study indicated that openness, which tends to dampen prices of traded goods, causes an appreciation of the real exchange rate in the short and long run. Capital inflows had appreciating effects on the real exchange rate in short and long run periods, but they were not highly significant in the short run. In addition, the study found that although external shocks had major effects on the real exchange rate, domestic shocks also played a role. The results showed that the interest rate differential has significant negative effects in the short- and long runs. On the other hand, government spending has significant positive effects on the real exchange rate in the short run and long run, while real GDP growth has positive effects in the short run but negative effects in the long run. In contrast with this study which used the oil prices as a proxy for terms of trade, the current study uses relative prices.

2.4. CHAPTER SUMMARY

From the foregoing review of the previous studies, it is evident that the magnitude of the effect of exchange rate volatility on trade flows varies considerably across countries and commodities. The theoretical and empirical research has so far provided contradictory evidence on the effects of exchange rate volatility on trade flows. In summary, several empirical studies have attempted to asses the nature of the relationship between exchange rate volatility and exports and reported both positive and negative relationships. Some studies have reported no significant relationship.

The review of available literature reveals that there have been limited attempts to model the effects of exchange rate volatility on horticulture exports in Kenya. Past evaluations that report on the effect of exchange rate volatility on horticulture exports in Kenya are by Were *et al.* (2002), Kiptui (2008), Gertz (2008) and Maana *et al.* (2010). However, none of these studies investigated the effects of exchange rate volatility on French bean exports in Kenya, even though

it is one of the leading vegetables in foreign exchange earnings. Thus, there is a gap in knowledge since there has been no attempt to model the effects of exchange rate volatility on French bean exports in Kenya.

In addition, the past evaluations show contradictory results on the effects of exchange rate volatility on exports in Kenya. Kiptui (2008) and Were *et al.* (2002) report negative effects while Gertz (2008), Minot and Ngigi (2004) and Maana *et al.* (2010) reveal positive or no effects. On appraising the reviewed literature, it is clearly evident that there is need to evaluate the effects of exchange rate volatility on French bean exports in Kenya.

CHAPTER 3

METHODOLOGY

3.1. INTRODUCTION

This chapter discusses the analytical framework for analyzing exchange rate volatility. The chapter is divided into five main sections. Firstly, the theoretical framework for analyzing the effect of exchange rate volatility on exports is presented. Secondly, the empirical model used to estimate the effect of exchange rate volatility on French beans exports in Kenya is specified.

Next, the estimation procedure, data sources, data collection procedures and the method used in data analysis are presented.

3.2. THEORETICAL FRAMEWORK

There are two schools of thought with regard to explaining the effect of exchange rate volatility on exports, the traditional and risk-portfolio. The traditional school of thought is based on theoretical studies by Clark (1973), Baron (1976), and Hooper and Kohlhagen (1978). It posits that higher volatility increases risk and therefore depresses trade. The traditional school of thought postulates that the volatility of exchange rates results in exchange rate risk, which affects the volume of exports and hence international trade (Hooper and Kohlhagen, 1978). The exporters are either risk-averse, risk neutral or risk loving and thus react differently to volatility in exchange rates. If agents are risk neutral, exchange rate volatility does not affect the exporters' decision. When agents are risk-averse, an increase in exchange rate volatility induces them to reduce the volume of exports by reallocating production towards domestic markets (Hooper and Kohlhagen, 1978).

On the other hand, the risk-portfolio school is based on studies by Broll and Eckwert (1999), Dellas and Zilberfarb (1993) and De Grauwe (1988). It asserts that higher risk presents greater opportunity for profit and should increase trade. The firm is assumed to be engaged in the domestic market and the export market and allocates output optimally between both markets (De Grauwe, 1988). The risk-portfolio claims that the traditional school is unrealistic. The main objection against the traditional school by the risk-portfolio theorists is that it does not properly model how firms manage risk. The theory postulates that the result of an increase in the

exchange rate volatility depends on the convexity of the utility function, which in turn depends on the level of risk aversion (Broll and Eckwert, 1999). For the highly risk-averse, a rise in exchange rate volatility leads to an increase in the utility of export revenue and encourages exporters to export more to avoid the risk of a decline in their revenues. This is referred to as the income effect of exchange rate volatility. The less risk-averse agents consider an increase in exchange rate volatility as greater risk. Thus, increased exchange rate volatility makes these players to reduce exports and switch resources to other sub-sectors. This is referred to as the substitution effect of exchange rate volatility (Broll and Eckwert, 1999). Thus exports increase with increase in exchange rate volatility; the greater the income effect while exports decline if the substitution effect outweighs the income effect. Therefore, higher income effect over substitution effect can lead to positive relationship between trade and exchange rate volatility (Broll and Eckwert, 1999). The theoretical ambiguity of the effect of exchange rate volatility on trade reinforces the need for evaluating the issue empirically.

3.3. EMPIRICAL MODEL

This study used an export demand model to assess the effects of exchange rate volatility on French bean exports in Kenya. In an export demand model, the volume of exports is the dependent variable and exchange rate volatility, relative prices and a measure of economic activity variable are regressors (Todani and Munyama, 2005). This model assumes that export supply is infinitely inelastic and the exporter has little or no market power so that equilibrium export quantity is demand determined (Bini-Smaghi, 1991; Chowdhury, 1991; Doroodian, 1999; Chou, 2000; Sauer and Bohara, 2001). The model suggests a long-run relationship among exports, foreign economic activity, relative prices and exchange rate volatility. It is given as:

$$ln X_t = \ + \ _1 ln Y_t + \ _2 ln P_t + \ _3 V_t + \ _t \qquad\qquad (2.6)$$

where *ln* stands for the natural logarithm of the respective variable; t is the time dimension, X_t is the export volume; Y_t represents the real incomes of foreigners, which measures the economic activity and purchasing power of the trading partners. The relationship between the logarithm of dependent and the independent variables as in an equation (2.6) represents elasticity and can be interpreted as the percent change of the dependent variable when the independent variable changes by one percent;

According to Baak *et al*. (2007), the real GDP of importing countries (EU in the case of Kenya's French beans) is commonly used as a proxy measure for economic activity. However, due to monthly data availability, the industrial production index was used as a proxy of economic activity in the EU. The same measurement has been used by previous studies such Baum *et al*. (2001), among others. The lack of monthly data on GDP of importing country leads to the use of the industrial production index as a proxy of the economic condition of importing countries. In addition, more conventional proxies for economic activity, such as income, were only available at quarterly frequency. P_t is relative price ratio, i.e. export price divided by world non-fuel commodity price. The lack of monthly world prices led to the use of non-fuel commodity prices as proxy for the world prices. V_t is the exchange rate volatility which is a measure of risk and $_t$ is a disturbance term. The export demand model is crucial for meaningful export forecast; international trade planning and policy formulation (Arize, 2001).

This study used an export demand model based on Goldstein and Khan (1978) and as applied by Chowdhury (1993) and Arize, *et al.* (2000). The model suggests a long-run relationship between exports, foreign economic activity, relative prices and exchange rate volatility. In addition, we

draw on Boug *et al.* (2006) who provide evidence that exporters follow much more closely the prices of competitors than domestic costs in setting their export prices.

Following Chowdhury (1993), the following functional export demand model was specified for Kenyan French bean exports to the EU market:

$$X_t = f (Y_t, P_t, V_t, L_t, Q_t) \tag{3.1}$$

Equation 3.1 can be expressed in log-linear form as:

$$\ln X_t = \Gamma + S_1 \ln Y_t + S_2 \ln P_t + S_3 \ln V_t + S_4 L_t + S_5 \ln Q_t + V_t \tag{3.2}$$

where *ln* stands for the natural logarithm of the respective variables, t refers to the monthly time period, X_t is export volume of French beans to 28 EU countries (MT), Y_t is foreign incomes proxied by the industrial production index of EU countries (US\$), P_t is Kenya's French bean export price to the EU relative to world non-fuel commodity prices (US\$), V_t is exchange rate volatility which is a measure of risk given by the GARCH method, L_t is a dummy variable representing exchange rate liberalization with a value of 1 representing the period after liberalization (1994-2011) and 0 for the period before exchange rate liberalization (1990-1993) and $_t$ is the error term which represents the effects of unknown and unmeasured variables that affect French bean exports in Kenya. Q_t represents the total volumes of monthly supply of French beans to the EU market less total export volumes of Kenya's French beans to 28 EU countries (MT).

The loglinear form was adopted because of its propensity to reduce heteroskedasticity (Maddala, 1992). The theory of demand suggests that quantity of trade rather than value is the appropriate dependent variable (Learner and Stern, 1970). The application of the industrial production index

as a proxy variable for the economic condition of the importing country was used due to the lack of monthly data of income or GDP. The variables X, Y, P, V and Q are in logarithm form so that the estimated parameters are interpreted as elasticities. If the coefficient of a variable is less than one, it implies that the export demand is inelastic. Hence an increase in the variable leads to less than proportionate change in demand of French bean exports in Kenya to the EU market.

The description, units of measurement and the hypothesized directions of the regression variables X, Y, P, V, L and Q based on economic theory are as indicated in Table 3.1.

Table 3.1. Description of Variables Hypothesized to Influence Volume of French Exports from Kenya

Variable	Symbol	Description	Unit	Coefficient	Expected Sign
Dependent Variable					
Volume of French Bean Exports	X	Total volume of Kenyan French beans exports to 28 EU countries (Appendix 1). (2002 = 1).	Tonnes		
Independent Variables					
Real Foreign Incomes	Y	Real foreign incomes for Kenya's 28 major trading partners in the EU (2002 = 100).	US$	β_1	+
Relative Prices	P	Ratio of Kenya's French bean export prices to world non-fuel primary commodity prices.	US$	β_2	-
Exchange Rate Volatility	V	Measure of exchange rate volatility evaluated using the GARCH model.		β_3	-
Exchange Rate Liberalization	L	Dummy variable to represent exchange rate liberalization with a value of 1 representing the exchange rate liberalization period (January 1994-December 2011) and 0 for the period before exchange rate liberalization (January 1990-December 1993).	Dummy	β_4	+
Supply of French Beans in the EU Market	Q	Total volume of French beans in the EU market less the total volume of Kenyan French bean exports to the EU market (2002 = 1).	Tonnes	β_5	-

The relative price variable (P_t) or the terms of trade was constructed as the ratio of the Kenya's export price to world non-fuel primary commodity prices. It measured the level of competitiveness. If the relative prices rise, the demand for exports will fall so $_2$ coefficient is expected to be negative (Goldstein and Khan, 1985). When exchange rate decreases, it indicates that as the Kenyan shilling appreciates; the competitiveness of the Kenyan exports consequently declines. Alternatively, an increase in the exchange rate represents depreciation or increased competitiveness. Hence, exports would be cheaper as exchange rate increases as result of depreciation in the value of the domestic currency. As Kenya's competitiveness improves, exports are expected to increase too.

The condition variance values obtained from GARCH (1, 1) model were incorporated into equation 3.1 to represent exchange rate volatility. The hypothesized sign of the coefficient of the exchange rate volatility $_3$ cannot be determined *a priori* since the effect of exchange rate volatility on exports is theoretically and empirically ambiguous. One theoretical argument is that exchange rate volatility may lead to decline in exports is centered on the view that exchange rate volatility represents uncertainty and will impose costs on risk averse traders. A number of authors, such as Broll and Eckwert (1999), Dellas and Zilberfarb (1993), and Wolf (1995) illustrate, in the context of theoretical models, that exchange rate volatility might reduce exports.

Contrary to this view, Franke (1991), De Grauwe (1988), and Giovannini (1988) have developed models, which show that exchange rate volatility may increase exports. For example, De Grauwe (1988) argues that if producers are sufficiently risk averse, an increase in exchange rate volatility raises the expected marginal utility of export revenue and induces them to export

more. Consequently, there is the possibility that exchange rate volatility can increase rather than decrease exports. As a result of this, the sign of the coefficient of exchange rate volatility is determined empirically rather than through theory but the expected signs are as shown in Table 3.1.

Several empirical studies reflect this ambiguity in the theoretical literature. Aristotelous (2001) and McKenzie (1998) find no firm evidence for the relationship between exchange rate volatility and trade. Akhtar and Hilton (1984), Kenen and Rodrik (1986), Koray and Lastrapes (1989), and Chowdhury (1993), *inter alia*, provide evidence in support of the view that the volatility of exchange rates reduces the volume of exports. On the other hand, McKenzie and Brooks (1997), and Klein (1990) find some evidence for a positive effect of exchange rate volatility on exports. The same conflicting evidence for the relationship between exchange rate volatility and trade exists with regard to developing countries. While some studies such as by Kumar and Dhawan (1991), Arize *et al.* (2000) and Doroodian (1999) found a negative relationship, the study by Warner and Kreinin (1983) failed to report any firm relationship between exports and exchange rate volatility.

Economic theory suggests that income in trading countries is a major determinant of a nation's exports (Pugel, 2007). Thus the level of foreign income is also a factor influencing exports such that an increase in income in Kenya's trading partners economy will lead their citizens to spend more on goods and services, including more on Kenya's exports. Based on economic theory, the amount by which Kenya's exports increase if foreign income increases is the foreign marginal propensity to import (Pugel, 2007). Economic theory dictates that $_1$ is expected to be positive

since an increase in the income of Kenya's trading partners should lead to greater volume of exports to those partners (Takaendesa, *et al*. 2005; Todani and Munyama, 2005). Hence a positive coefficient of $_1$ in equation (3.1) is expected between real foreign income and exports of French beans in Kenya, since higher real incomes would lead to an increase in imports and higher incomes for Kenyan French beans exporters.

Exports of French beans are also expected to be affected by exchange rate liberalization. The exchange rate liberalization was a major ingredient of economic liberalization. The economic liberalization which commenced in Kenya in the early 1990s meant greater freedom for the market mechanism in economic activities. The market mechanism means that the economic activities such as production, consumption, savings and investments are guided and decided by the price without government intervention (Gertz, 2008).

The exchange rate liberalization meant that the currency was to be exchanged with foreign currencies for economic transactions that promoted the economy and economic welfare of the general public (Adam *et al*. 2010). The exchange rate liberalization is the route to link the domestic economy with the global economy in pursuit of economic benefits advocated by principles of international economics. In Kenya, exchange rate policy has undergone various regime shifts mostly driven to a large extent by economic events, especially balance of payments crises (Adam *et al*. 2010). The period 1990-1993 was characterized by a fixed exchange rate regime while a floating exchange rate system was adapted from 1994 to 2011.

The adoption of a floating exchange rate system after 1993 was an effort to make the exchange rate more aligned to the market determined equilibrium exchange rate (Adam *et al.* 2010). The period from January 1990 to December 1993 represents the period before exchange rate liberalization and from January 1994 to December 2011 represents the period after exchange rate liberalization. A dummy variable L_t is specified to represent exchange rate liberalization with a value of 1 representing the period during exchange rate liberalization and 0 to stand for the period before exchange rate liberalization. $_4$ the coefficient of the exchange rate liberalization dummy variable is expected to be positive.

Q_t represents total volumes of French beans in the EU market less the volumes of Kenyan French beans exports to the EU market and thus $ß_5$ is expected to be negative since a glut in the market will lead to a reduction in exports of French beans from Kenya to the EU.

3.4. UNIT ROOT TESTS

Unit root tests were used to determine the nonstationarity in data. The common feature in time series variables is that their means and variances may change over time. This is a departure from assumptions of the standard regression model i that mean and variance of variables being tested should be constant over time; i.e., they are stationary (Greene, 2004;Gujarati, 2005). This implies that the current shocks have permanent effects on the time series variables and thus the fluctuations are not transitory. A variable is said to be nonstationary if it has no clear tendency to return to a constant value or linear trend (Greene, 2004). The use of nonstationary or unit root variables in estimating regression equations yields misleading inferences (Greene, 2004). In effect, statistical inferences associated with stationary processes are no longer valid if the time

series are indeed realizations of nonstationary processes. When a unit root is identified, the data are differenced to determine the order of integration. This is the number of times a nonstationary series has to be differenced to transform it into a stationary series (Gujarati, 2005). .

A nonstationary series (X_t) is integrated of order **d** denoted as **I (d)** if it becomes stationary after being differenced **d** times (Greene, 2004). The unit root test is used to find out whether time series variables are affected by transitory or permanent shocks (Engle, 2003). Some of the previous studies fail to recognize that exports and some of the determinants are potentially non-stationary integrated variables. In this study nonstataionarity was by tested using the unit root test and adopting the appropriate econometric model in volatility analysis.

Several tests for unit roots have been proposed in the literature. The commonly used ones are the Augmented Dickey-Fuller (ADF) (1979) and Phillips-Perron (PP) (1988) unit root tests. The ADF procedure is a parametric test that is most commonly used, but requires homoscedastic and uncorrelated errors in the underlying structure. The PP is a non-parametric test and generalizes the ADF procedure, allowing for less restrictive assumptions for the time series in question. The PP is a more powerful test for unit roots than the Dickey-Fuller (1979) test in small samples and follows a first order autoregression. In large samples the results of the PP and DF test statistic are similar in most empirical evaluations. The null hypothesis in the unit root test is that the time series under consideration has a unit root, that is, it is nonstationary while the alternative hypothesis is that the time series is stationary (Greene, 2004).

There was need to check for the stationarity of the data series before estimating the relationships between French beans exports and the explanatory variables. The testing of the stationarity of economic time series is of great importance since standard econometric methodologies assume stationarity in the time series while they are in fact non-stationary (Engle and Granger, 1987). Consequently, the usual statistical tests are likely to be inappropriate and the inferences drawn are likely to be erroneous and misleading. For instance, the ordinary least squares (OLS) estimation of regressions in presence of non-stationary variables gives rise to spurious estimates (Engle and Granger, 1987). This study used of both the ADF(1979) and PP (1988) unit root tests in order to corroborate the robustness of the test results and ensure that the inferences regarding stationarity were not influenced by the choice of the testing procedure.

The ADF test is based on the regression equation with the inclusion of a constant and a time trend of the form:

$$\Delta X_t = \ulcorner + \mathsf{S}t + \mathsf{u}\, X_{t-i} + \sum_{i=1}^{p} <_i \Delta X_{t-i} + \mathsf{v}_t \qquad\qquad (3.3)$$

where   is the difference operator, X_t is the natural logarithm of the series, t is a time trend variable, , ,   and '   are the parameters to be estimated, i is the level of differencing and v_t is the error term. The Akaike Information Criterion (AIC) determines the lag length p for this equation. The test statistics from equation (3.3) are known as the t_μ, and t statistics whose critical values were tabulated by Dickey-Fuller (1979). If the coefficient   is not significant, the null hypothesis of non-stationarity is not rejected and the conclusion is that the series is **I (d)** process. This procedure is repeated on higher levels of differenced data until the null hypothesis is rejected. The order of differencing corresponds to the variable's order of integration.

3.5. COINTEGRATION ANALYSIS

The long run covers the desired (unobserved) demand or the period of potential demand, while the short run covers the actual or observed demand or a time span representing a proportion of the potential demand. This study used cointegration and error correction models to obtain the long-run and the short-run relationships between the dependent and independent variables respectively. Having tested the stationarity of each time series, the next step was to search for cointegration among these variables. Cointegration analysis refers to the process of getting equilibrium or long-run relationships among non-stationary variables. The idea is that although the variables are non-stationary, linear combinations of them may be stationary, given that all variables are integrated of the same order (Enders, 2010).

The vector that links the variables in the long-run relationship is called the cointegrating vector. The cointegration analysis is used to avoid spurious regressions whilst providing a means of clearly distinguishing between long-run and short-run elasticities through the error correction formulation. If long-run elasticities are present, then it is rational to evaluate how short-run behavior responds to long-run elasticities (Enders, 2010). Various tests for the presence of cointegration among variables that are stationary at the level of first differencing, that is, they are **I (1)**, have been proposed beginning with Engle and Granger (1987). The current study used a multivariate procedure based on maximum likelihood methods introduced by Johansen (1988, 1991) and expanded upon by Johansen and Juselius (1990). The procedure is based on a vector autoregressive (VAR) model of X_t:

$$X_t = \Pi_1 X_{t-1} + \ldots \Pi_k X_{t-k} + \tilde{\ }_0 + \tilde{\ }_1 t + v_t \qquad\qquad\qquad \textbf{(3.4)}$$

where X_t is an *n*-dimensional column vector of **I (1)** variables, and μ_0 and μ_1 are *nx1* vectors of constant and trend coefficients respectively. It was convenient to let $\mu_t = \mu_0 + \mu_{1t}$ denote the deterministic part of the model. The error vector, $_t$, which is *n x1*, is assumed to be multivariate normal with mean vector *0* and covariance matrix , and to be independent across time periods. This model is rewritten in the error correction form as follows:

$$\Delta X_t = \Pi X_{t-k} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-1} + \tilde{}_0 + \tilde{}_1 t + v_t \qquad \textbf{(3.5)}$$

where Π and the Γ_i are *n x n* matrices. Since ΔX_t is an **I (0)** process, the stationarity of the right side of the equation is achieved only if ΠX_{t-k} is stationary.

The Johansen and Juselius (1990) procedure examines the rank of Π (denoted as *r*) which determines the number of cointegrating vectors present in the system. If *rank* $(\Pi) = r < n$, then $\Pi = \Gamma s'$ where both Γ and are *n* x *r* matrices of full rank. If $r = 0$, then $\Pi = 0$ and there exists no linear combination of the elements of X_t that is stationary. The other extreme is, if $rank(\Pi) = n$, X_t is a stationary process. In the intermediate case, when $0 < r < n$, there exist *r* stationary linear combinations of the elements of X_t. Γ represents the speed of adjustment to disequilibrium while is the matrix of cointegrating vectors; the number of such vectors is *r*(Enders, 2010). Since the cointegrating vectors have the property that $_j X_t$ (*j = 1 ... r*) is stationary, then the system is stationary. The cointegrating vectors are said to represent the long-run relationships present in the system.

The trace statistic was used in this study to test the null hypothesis that *rank* $(\Pi) = r$ against the alternative hypothesis that *rank* $(\Pi) = n$. Equivalently, the trace statistic tests whether *r*

cointegrating vectors are present in the system against the alternative hypothesis that the system is already stationary; for example, n cointegrating vectors are present in the system (Johansen and Juselius, 1990). The null hypothesis is tested under the assumption that $\sim_t \neq 0$. The trace statistic is a likelihood ratio (LR) statistic of the form:

$$\text{Trace} = -T \sum_{i=r+1}^{n} \log(1 - \lambda_i) \tag{3.6}$$

where the λ_i are the ordered solutions to the eigenvalue problem $\left| \lambda s_{kk} - s_{k0} s_{00}^{-1} s_{00} s_{ok} \right| = 0$. The s_{ij} matrices are the residual moment matrices derived from the postulated error correction form. Where the eigenvalue problem is to determine real or complex numbers, $\lambda_1, \lambda_2, \ldots \lambda_n$ (eigenvalues) and corresponding nonzero vectors, $x_1, x_2, \ldots, x_n$ (eigenvectors) that satisfy the equation, $Ax = \lambda x$ where A is a given real or complex $n \times n$ matrix (Johansen and Juselius, 1990).

3.6. VECTOR ERROR CORRECTION MODEL

Having reached conclusions on the inherent long-run relationships between the dependent and independent variables, the ECM investigates the short-run dynamics of the export demand function. As the Engle-Granger representation theorem suggests, the existence of cointegration among the **I (1)** variables entails the presence of short-run error correction relationship associated with them. The relationship represents an adjustment process by which the deviated actual export is expected to adjust back to the long-run equilibrium path (Engle and Granger, 1987). The Engle-Granger representation theorem states that if a set of variables is cointegrated of the same order, there exists a valid error correction representation of the data.

Engle and Granger (1987) provided a principal feature of the cointegrated dependent and independent variables in that their time paths are influenced by the deviation from the long-run

relationship, given that cointegration implies an error correction representation. That is, a cointegrated system can be represented by an Error Correction Model (ECM), which represents short-run relationship. In the case of French bean exports in Kenya the following ECM was estimated:

$$\Delta E_{X_t} = C + x E_{C_{t-1}} + \sum_{i=0}^{n} s_{1i} \Delta E_{X_{t-i}} + \sum_{i=0}^{n} s_{2i} \Delta Y_{t-i} + \sum_{i=0}^{n} s_{3i} \Delta P_{t-i} + \sum_{i=0}^{n} s_{4i} \Delta V_{t-i} + \sum_{i=0}^{n} s_{5i} \Delta Q_{t-i} + v_t \qquad \textbf{(3.7)}$$

where C is a constant

$E_{C_{t-1}}$ is lagged value of the long-run disturbance term

ΔE_{X_t} is the first difference of French bean exports volume

$\Delta E_{X_{t-i}}$ is the lagged French beans exports volume

ΔY_{t-i} is the lagged value of real foreign incomes

ΔP_{t-i} is lagged value of relative prices

ΔV_{t-i} is lagged value of exchange rate volatility

ΔQ_{t-i} is lagged value of French beans supply volumes in the EU market

x is the coefficient representing the proportion of the disequilibrium in French beans exports in one month corrected in the next month. The parameter represents the short-run adjustment and indicates the speed of adjustment towards the long-run equilibrium state so that a high coefficient implies rapid adjustment and a low coefficient slow adjustment. The forecast for X_t improves when lagged values of the independent variables are used while the speed of adjustment towards equilibrium should have a negative sign for convergence (Engle and Granger, 1987).

3.7. DATA SOURCES

This study used secondary monthly time series data from various sources. The series was for a period of 22 years from January, 1990 to December, 2011. Overall this study used 264 observations. The prices of French bean exports in US$ were obtained from the Monthly Trade Reports of the Customs Department of the Kenya Revenue Authority (KRA). In order to ensure consistency in data, the prices of French beans exported from Kenya were converted from the Kenyan shillings US$. On the other hand, the volume and value of French bean exports from Kenya were obtained from the Ministry of Agriculture Livestock and Fisheries (MoALF), Horticultural Crops Development Authority (HCDA), and the United Nations Food and Agriculture Organization Statistical Database (FAOSTAT).

The national Consumer Price Index (CPI) statistics for the period under consideration were obtained from the Kenya National Bureau of Statistics (KNBS). The volumes of French beans supply in the markets of 28 EU countries were obtained from the European Statistical Database (EUROSTAT). The nominal exchange rates were obtained from the Ministry of Finance and the CBK. The foreign exchange rate used in this study is the Kenyan shilling (Kshs.) against the US$. This exchange rate was chosen because the US$ is the leading currency in the foreign exchange market and most of the official reserves and foreign currency transactions in Kenya are held in this currency.

The exchange rate volatility was evaluated by using the conditional variance of the exchange rate from the GARCH model and incorporated as an independent variable. The Augmented Dickey-Fuller (ADF) (1979) and Phillips-Perron (PP) (1988) methods were used to test for the presence

of unit roots in the variables used in estimating the export demand model. The Johansen-Juselius (1990) cointegration test was employed in the assessment for the presence of long-run equilibrium relationships among the variables in the export demand model.

The export volumes of French beans from Kenya to the EU market are given in tonnes while export prices are in US$. Other sources of the secondary data were the International Financial Statistics (IFS) of the International Monetary Fund (IMF), where world non-fuel commodity prices which together with export prices of French beans in Kenya were used to derive relative prices (which are export prices divided by world non-fuel commodity prices). The real foreign incomes were proxied by the industrial production index of EU countries and were obtained from the IFS of the IMF.

The real values of foreign incomes, export prices and exchange rates were obtained by deflating the nominal values using the monthly Consumer Price Index (CPI) from the Kenya National Bureau of Statistics (KNBS). The base year of analysis was 2002, such that September 2002 = 100. The monthly French beans export volumes and supply volumes were normalized such that September 2002=1.

3.8. DATA LIMITATIONS

Evaluations based on secondary time series data are better when based on large number of observations for longer time periods. Thus, the analysis in this study was limited by the availability of continuous good quality disaggregated horticultural crops data from secondary sources. Also there could be biases in the data that are not known by the researcher since he had

no control on how the primary data was collected. In addition, the researcher is not privy to any problems encountered in the primary data collection process.

3.9. DATA COLLECTION PROCEDURES

The secondary data were collected by the researcher and the assistants by making visits to relevant organizations. In addition, internet search, library search and indexing were used to collect the data. The data were screened to identify outliers, miscoding, missing or any other anomalies to improve performance of the analytical method. In order to establish the reliability of the data, the researcher obtained information on how the data were collected from respective institutions.

3.10. DATA ANALYSIS

The study made use of descriptive statistics and econometric techniques to analyze the data. Stata computer software package was used. Descriptive statistics of all the variables used in estimation were computed for the whole sample period. The unit root tests were used to test the data series for stationarity or the order of integration in order to avoid spurious regression results. Johansen's maximum likelihood cointegration analysis was carried out and an export demand model estimated to determine the long-run effects of the variables. Finally, an error correction model was estimated to determine the short-run effects of the explanatory variables on the exports of French beans from Kenya to the EU market.

3.11. CHAPTER SUMMARY

The chapter provides the framework for analyzing exchange rate volatility used. This is followed by the specification of the export demand model used to estimate the effects of exchange rate volatility on French beans exports in Kenya. Next, the model diagnostic unit root tests, cointegration analysis and the error correction model are described. Lastly, the data sources, collection procedures and the analysis are presented.

CHAPTER 4

EMPIRICAL RESULTS AND DISCUSSION

4.1. INTRODUCTION

This chapter presents the empirical results of the evaluation of the effect of exchange rate volatility on French bean exports from Kenya to the EU market. First, the descriptive statistics of the variables used in the export demand model are presented and discussed. This is followed by the presentation of the results of the unit root and cointegration tests. The Augmented Dickey-Fuller and Phillips-Perron unit root tests were used to evaluate the existence of unit roots in the variables used in the export demand model. Then, a Johansen and Juselius (1990) cointegration test for the presence of long-run equilibrium relationship among the variables was carried out.

Finally, the Vector Error Correction Model estimates depicting the short run dynamics of the export demand model are presented and discussed.

4.2. DESCRIPTIVE STATISTICS

The descriptive statistics on the volumes of French bean exports from Kenya to the EU market during the period before and after the exchange rate liberalization periods are as presented in Table 4.1.

Table 4.1. Mean and Coefficient of Variation of Export Volumes (T) in Pre-liberalization and Post-liberalization Periods

Variable	Pre-liberalization period (1990-1993)		Post-liberalization period (1994-2011)		Entire period (1990-2011)	
	Mean	CVª (%)	Mean	CVª (%)	Mean	CVª(%)
Export volume (T)	2011.85	140.27	3788.73	266.92	3465.66	266.81

Note: ª The coefficient of variation (CV) is a ratio of the standard deviation to the mean.
Source: Author's Computations

The evolution of French bean export volumes from Kenya to the EU market from January, 1990 to December, 2011 is presented in Figure 4.1.
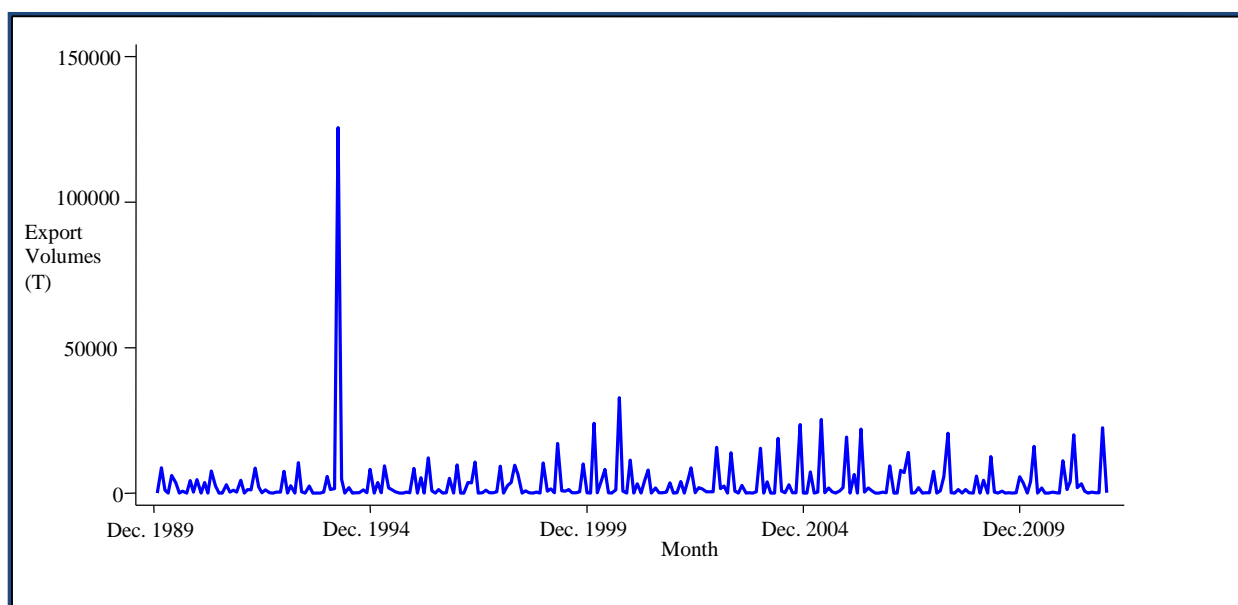
Figure 4.1. Kenyan French Beans Export Volumes (T) to the EU Trend (1990-2011)
Source: Author's Computation

The mean export volume of French beans from Kenya to the European Union (EU) was higher and more variable during the post-liberalized period than the pre-liberalization period (Table 4.1 and Figure. 4.1). The mean export volume rose from 2012 tonnes to 3789 tonnes which represents an 88 percent increase (Table 4.1). The French bean export volumes have no clear tendency to return to a constant value or linear trend, suggesting that the variable is non-stationary and hence the need to perform formal unit root tests (Figure 4.1).

Notably, there was a sharp increase in the volume of French beans exports observed in 1993. During this period, the Kenyan exports of French beans to the EU grew, because of the ability of the exporters to penetrate the market more directly. This success was achieved by the larger exporters with higher value products, pre-packed and prepared packs that bypassed many of the middlemen. In addition, the exporters became more sophisticated and also grew with the market. There is also another notable sharp increase in French bean export volumes to the EU market immediately after the liberalization of the shilling exchange rate in early 1994 (Figure 4.1). This was a result of the liberalization of the foreign exchange market and removal of trade restrictions (World Bank, 2011). These measures, particularly the devaluation of the Kenya shilling, boosted exports.

The variability of French bean export volume as represented by the coefficient of variation (CV) increased during the post liberalization period from 140 percent to 267 percent (Table 4.1). Thus the French bean export volume was more variable during the post-exchange rate liberalization

period than during the pre-liberalization period. The increase in variability implies that Kenya French bean export volume was less stable during the post-liberalization period as compared to pre-liberalization period.

To determine whether the mean export volumes were significantly different between the two time periods, a two sample mean comparison test was carried out and the results are as shown in Table 4.2. The null hypothesis was that the mean export volumes during the pre-liberalization and post-liberalization periods are equal against the alternative that they are not equal. The test statistic falls in the rejection region and the null hypothesis is rejected at the 95 percent level of significance. These results imply that the mean French bean export volume to the EU before the liberalization of the exchange rates was significantly different from the mean export volume after the liberalization of the exchange rates.

Table 4.2. Two Sample Mean Comparison Test on French Beans Export Volumes (T)

Period	Number of observations	Mean	Standard error	Standard deviation
Pre-liberalization	48	2011.85	407.31	2821.94
Post-liberalization	216	3788.73	688.10	10112.89
Entire period	264	3465.66	569.09	9246.61
Difference		-1776.88	799.61	
t value	-2.22			
	0.05			
Rejection region	t < -1.96 or t > 1.96			

Note: represents the level of significance and t is the test statistic.
Source: Author's Computations

The economic implication of this result is that the mean French bean export volume was higher during the floating exchange rate period compared to the fixed exchange rate period. The conclusion is that the liberalization of Kenya shilling exchange rate resulted to an increase in the mean French beans export volume to the EU market.

The evolution of real exchange rates of the shilling against the US$ before and after the exchange rate liberalization period is presented in Figure 4.2. The real exchange rate series are characterized by rapid changes with an increasing trend (Figure 4.2). The upward trend indicates that the monthly exchange rate series changes over time, thus implying nonstationary property and therefore the need for carrying out formal unit root test. The shilling real exchange rate depreciated in 1992 due to the severe drought experienced in the period which negatively affected agriculture and hence the key export crops. In 1992, the deterioration of the Shilling exchange rate was also due to the printing of money by the Central Bank of Kenya (CBK) to enable the ruling party win elections after the sanctioning of multiparty politics. There is a large increase in the Kshs/US$ exchange rate after the Kenyan shilling was allowed to float in 1993 (Figure 4.2) leading to one of the highest inflation rates experienced in the country.
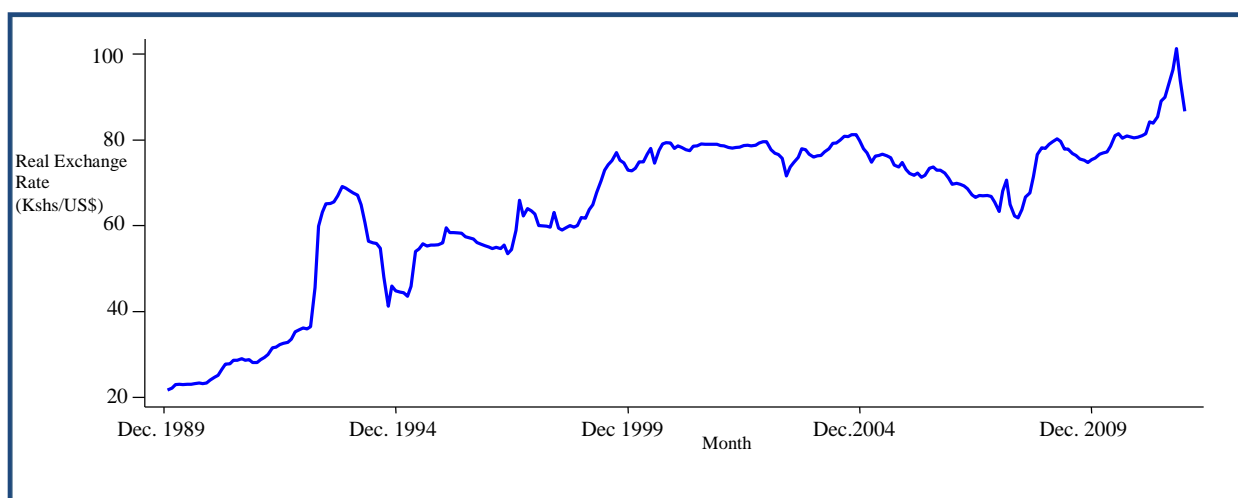
Figure 4.2. Monthly Real Exchange Rates (Kshs/US$) Trend (1990-2011)
Source: Author's Computations

The sharp depreciation of the shilling in 1997 (Figure 4.2) came as a result of the *El Nino* rains which disrupted agricultural production and economic activities and the withholding of aid by

the Paris Club of donors due to the 1997 General Elections (World Bank, 2011). The decline in agricultural production during the *El Nino* phenomenon coupled with the withholding of aid led to high food prices which led to rising inflation, leading to the weakening of the shilling against the dollar (World Bank, 2011). There was also a large depreciation of the shilling exchange rate in 1998 and 2000 (Figure 4.2) as a result of the drought experienced in Kenya during these years. The episode of drought experienced during the 1998 and 2000 led to high food and electricity prices, resulting in high inflation rates and the depreciation of the shilling (Figure 4.2). In addition, the assumption into power of the NARC government in 2000 led to the strengthening of the Shilling against the US dollar (World Bank, 2011).

 In 2008, the Kshs/US$ exchange rate slightly increased (Figure 4.2) due to the effects of the post-election violence which brought political uncertainty, thus deterring domestic and international investment and consumption, leading to the weakening of the shilling. Notably, there was also another sharp increase in the shilling exchange rate against the US$ in 2011 as a result of a rapid rise in oil prices, Euro crisis and incidence of drought (World Bank, 2011).

In 2011, the Euro crisis created uncertainty in the global market. Since Europe is the main market for Kenya's horticulture, the economic meltdown in Europe along with the crisis in the Arab world, a significant destination for Kenya's exports, negatively impacted the growth of Kenya's key exports due to reduced demand thus leading to a large depreciation of the shilling (Figure 4.2). The depreciation of the shilling in 2011 was also as a result of high oil prices which led to high import bill, thus increasing the demand for US$ and leading to depreciation of the shilling (Figure 4.2).

The descriptive statistics of the real exchange rates (Kshs/US$) during the period prior to and post-exchange rate liberalization periods are as presented in Table 4.3.

Table 4.3. Mean and Coefficient of Variation of Real Exchange Rates (Kshs/US$) in Pre-liberalization and Post-liberalization Periods

Variable	Pre-liberalization period (1990-1993)		Post-liberalization period (1994-2011)		Entire period (1990-2011)	
	Mean	CV[a] (%)	Mean	CV[a] (%)	Mean	CV[a](%)
Real exchange rates (Kshs/US$)	35.60	43.39	70.70	14.99	64.32	27.75

Note: [a] The coefficient of variation (CV) is a ratio of the standard deviation to the mean.
Source: Author's Computations

As indicated in Table 4.3 and Figure 4.2, the mean real exchange rate was higher during the post-exchange rate liberalization period compared with the pre-liberalization period. In particular, the mean real exchange rates of the shilling depreciated from 36 Kshs/US$ during the pre-liberalization period to 71 Kshs/US$ in the liberalization period, thus representing a 99 percent increase in the mean real exchange rate. In 1997 the International Monetary Fund (IMF) announced that it was delaying an expected disbursement awaiting reforms on governance (World Bank, 2011). This was interpreted by some players in the financial markets as an aid freeze and other development partners followed suit, thus leading to depreciation in the shilling exchange rate.

The CV declined during the post liberalization period from 43 percent to 14 percent (Table 4.3). This suggests that the liberalization led to a stabilization of the exchange rate. The reduction of the variability of the exchange rate implies that Kenyans received more stable exchange rates

during the post-liberalization period as compared to pre-liberalization period. However, this does not rule out volatility during the post-liberalization period as depicted by the marked difference in the mean real exchange rates during the two periods. The volatility in exchange rate led to an increase in variability of the French beans real exports to the EU during the shilling exchange rate liberalization period.

Figure 4.3 shows the empirical distribution of the real exchange rates with a curve of the kernel density plot overlaid. The exchange rate series have lots of the observations around the average of 64.32 (Figure 4.3) and a relatively large number of the observations that are far from the average, on the centre of histogram, with a high peak and the tails being relatively heavy compared to the normal, thus indicating that these series are leptokurtic (Figure 4.3). The observations of the time series have a distribution which often is assumed to be normal. However, empirical studies of practically any financial time series show that this is not always the case. To quantify this property in the exchange rate series a look at the kurtosis of the distributions is done.

The leptokurtic distribution has a kurtosis value of 3.18 which is greater than that of a standard normal distribution of 3 (Gujarati, 2005). Such a distribution gives the exchange rate distribution a high peak, a thin midrange and long tails. This implies that exchange rate series have a higher probability for extreme events than in data that are normally distributed.
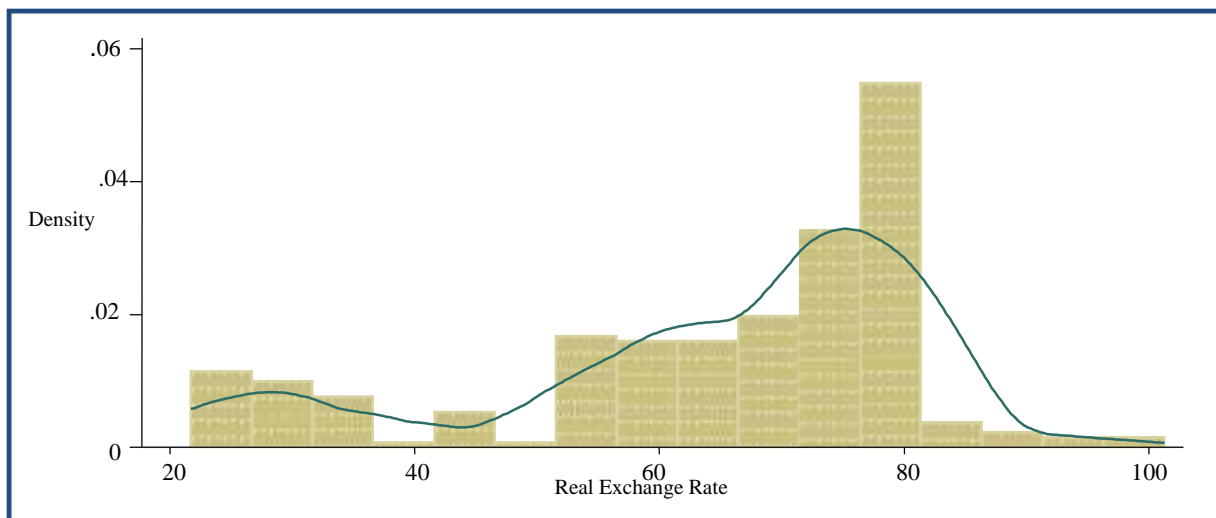
Figure 4.3. Empirical Distribution of the Kshs/US$ Real Exchange Rates (1990-2011)
Source: Author's Computations

The Consumer Price Index (CPI) was used to deflate the nominal exchange rates to come up with real exchange rate series for January 1990 to December 2011. The values for the real exchange rate volatility of the Kenya shilling against the US$ were estimated using the conditional variance of the exchange rate from the GARCH model. The GARCH model was estimated using the maximum likelihood method. The GARCH procedure allows the capture of the time-varying conditional variance as the parameter generated from the time series model of the conditional mean and variance of the exchange rate. This effect is applicable in the export demand model in that if traders need to forecast the exchange rate to estimate their stream of profits from trading, their trading contracts will depend on the forecast of the exchange rate and the uncertainty regarding the accuracy of the forecasts.

To determine whether the mean real exchange rates were significantly different between the pre-liberalization and post-liberalization periods, a two sample mean comparison test was carried out and the results are as shown in Table 4.4. The null hypothesis was that the mean Kshs/US$

during the pre-liberalization and post-liberalization periods is equal against the alternative that it is not equal.

Table 4.4. Two Sample Mean Comparison Test on the Kshs/US$ Real Exchange Rates

Period	Number of observations	Mean	Standard error	Standard deviation
Pre-liberalization	48	35.60	2.23	15.45
Post-liberalization	216	70.70	0.72	10.60
Entire period	264	64.32	1.10	17.85
Difference		-35.10	2.34	
t value	-14.98			
	0.05			
Rejection region	t < -1.96 or t > 1.96			

Note: represents the level of significance and t is the test statistic.
Source: Author's Computations

The test statistic falls in the rejection region and the null hypothesis is rejected at the 95 percent level of significance (Table 4.4). This confirms the finding from descriptive statistics that the liberalization of the shilling exchange rate led to an increase in the mean real Kshs/US$ exchange rate (Table 4.3). The economic implication of this is that the mean Kshs/US$ exchange rate was higher during the shilling floating exchange rate period compared to the fixed exchange rate period. An increase in the mean Kshs/US$ exchange rate represents depreciation thus leading to increased competitiveness. As Kenya's competitiveness improved, French beans exports to the EU increased after liberalization of exchange rate.

The descriptive statistics on real foreign incomes (US$) before and after exchange rate liberalization are as presented in Table 4.5.

Table 4.5. Mean and Coefficient of Variation of Real Foreign Incomes (US$) in Pre-liberalization and Post-liberalization Periods

Variable	Pre-liberalization period	Post-liberalization period	Entire period
	(1990-1993)	(1994-2011)	(1990-2011)

	Mean	CVª (%)	Mean	CVª (%)	Mean	CVª(%)
Real foreign incomes (US$)	85.80	7.47	95.01	7.37	93.33	8.31

Note: ª The coefficient of variation (CV) is a ratio of the standard deviation to the mean.
Source: Author's Computations

The trend in real foreign incomes for Kenya's major trade partners in the EU before and after the liberalization of the exchange rate is presented in Figure 4.4. The mean real foreign income for Kenya's major trade partners in the EU was higher and less variable during the post-exchange rate liberalization period than in the pre-liberalization period (Table 4.5 and Figure 4.4). The real foreign incomes are upward trended thus suggesting a nonstationary trend and hence the need to perform formal unit root test. The mean real foreign income rose from 86 US$ during the pre-liberalization period to 95 US$ during the post liberalization period which represents a 10 percent increase (Table 4.5). The variability of the real foreign incomes declined as indicated by the reduction of the CV from 7.47 percent during the pre-liberalization period to 7.37 percent during the post-liberalization period (Table 4.5).

Figure 4.5. Monthly Kenyan French Beans Relative Prices to the EU Trend (1990-2011)
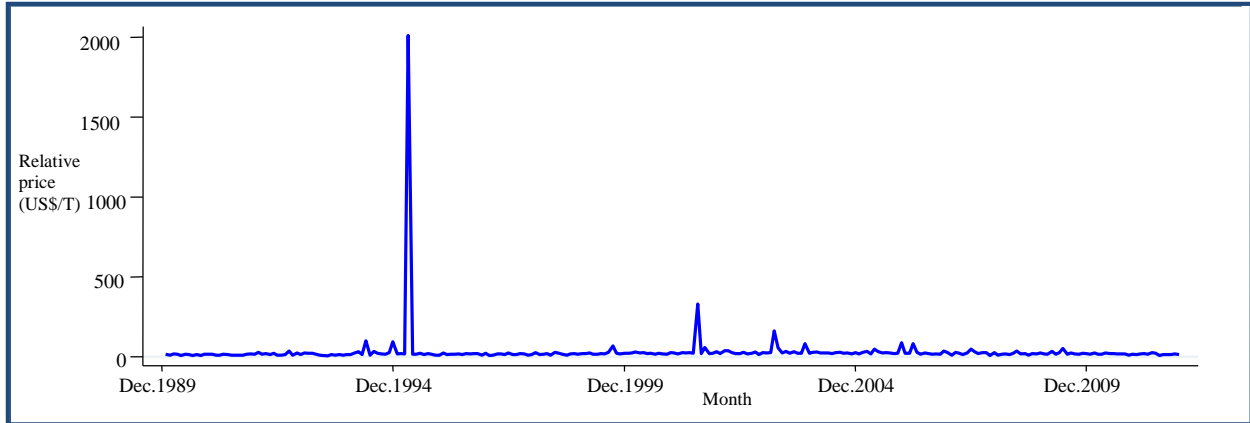
Source: Author's Computations
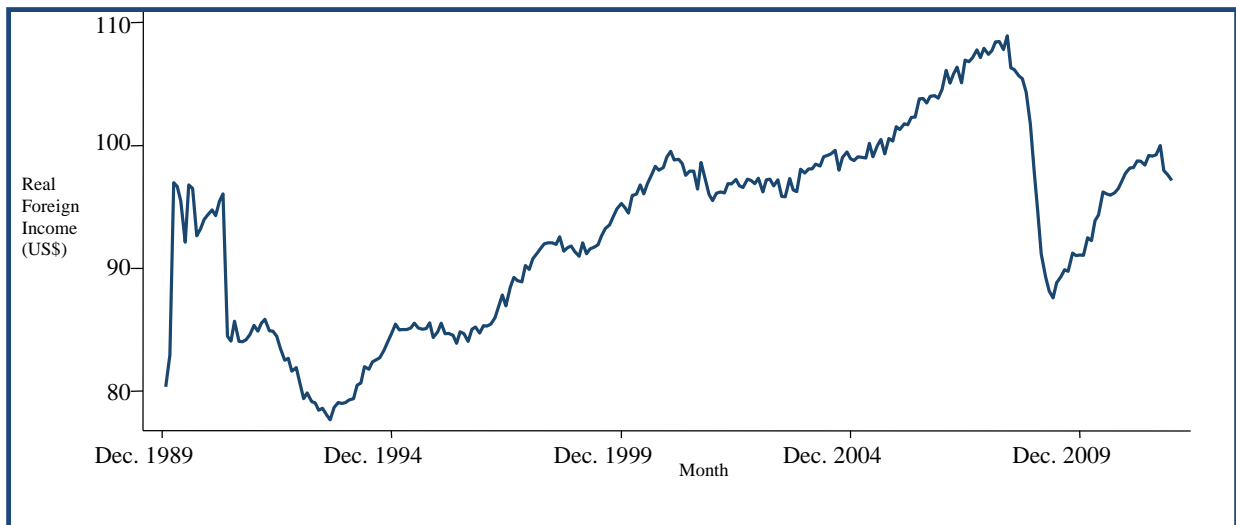
Figure 4.4. Real Foreign Incomes (US$) of EU Countries Trend (1990-2011)

Source: Author's Computations

To determine whether the mean real foreign income was significantly different between the pre-liberalization and after the exchange rate liberalization periods, a two sample mean comparison test was performed and the results are as shown in Table 4.6. It was hypothesized that the mean real foreign income for Kenya's major trade partners in the EU during the pre-liberalization and post-liberalization periods are equal against the alternative hypothesis that they are not equal.

The test statistic falls in the rejection region and the null hypothesis is rejected at the 95 percent level of significance (Table 4.6). The implication of these results is that the mean real foreign income after the liberalization of the exchange rates was significantly higher than the mean real foreign income before the liberalization of the exchange rate. The economic implication of this is that the mean real foreign income for Kenya's major trading partners in the EU was higher during the shilling floating exchange rate period compared to the fixed exchange rate period.

Table 4.6. Two Sample Mean Comparison Test on Real Foreign Incomes (US$)

Period	Number of observations	Mean	Standard error	Standard deviation
Pre-liberalization	48	85.80	0.92	6.41
Post-liberalization	216	95.01	0.48	7.00
Entire period	264	93.33	0.48	7.75
Difference		-9.20	1.04	
t value	-8.84			
	0.05			
Rejection region	t < -1.96 or t > 1.96			

Note: represents the level of significance and t is the test statistic.
Source: Author's Computations

As expected, Kenya increased the volume of French beans exports to the EU market after the liberalization due to increased demand in the EU countries as a result of increased real incomes in these nations as indicated by these results. This concurs with the quantity theory of demand for money; that as the income of a nation's major trading partners increases, the value of the country's currency increases, thus leading to a decline of the exchange rate (Pugel, 2007).

The descriptive statistics of relative prices (US$/T) during the period before and after exchange rate liberalization periods are as presented in Table 4.7.

Table 4.7. Mean and Coefficient of Variation of Relative Prices (US$/T) in Pre-liberalization and Post-liberalization Periods

Independent variable	Pre-liberalization period (1990-1993)		Post-liberalization period (1994-2011)		Entire period (1990-2011)	
	Mean	CV[a] (%)	Mean	CV[a] (%)	Mean	CV[a](%)
Relative prices (US$/T)	14.18	0.39	33.67	4.09	30.13	4.14

Note: [a] The coefficient of variation (CV) is a ratio of the standard deviation to the mean.
Source: Author's Computations

The evolution of relative prices of Kenya's French bean exports to the EU, both prior to and after the liberalization of the shilling exchange rate, is graphically illustrated in Figure 4.5.

The mean relative price was higher during the post-exchange rate liberalization period than the pre-liberalization period (Table 4.7 and Figure 4.5). The mean relative price rose from 14 US$/T during the pre-liberalization period to 34 US$/T during the post-exchange rate liberalization period which represents a 143 percent increase. As depicted in Figure 4.6 the relative price has no clear tendency to return to a constant value or linear trend suggesting that the variable is non-stationary and hence the need to perform formal unit root tests. Notably, there was a peak in relative prices in the beginning of 1995 following the liberalization of exchange rates in 1994.

Figure 4.6. Trend of the Monthly French Beans Supply Volumes (T) to the EU Market (1990-2011)
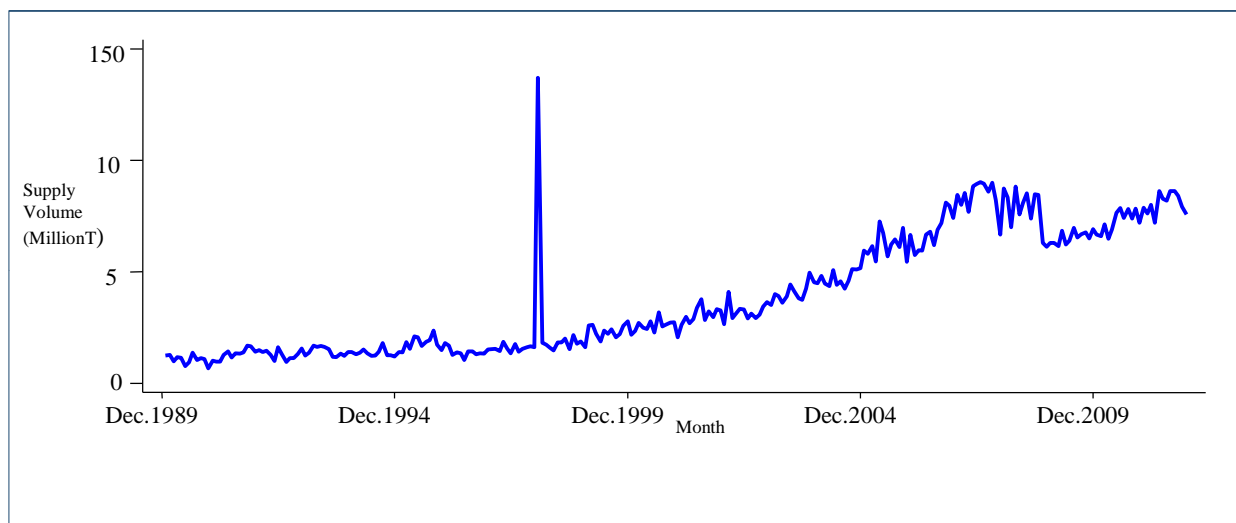
Source: Author's Computations

To determine whether the difference in mean relative prices between the pre-liberalization and after the exchange rate liberalization periods was significant, a two sample mean comparison test was performed and the results are as shown in Table 4.8. It was hypothesized that the mean relative prices during the pre-liberalization and post-liberalization periods are equal against the alternative hypothesis that they are not equal. The test statistic falls in the rejection region and the null hypothesis is rejected at the 95 percent level of significance (Table 4.8). The implication of these results is that the mean relative price after the liberalization of the exchange rates was significantly higher than the mean relative price before the liberalization of the exchange rates (Table 4.8). The economic implication of this is that during the shilling floating exchange rate regime the mean relative French beans price was higher than the mean relative price during the fixed exchange rate period.

Table 4.8. Two Sample Mean Comparison Test on the Relative Prices (US$/T)

Period	Number of observations	Mean	Standard error	Standard deviation
Pre-liberalization	48	14.18	0.79	5.50
Post-liberalization	216	33.67	9.37	137.73

Entire period	264		30.13	7.68	124.78
Difference			-19.49	9.40	
t value	-2.07				
	0.05				
Rejection region	t < -1.96 or t > 1.96				

Note: represents the level of significance and t is the test statistic.
Source: Author's Computations

The descriptive statistics on supply volumes (T) during the period before and after exchange rate

liberalization periods are as presented in Table 4.9.

Table 4.9. Mean and Coefficient of Variation of Supply Volumes (T) in Pre-liberalization and Post-liberalization Periods

| Independent variable	Pre-liberalization period (1990-1993)		Post-liberalization period (1994-2011)		Entire period (1990-2011)	
	Mean	CV^a (%)	Mean	CV^a (%)	Mean	CV^a(%)
Supply Volume (T)	1276222.00	19.29	4439631.00	59.30	3864480.00	69.29

Note: ^{a} The coefficient of variation (CV) is a ratio of the standard deviation to the mean.
Source: Author's Computations

The trend of the monthly French bean supply volumes to the EU market both before and after the

liberalization of the shilling exchange rate is graphically illustrated in Figure 4.6.

The mean supply volume of French beans to the European Union market was higher during the

post-exchange rate liberalization period than the pre-liberalization period (Table 4.9 and Figure

4.6). The mean supply volume rose from 1,276,222 tonnes during the pre-liberalization period to

4,439,631 tonnes during the post-exchange rate liberalization period, which represent a 248

percent increase (Table 4.9). The supply volume has no clear tendency to return to a constant

value or linear trend suggesting that the variable is non-stationary and hence the need to perform

formal unit root test (Figure 4.6).

To determine whether the mean supply volumes were significantly different between the pre-liberalization and after the exchange rate liberalization periods, a two sample mean comparison test was performed and the results are as shown in Table 4.10. It was hypothesized that the mean French beans supply volumes to the EU market during the pre-liberalization and post-liberalization periods are equal against the alternative hypothesis that they are not equal.

Table 4.10. Two Sample Mean Comparison Test on the Monthly French Beans Supply Volumes (T) to the EU Market

Period	Number of observations	Mean	Standard error	Standard deviation
Pre-liberalization	48	1276222.00	35534.15	246187.80
Post-liberalization	216	4439631.00	179117.80	2632483.00
Entire period	264	3864466.00	164804.10	2677749.00
Difference		-3163409.00	182608.50	
t value	-17.32			
	0.05			
Rejection region	t < -1.96 or t > 1.96			

Note: represents the level of significance and t is the test statistic.
Source: Author's Computations

The test statistic falls in the rejection region and the null hypothesis is rejected at the 95 percent level of significance (Table 4.10). These test results are consistent with the finding of the descriptive statistics that the mean French beans supply volume to the EU market after the liberalization of the exchange rates was significantly higher than the mean supply volume before the liberalization of the exchange rates (Table 4.9). The economic interpretation of these results is that during the shilling floating exchange rate period, the volume of French beans supplied to the EU market was higher than during the fixed exchange rate regime.

4.3. RESULTS OF UNIT ROOT TESTS

The Augmented Dickey-Fuller (ADF) (1979) and Phillips-Perron (PP) (1988) methods were used to test for the existence or non-existence of unit roots in the variables used in estimating the export demand model and the results of the tests are as presented in Table 4.11. The tests were

applied to each variable over the period of 1990-2011 at the variables level and at their first

difference. The test results were compared against the MacKinnon (1991) critical values for the

rejection of the null hypothesis of no unit root.

Table 4.11. Unit Root (ADF and PP) Tests Results

Series	Level Series			First Differences		I (d)
	ADF	PP	Lags	ADF	PP	
Dependent Variable						
Export Volumes (T)	-2.88	-2.88	1	-5.57[c]	-4.30[c]	I (1)
Independent Variables						
Real Exchange Rates (Kshs/US$)	-2.89	-2.88	1	-6.88[c]	-6.94[c]	I (1)
Real Foreign Incomes (US$)	-2.90	-2.82	1	-6.26[c]	-7.40[c]	I (1)
Relative Prices (US$)	-2.90	-3.00	1	-6.47[c]	-6.91[c]	I (1)
Supply Volumes (T)	-2.89	-2.88	1	-6.93[c]	-6.85[c]	I (1)
5% Critical Values	-3.50	-3.50		-3.50	-3.50	

Note: [c] Denotes rejection of the null hypothesis of a unit root at the 5 percent level of significance (MacKinnon, 1991).

Source: Author's Computations

The null hypothesis of nonstationaity or unit root is accepted if the absolute values of the

computed ADF and PP statistics exceed the absolute critical values at 5 percent level of

significance. The ADF and PP test critical values at 5 percent level of significance were given as

-3.5 (Enders, 2010) at the variable level and first difference series (Table 4.11). The computed

test statistic for the French beans export volumes was -2.88 in the ADF and PP level series. In

the first difference of the export volumes series, the ADF and PP statistics were -5.57 and -4.30

respectively.

The absolute values of the computed test statistic for the export volumes level series are less than

the critical absolute values at 5 percent level of significance in both the ADF and PP test.

However, the absolute values of the computed test statistics for the export volumes first

difference series are greater than the critical absolute values at 5 percent level of significance in

both the ADF and PP tests (Table 4.11). The results show the presence of a unit root implying that the export volumes series were nonstationary in their level series. However, the first difference series were stationary, hence it is concluded that the export volumes series was integrated of order one, that is; they were **I (1)**. Similarly, comparisons of the computed and critical values of the ADF and PP test statistics for the real exchange rates, real foreign incomes, relative prices and supply volumes show that all variables were integrated of order one that is (**I (1)**) in levels, and of order zero, that is (**I (0)**) in first differences, meaning that they were nonstationary in levels but stationary in first differences (Table 4.11). From the results of the unit root tests, the data series used in the export demand model in this study were found be **I (1)** in the level series, while the first differences series were **I (0)**. A key implication of these findings is the existence of a long run relationship between the dependent and independent variables. This means that in the long run, the dependent variable (French bean export volumes) can be predicted well using the specified independent variables.

The nonstationarity of the level series of export volumes, exchange rates, real foreign incomes, relative prices and supply volumes implied that the means and variances of these variables varied over time. If the regressions were carried out on nonstationary variables they would have given spurious results, implying that the estimates would have been invalid and have no economic implications; hence the need to formally test for unit roots to determine the right choice of model to apply (Table 4.11).The results in Table 4.11 indicated that the variables were **I (1)** and specifying the export demand function of the variables in the level of the series was inappropriate because it could lead to problems of spurious regression.

The econometric results of the model in the level of series would not have been ideal for policy making and such results could not be used for prediction in the long-run. Given that the level series were **I (1)** and the first difference were **I (0)** as shown in Table 4.11, the Johansen-Juselius (1990) cointegration test therefore was appropriate for assessing the existence of long-run relationships among the variables.

4.4. COINTEGRATION ANALYSIS

Since the level series were **I (1)** and the first difference were **I (0)**, the Johansen-Juselius (1990) cointegration test was appropriate for assessment of the presence of long-run equilibrium relationships among the variables in the export demand model. Before proceeding to the results of the cointegration test, the optimal lag length for the VAR specification was determined using the Akaike Information Criterion (AIC), Schwarz Information Criterion (SCIC) and the Hennan-Quinn Information Criterion (HQIC). Table 4.12 shows the results of the lag length for the different information criteria used. The results show that the optimal lag length for the Vector Autoregression Model (VAR) model is 1 (Table 4.12). This is because all the information criteria adopted chose 1 as the optimal lag length since it gave the minimum value for each of the evaluated information criterion in AIC, SCIC and HQIC (Table 4.12).

Table 4.12. Optimal Lag Length Selection

Dependent variable: Monthly export volumes of French beans to the EU

Independent variables: Real foreign incomes, relative prices, real exchange rates and supply volumes

Lag	Log L	FPE	AIC	SCIC	HQIC
0	-599.8353	6.155779	4.655231	4.791428	4.709972
1	-602.1732	6.10956	4.647705*	4.769946*	4.696831*
2	-597.844	6.219219	4.666472	4.8157	4.725859
3	-592.4404	6.12103	4.649542	4.813881	4.715608

Note: * indicates the lag length selected by the criterion
FPE: Final Prediction Error
AIC: Akaike Information Criterion
SCIC: Schwarz Information Criterion
HQIC: Hennan-Quinn Information Criterion

On the basis of the optimal lag length chosen by the lag selection criteria, the results of the maximum eigenvalue and the trace statistic were obtained from the Johansen and Juselius (1990) method to ascertain the number of cointegrating relationships. Except for the exchange rate volatility and liberalization, the other variables were converted into their logarithmic forms in order to remove heteroscedasticity problem from the VAR model. This implies that the parameter estimates generated from the VAR model are interpreted as elasticities. The model was normalized on the export volumes variable, X_t, in order to obtain the long-run parameter estimates as reported in Table 4.13.

Table 4.13. Johansen Multivariate Cointegration Test Results

	λ-max Statistics					Trace Statistics				
H_0	$r = 0$	$r \leq 1$	$r \leq 2$	$r \leq 3$	$r \leq 4$	$r = 0$	$r \leq 1$	$r \leq 2$	$r \leq 3$	$r \leq 4$
H_a	$r = 1$	$r = 2$	$r = 3$	$r = 4$	$r = 5$	$r = 1$	$r = 2$	$r = 3$	$r = 4$	$r = 5$
	63.47	31.95	22.06	9.25	2.79	34.82	22.48	16.13	9.66	2.35
5% Critical values	59.46	39.89	24.31	12.53	3.84	30.04	23.80	17.89	11.44	3.84

Note: The critical values are from Osterwald-Lenum (1992).
Source: Author's Computations

The appropriate cointegrating vector is indicated by the first column under the largest eigenvalue and trace statistics. Hence, starting with the null hypothesis of no co-integration (r 1) among the variables; the maximum eigenvalue test statistics of 63.47 and 59.46 and trace test statistics of 34.82 and 30.04 both rejected the null hypothesis of more than one cointegrating vector at the 5 percent significance level (Tables 4.13). Therefore, on the basis of the eigenvalue and the trace test statistics, there is one cointegrating vector for the VAR model. In particular, this suggested that there was a unique long run equilibrium relationship amongst the variables. Thus, the spurious regression problem associated with nonstationary data did not affect the analysis.

4.5. FACTORS INFLUENCING DEMAND FOR KENYA'S FRENCH BEAN EXPORTS TO EU

The results of the Johansen Multivariate Cointegration test indicate the presence of a long run cointegrating relationship between the variables. The results of French bean export demand model estimation are given in Table 4.14:

Table 4.14. Results of the Export Demand model
Dependent Variable: Monthly French bean export volumes to the EU

Variable	Coefficient	Standard error	t-statistic	p-value
Constant	12.87	3.27	3.94	0.045
$\ln Y_t$	4.96	2.14	2.32	0.031
$\ln P_t$	-0.45	0.15	-3.00	0.016
$\ln V_t$	-2.30	0.89	-2.58	0.023
L_t	0.53	0.21	2.52	0.037
$\ln Q_t$	-0.86	0.34	-2.53	0.024
Summary statistics				
R^2	0.87			
Adjusted R^2	0.86			
Durbin-Watson statistic	2.28			
F-statistic	18.62			

Note: ** denotes significance at the 5 percent significance level.

Source: Author's Computations

where the values in parentheses are standard errors and all the estimated elasticities are significant at the 5 percent level of significance, and X_t is export volumes of French bean exports to the 28 EU countries (Tonnes), Y_t is real foreign incomes proxied by the industrial production index of EU countries (US$), P_t is Kenya's French beans export prices to the EU relative to world non-fuel commodity prices (US$), V_t is the exchange rate volatility given by the GARCH method and L_t is a dummy variable to represent exchange rate liberalization with a value of 1 representing the liberalization period (1994-2011) and 0 to stand for the period before exchange rate liberalization (1990-1993) and Q_t represents the total volumes of monthly supply of French beans to the EU market less the total volumes of Kenyan French beans exports to the EU market (Tonnes).

The results show that the estimated long-run foreign economic activity (Y_t) elasticity carries the expected positive sign and is greater than unity at 4.96. This implies that French bean exports' responsiveness to real foreign incomes is elastic (Table 4.14). Thus a 1 percent increase in foreign income would lead to 4.96 percent increase in Kenya's French bean exports to the EU. The economic implication of this is that an increase in real incomes of Kenya's trading partners in the European Union countries leads to more than a proportionate increase in demand for French beans exports from Kenya. The result supports the theoretical proposition that an increase in the importing country's income leads to an increase in export demand for the exporting country (Pugel, 2007). The elasticity of income reflects the degree to which exports have been adapted to the local tastes of the importing country, where higher income elasticity shows greater adaption (Riedel, 1988, 1989). Thus as the real incomes of the European Union countries increase, their citizens will buy more of all kinds of goods, including more of Kenyan French

beans exports which are adapted to the tastes of their consumers. According to Adler (1970), different elasticities of income reflect the degree to which exports have been adapted to the local tastes of the importing country, where higher income elasticity indicates greater adaption.

The long-run relative price (P_t) coefficient estimate was 0.45 (Table 4.14) and had the expected negative sign. This means that the demand for Kenya's French bean exports to the EU is price inelastic. Hence an increase in the relative price leads to less than proportionate fall in demand of French beans exports from Kenya to the EU market. The result indicates that a 1 percent increase in the relative price of French beans in the EU market leads to a decrease of 0.45 percent in the export demand in case of Kenya. This is consistent with the theoretical expectation; that an increase in the relative price represents reduced competitiveness. As the country's competitiveness declines, exports are expected to decrease due to reduced demand, *ceteris paribus*.

The coefficient of the exchange rate volatility variable (V_t) had a negative effect on French bean exports with elasticity of 2.30 (Table 4.14). Thus, the responsiveness of French beans export demand in the EU market to exchange rate volatility is elastic. A significant negative coefficient,-2.3, for exchange rate volatility in the case of French beans exports demand model implies that an absolute 1 percent increase in the volatility of the exchange rate would reduce Kenya's French bean exports to the European Union by 2.3 percent. This implies that an increase in the shilling exchange rate volatility leads to a more than proportionate decrease in demand for French beans exports from Kenya in the EU market. The result rejects the second hypothesis in this study; that the volatility of exchange rates in Kenya has no effect on French bean exports.

As the results indicate, a unit increase in exchange rate volatility in Kenya leads to a two-fold decrease in French beans exports to the EU. This is in concurrence with the expectation in African countries where a negative sign is predicted due to the absence of forward exchange markets.

Thus increased exchange rate volatility increases uncertainty about future exchange rate behavior. This implies that French beans exporters in Kenya are therefore risk-averse and with an increase in exchange rate volatility exporters reduce their exports in order to reduce their risk exposure. These results are explained by the fact that Kenya's French beans exports compete with the local market, as there is a substantial amount that is consumed domestically. Hence in conditions of high exchange rate volatility which causes uncertainties regarding exporters' profits, their option is to reduce production or sell to the domestic market. According to the risk aversion theory, this is due to lack of well-developed hedging facilities and institutions in Kenya's foreign exchange markets (Doroodian, 1999). Therefore, under high exchange rate volatility, exporters prefer to sell in domestic markets rather than foreign markets, negatively affecting exports. The implication is that economic policies aimed at stabilizing the exchange rate will increase the volume of French beans exports in Kenya.

Exchange rate volatility was found to have a negative effect on French beans exports flows between the Kenya and the EU. The reason behind this result was that an increase in exchange rate volatility makes the exchange rate less predictable, thereby introducing a greater factor of risk in doing French beans business. Risk-averse French beans traders leave the business, greatly reduce their production activities, or require a risk premium to maintain their previous level of

economic activity. Those who stay in business are often forced to adjust their production costs by reducing the size of their production facilities and the volume of production (Kandilov, 2008, Cho *et al*. 2002 and Dell'Ariccia, 1999). Other traders, who are risk takers, increase their French beans export prices to offset the potential losses from the associated risk. This makes markets vulnerable and reduces French beans exports. In addition, the volatile exchange rate indirectly reduces French bean exports through reallocation of resources (Orden, 2002).

Kenya's French beans exports respond negatively and statistically significantly to exchange rate volatility. This is consistent with both existing literature that argues that the agricultural sector is most susceptible to exchange rate volatility compared with trade in chemicals and other manufactured goods (Anderson and Garcia 1989, Cho, *et al*. 2002, Maskus 1986, Pick 1990). Empirical evidence shows that agricultural markets are highly price competitive (Barrett *et al*. 1999, Barrett and Li 2002). Kenya's French bean exports are relatively import intensive, depending on considerable imports of farm inputs such as fertilizer and pesticides. Given heavy reliance on imported intermediate inputs in those agricultural sub-sectors that account for most of Kenya's exports to the EU (HCDA, 2011), exchange rate volatility thus discourages agricultural production and trade by causing volatility in both the cost of inputs and in expected export revenues.

In addition, Kenya's French beans production relies heavily on small-scale farming and agribusinesses, with small average farm size and relatively little capital, as compared to its trading partners, and intensely competitive, with low average profit margins (HCDA, 2011). These firms operate in a highly competitive environment and are likely more reluctant than large industrial firms to manage exchange rate volatility through hedging instruments in the futures or

forward markets, both because of the high cost associated with these transactions and specific requirements on farm credit, as well as availability of skilled human capital for such sophisticated management. Kenyan farmers and exporters have limited ability to absorb losses associated with exchange rate uncertainty, and thus French beans export volumes are dampened by exchange rate volatility.

The results strongly supported that agricultural trade volumes exhibit an unusually high degree of sensitivity to exchange rate uncertainty, far more than in other sectors (Adubi and Okunmadewa, 1999), indeed this effect emerges in the Kenyan-EU French bean trade flow data used in this study. This suggests a possible role for policy mechanisms to help farmers and exporters of agricultural commodities hedge currency risk in the marketing system (Adubi and Okunmadewa, 1999). These results imply that policies to stabilize agricultural markets must pay attention not only to agricultural sectoral policy, but also to macroeconomic policies that affect exchange rate volatility.

The long run exchange rate liberalization (L_t) coefficient estimate is 0.53 (Table 4.14)and has a positive sign in line with *a priori* expectation. This implies that the responsiveness of French bean export volumes to exchange rate liberalization was inelastic. This indicates that French beans export volumes increased after the liberalization of the shilling exchange rate. This result reveals that the shilling exchange rate liberalization in Kenya had a positive effect on French beans export volumes to the EU. A positive long run exchange rate liberalization dummy coefficient implies a higher export volume during the exchange rate liberalization period. Thus the monthly Kenyan French beans export volumes to the EU were higher for the period from

January 1994 to December 2011 as compared to the period from January 1990 to December 1993. Thus, the liberalization of the shilling exchange rate led to a rise in the monthly French beans export volumes to the EU. This result is consistent with the preliminary finding from the descriptive statistics that during the exchange rate liberalization period there was an increase in the volumes of French beans exports to the EU market.

The long run supply volumes (Q_t) coefficient estimate is 0.86 (Table 4.14)and has negative sign as expected *a priori*. This implies that the responsiveness of Kenyan French bean export volumes to the total volumes of French beans supplied in the EU market was inelastic. Hence an increase in the supply volume leads to less than proportionate decrease in demand of French beans exports from Kenya to the EU market. The result indicates that a 1 percent increase in the total volumes of French beans supplied in the EU market leads to a decrease of 0.86 percent in the export demand in case of Kenya. This is consistent with the theoretical expectation; that an increase in the total volume supplied in a market leads to a decline in the volume supplied by a particular entity due to glut.

4.6. MEASUREMENT OF EXCHANGE RATE VOLATILITY

From the review of literature, a number of measures of volatility have been used as a proxy for risk. In this study, real exchange rate volatility is used in the analysis. Using only previous volatility information, the GARCH model is employed because it incorporates recent results, trends, and some tendency towards a long-term level. The GARCH model also solves the autocorrelation problem and provides more accurate results for the large number of observations analyzed in this study.

The GARCH model was developed by Bollerslev in 1986. The GARCH model is an extension of the ARCH model in which the variance is given by:

$$u^2 = r_0 + s_1 u^2_{t-1} + s_2 u^2_{t-2} + \ldots s_k u^2_{t-k} + r_1 u^2_{t-1} + r_2 u^2_{t-2} + \ldots + r_m u^2_{t-m}$$ **(4.1)**

where u^2_{t-1} for j= 1, 2....k is the GARCH term representing the last period's forecast variance. GARCH (1,1) is the simplest specification in this class, and is the most widely used specification. Thus, the GARCH (1,1) model is given by:

$$u^2_t = r_0 + s_i u^2_{t-1} + r_i v^2_{t-1}$$ **(4.2)**

where u^2_t is a non-negative process, and $r_0 > 0$, $r_i \ 0$ while $s_i \ 0$. The non-negativity restrictions on the parameters ensure positivity of the variance, u^2_t. The sizes of the parameters r_i and s_i determine the short-run dynamics of the resulting volatility process (Bollerslev, 1986). Large ARCH error coefficient r_i, imply that volatility reacts significantly to market forces whilst large GARCH coefficients, s_i, indicate that shocks to the conditional variance take a long time to die out hence volatility is persistent. On the other hand, high r_i coefficient relative to s_i indicate that volatility tends to be high (Bollerslev, 1986).

This study therefore employs equation (4.3) as the GARCH process because GARCH (1, 1) is the simplest and most robust of the family of volatility models (Bollerslev *et al.* 1992). The results of equation (4.3) may be interpreted as exporters' prediction of the current period's real exchange rate variance. Equation (4.3) captures exchange rate volatility and was estimated using the maximum likelihood method. The results of equation 4.3 may be interpreted as Kenyan

French beans exporters prediction of the current period's exchange rate variance. This variance is measured as a weighted average of a long-term average (the constant term) and the GARCH and ARCH terms. Thus the predicted values of u^2_t from equation 4.3 provide the measure of exchange rate volatility of the Kenyan Shilling against the U.S. dollar. This involves explaining the exchange rate volatility by positing a structural relationship between volatility and its determinants. The results of GARCH (1,1) model for the period from January, 1990 to December, 2011 are shown in Table 4.14. The results show that the evaluated GARCH (1,1) model parameter estimates are significant at 5 percent level and are satisfactory in terms of the goodness of fit as depicted by the high R^2 value of 0.782.

The test for the presence of autocorrelation was carried out using the Durbin Watson statistics and was found to be within the normal bound at 2.48, indicating that the model is free from autocorrelation (Table 4.14). Thus, volatility is time-varying and shocks are persistent and the process is stationary. The forecast series u^2_t from the GARCH model provides a suitable measure of exchange rate volatility. As a result, it was found that Kenya's exchange rates follow the GARCH process and the conditional variance can be chosen as a measure of exchange rate volatility. Figure 4.7. plots the estimated volatility process of the GARCH (1,1) model in Table 4.14 and shows the trend of the estimated exchange rate volatility process. The exchange rate has a number of sharp jumps, indicating that the assumption of normality might be violated. Further, it does not have a constant mean and exhibits phases of relative tranquility followed by periods of high volatility.

**Table 4.15. Estimates of the GARCH (1,1) Model**

Variable	Coefficient	t statistic	value
r_0	0.00000035	2.551	0.02

u^2_{t-1}	0.791	32.727	0.04
v^2_{t-1}	0.0708	5.339	0.03
R^2	0.782		
Loglikelihood	-2896.968		
Durbin-Watson statistic	2.48		

Source: Author's Computations

Figure 4.7. reveals that the exchange rate had several hikes in the beginning and a few hikes towards the end of the period under review. The real exchange rates experienced a much more volatile period from 1990 to 2000. The exchange rate then was relatively stable until late 2008 and the volatility increased again towards the end of the sample period.

Figure 4.7. GARCH Volatility of the Real Exchange Rates (1990-2011)
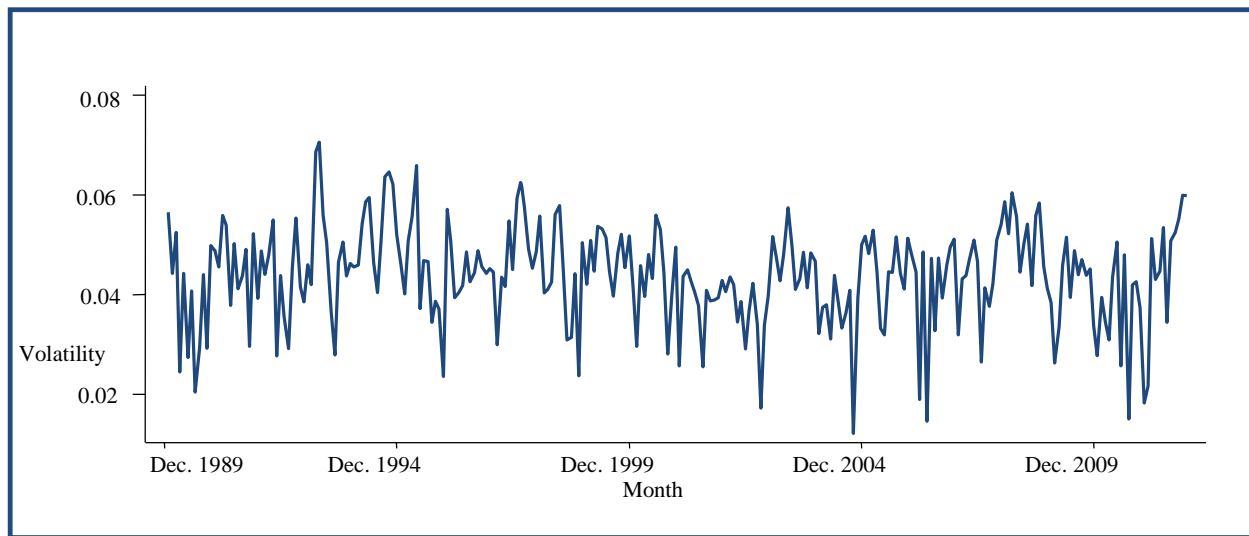
Source: Author's Computations

The trend portrays a period of relative stability between 1990 and 1993 and high volatility in the exchange rate after 1993 (Figure 4.7). Notably, there was a sharp rise in volatility in 1993 which was caused by a balance of payment crisis in Kenya due to a rapid decline in the value of the shilling as a result of 1992 general elections (Adam *et al*. 2010). Overall, the exchange rate volatility was lower during the period of exchange rate liberalization from 1994 to 2011

compared to the period before the exchange rate liberalization from 1990 to 1993. These results reject the first hypothesis in this study that there is no volatility of exchange rates in Kenya and the study concludes that the liberalization of the exchange rates led to a decline in exchange rate volatility.

4.7. ERROR CORRECTION MODEL

Based on the Engle and Granger representation theorem (1987), the existence of a cointegrating relationship among a set of variables that are not stationary in levels implies that there will be a short-run error correction relationship associated with them. The finding that there is one cointegrating vector (Table 4.13) among the variables in the French beans export demand model for Kenya implies that it is possible to formulate and estimate an error correction model to evaluate the short-run dynamics of French bean export demand model. This relationship represents an adjustment process by which the deviated actual export is expected to adjust back to the long run equilibrium path and thus reflecting the dynamics that exist between French bean exports and its major determinants. Table 4.15 provides the regression results for the error correction model given in Equation 3.6.

In Table 4.16, ln represents natural logarithm, the symbol   is the first difference operator, X_{t-1} is the French beans exports volume, Y_t is real foreign incomes, P_t is relative prices, V_t is a measure of exchange rate volatility represented by the conditional variance obtained from the GARCH (1,1) model, Q_t is French beans total supply volumes in the EU market, L_t is exchange rate liberalization dummy and ECM_{t-1} is the error correction term. The lag length for each variable

and the sequence in which the variables were entered in the VECM was selected using the

Akaike Information Criterion (1969).

Table 4.16. Estimates of Vector Error Correction Model (1990-2011)

Variable	Coefficient	Standard error	value
Constant	2.04**	0.57	0.035
lnX_{t-1}	-0.23**	0.11	0.026
lnY_t	4.86**	2.33	0.019
lnP_t	-0.38**	0.12	0.027
V_t	-1.73 **	0.75	0.044
lnQ_t	-0.71**	0.19	0.021
L_t	0.42**	0.18	0.020
ECM_{t-1}	-0.77**	0.29	0.015
Summary statistics			
$R^2 = 0.74$			
Durbin-Watson = 2.49			
Serial Correlation, F = 1.15 (0.46)			
Heteroscedasticity, F-statistic = 4.97 (0.01)			
Normality, Jarque-Bera = 0.54 (0.91)			

Note: ** denotes significance at the 5 percent significance level.
Source: Author's Computations

The R^2 is high at 0.74 (Table 4.16) indicating that goodness of fit of the vector error correction

model. The model explains 74 percent of the variance in the volumes of French bean exports.

The F-statistics of 4.97 with a statistical significance at 1 percent shows that the variation in the

long-run French beans export volumes is attributable to changes in the given independent

variables (Table 4.16). The Durbin Watson statistic was 2.49, indicating that the model is free

from autocorrelation (Table 4.16). The Durbin Watson statistic is low at 2.49 indicating the need

for the unit root test to make the data stationary. The model fulfilled all diagnostic tests of no

serial correlation, homoscedasticity, and normality of residuals as indicated by the summary

statistics (Table 4.16). The results show that Kenya's French beans export demand can

effectively be explained by using the specified independent variables.

The coefficients on the lagged values of lnY_t, lnP_t, lnV_t and lnQ_t are short-run parameters

measuring the short-run immediate impact of independent variables on X_t. The coefficients on

the lagged values of $\ln P_t$, $\ln V_t$ and $\ln Q_t$ are significant at 5 percent level and have negative

signs (Table 4.16). This means that a unit change in any of these variables will impact negatively

on the level of French beans export demand. The short-run coefficients follow the same pattern

as the long-run coefficients, but the magnitudes of the short-run coefficients are smaller than the

long-run coefficients. The implication of this is that the independent variables have smaller

effects on the volumes of French beans exports in the short-run compared with the long run.

With the dynamic specification of the model, the short-run dynamics are influenced by the

deviation from the long-run relationship as captured by ECM_{t-1} term. The regressor ECM_{t-1}

corresponds to one month lagged error correction term which is indicative of the the average

speed at which export volume adjusts to a change in equilibrium conditions or the average time

lag for adjustment of exports to changes in the explanatory variables. The coefficient on error

correction term ECM_{t-1} is negative as theoretically predicted and is statistically significant at the

5 percent level (Table 4.16).

The error correction term which measures the speed of adjustment towards equilibrium should

have a negative sign for convergence (Engle and Granger, 1987). From the results it is shown

that the error correction term is significant and has the right negative sign (Table 4.16). This

finding supports presence of an equilibrium relationship among the variables in the cointegrating

equation. This implies that overlooking the cointegrating relationship among the variables would

have introduced misspecification in the underlying dynamic structure. It also indicated that the

speed of adjustment is high.

The significant error correction term implies that Kenya's French beans exports demand model adjusts rapidly to changes in the specified independent variables. This further confirms the existence of a stable equilibrium long run relationship among the variables in the model which is consistent with Banerjee *et al.* (1993). The result justifies the use of ECM specification and further confirms that the variables are indeed cointegrated. The magnitude of the error correction term represents the change in French bean exports per period that is attributable to the disequilibrium between the actual and equilibrium levels. The coefficient of the ECM_{t-1} shows the proportion of the disequilibrium that is corrected each month.

The economic importance of this finding is that the French bean exports speed of adjustment to correct long run disequilibrium between itself and its determinants is high, with 77 percent of the disequilibrium being eliminated in one month. These estimates of ECM suggest that in the absence of further shocks, the gap to revert back to equilibrium would be closed within a period of 1.3 months. These results indicate that the adjustment of French beans export volumes to any change in the independent variables of the export demand model does not take a long time to return to equilibrium because market forces in the export market would rapidly restore the equilibrium.

4.8. CHAPTER SUMMARY

This chapter reports on the estimates of descriptive statistics focusing on the mean and the variability of volumes of French beans exports, real exchange rates, real foreign incomes, relative prices and supply volumes during the period prior to and after the exchange rate liberalization. For each of the variables, a twenty two year time series trend was constructed and

discussed. Then the results of the unit root tests, cointegration analysis and the error correction model were presented.

The results from the descriptive statistics show that the liberalization of the shilling exchange rate resulted to an increase in Kenyan French beans export volumes to the EU. This indicates that Kenya's French beans exports were stimulated by a shift in the exchange rate regime from fixed to floating. The cointegration analysis results show that the exchange rate volatility has a negative and elastic long run effects on French beans exports from Kenya. This implies that an increase in the shilling exchange rate volatility leads to more than proportionate decrease in demand for French beans exports from Kenya in the EU market. This is consistent with the expectation in African countries where a negative sign is predicted due to the absence of forward exchange markets.

The results of the cointegration analysis further indicate that the long run relative price coefficient is inelastic and has the expected negative sign. Hence an increase in the relative price leads to less than proportionate decrease in demand of French beans exports from Kenya to the EU market. This is consistent with the theoretical expectation that an increase in the relative price represents reduced competitiveness. Thus Kenya's exports decrease as a result of reduced demand due to decline in competitiveness leading to a negative supply response. In effect, as the relative price of Kenyan French beans exports to the European Union market increases Kenya's French beans export volumes decrease.

The error correction model results indicate a high speed of adjustment of the French beans exports to correct for long run disequilibrium between itself and its determinants, with 77 percent of the disequilibrium of the previous month`s shock adjusting back to equilibrium in the current month. Thus it takes 1.3 months for the system to revert back to the long run equilibrium after a short run shock. The next chapter presents the main conclusions and recommendations drawn from the results reported in this chapter. In addition, the following chapter includes data limitations, contribution of this study and suggests direction for future research.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. SUMMARY

The purpose of this study was to evaluate the effects of exchange rate volatility on French beans exports from Kenya to the European Union market using monthly data from January, 1990 to December, 2011. The study had two specific objectives. The first one was to evaluate the trends in the volatility of the Kenyan shilling exchange rate. The second was to quantify the effect of exchange rate volatility on Kenya's French bean exports. In addition, the study discusses the implications of the results and offers recommendations.

In order to evaluate the trends in the volume of French beans exports, Kshs/US$ real exchange rates, real foreign incomes, relative prices and French beans supply volumes in the EU market; descriptive statistics comprising the mean, coefficient of variation together with graphical representations were computed. The results of the descriptive statistics were compared for the pre-exchange rate liberalization and post liberalization periods. The period 1990-1993 and 1994-2011 represented the pre-liberalization and post-liberalization periods respectively.

The values of exchange rate volatility of the Kenya shilling against the US$ were computed using the Generalized Autoregressive Conditional Heteroscedasticity model. The study applied the Augmented Dickey-Fuller (1990) and Phillips-Perron (1988) methods to test for the long run stability of the variables used in the empirical analysis. In order to detect whether the variables moved along the same path or not, cointegration analysis using Johansen and Juselius (1990) method was used. The cointegrating long run relationship of the export demand model was

estimated using monthly data for the period January 1990 to December 2011. To detect the speed of adjustment to equilibrium in case of sudden shock, the Vector Error Correction Model was used. This relationship represents an adjustment process by which the deviated actual export is expected to adjust back to its long run equilibrium path.

The results of the descriptive statistics show that the mean export volume of French beans from Kenya to the European Union was significantly higher and more variable during the post-exchange rate liberalization period than in the pre-liberalization period. The mean export volume rose from 2012 tonnes to 3789 tonnes which represents an 88 percent increase while the variability increased as indicated by an increase in the coefficient of variation from 140 percent to 267 percent. Therefore, liberalization of the exchange rate resulted in an increase in French bean exports to the European Union. This indicates that Kenya's French beans exports were stimulated by a shift in the exchange rate regime from fixed to floating, with the export volumes increasing during the floating exchange rate regime.

The mean exchange rate was higher and less variable during the post-exchange rate liberalization period from January 1994 to December 2011 compared with the pre-liberalization period from January 1990 to December 1993. In particular, the mean real exchange rate depreciated from 36 Kshs/US$ to 71 Kshs/US$ (or a 99 percent fall) while the variability declined from 43 percent to 15 percent during the post-liberalization period. It is concluded that the liberalization of the shilling exchange rate led to depreciation and reduced volatility. This resulted in an increase in Kenya's French beans exports to the European Union, showing that a floating exchange rate system was more favourable to the export of French beans to the European Union market. The results of the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model

indicate that the exchange rate volatility was lower post-liberalization than before liberalization. As a result, the null hypothesis of no volatility of exchange rate could not be sustained.

The mean real foreign income of Kenya's major trade partners in the European Union was significantly higher and more stable after the liberalization of the shilling exchange rate than during the pre-liberalization period. The mean foreign real income rose from 86 US$ during the pre-liberalization period to 95 US$ during the post-exchange rate liberalization period, which represents a 10 percent increase. The variability of the real foreign income declined as indicated by the reduction of the coefficient of variation from 7.47 percent during the pre-liberalization period to 7.37 percent during the post-liberalization period. Thus the level of real income for Kenya's major trading partners in the European Union increased during the post-exchange rate liberalization period leading to an increase in demand for goods and services. Thus, Kenya increased the volume of French bean exports to the European Union market after the liberalization due to increased real income in the importing countries.

The study found that mean relative price or terms of trade was higher after the liberalization of the exchange rate than during the pre-liberalization period. This is depicted by the rise in the mean relative price from 14 US$/T during the pre-liberalization period to 34 US$/T during the post-exchange rate liberalization period, thereby representing a 143 percent increase. Thus the mean relative price after the liberalization of the exchange rates was significantly higher than the mean relative price before the liberalization of the exchange rates.

The mean French beans supply volume to the European Union market was found to be significantly higher after the liberalization of the exchange rate than before. The mean supply volume rose from 1,276,222 tonnes during the pre-liberalization period to 4,439,631 tonnes during the post-exchange rate liberalization period which represents a 248 percent increase. It is thus concluded that the mean French bean exports supply volume to the European Union market increased during the period of floating exchange rate as indicated by higher real foreign incomes during the post-liberalization period as compared to the pre-liberalization period.

The results of cointegration analysis using the Vector Autoregressive model revealed a long-run equilibrium relationship between French beans exports, real foreign incomes, relative prices, exchange rate volatility, liberalization and supply volumes. The French bean exports long-run responsiveness to real foreign incomes and exchange rate volatility was elastic, but inelastic for relative prices, liberalization and supply volumes respectively. The cointegration analysis results suggest that the estimated long run foreign economic activity elasticity carries the expected positive sign and is greater than unity at 4.96 implying that French beans export responsiveness to real foreign income is therefore elastic.

The high income elasticity provides evidence that French beans exports have been adapted to the EU country's local tastes and preferences. The economic implication of this is that an increase in real income of Kenya's trading partners in the European Union countries leads to more than a proportionate increase in demand for French beans exports from Kenya. The result supports the theoretical proposition that an increase in the importing country's income leads to an increase in export demand for the exporting country. Therefore, as real incomes of the European Union countries rise, their citizens are expected to buy more of all kinds of goods, including more of

Kenyan French beans assuming that their tastes and preferences remain the same. The foreign income growth increases demand for Kenya's French beans by the EU trading partners mainly due to the relative importance of the trading partners to each other.

The exchange rate volatility had negative long-run effect on French bean exports with elasticity of 2.30. The responsiveness of French beans export demand in the EU market to exchange rate volatility is elastic. This implies that an increase in the shilling exchange rate volatility leads to a more than proportionate decrease in demand for French beans exports from Kenya in the EU market. The result rejects the second hypothesis in this study which states that volatility of exchange rates has no effect on Kenya's French beans exports.

The long run relative price coefficient was 0.45 with the expected negative sign, indicating an inelastic relationship. Hence an increase in the relative price leads to less than proportionate decrease in demand of French beans exports from Kenya to the European Union market. The result indicates that a 1 percent increase in the relative price of French beans in the European Union market leads to a decrease of 0.45 percent in the export demand in case of Kenya. This is consistent with the theoretical expectation that an increase in the relative price leads to reduced competitiveness. As the country's competitiveness declines, exports are expected to decrease due to reduced demand for the exports thus as the relative price of Kenyan French beans to the European Union market increases, Kenya's French beans export volumes decrease.

The study found the long-run liberalization coefficient estimate to be 0.53 with a positive sign as expected. This indicates that the responsiveness of French beans export demand to the

liberalization of the shilling exchange rate is inelastic. The positive sign implies that the liberalization of the exchange rate led to an increase in the French beans export volumes from Kenya to the European Union countries. Thus, it seems that Kenya's French beans exports were stimulated by liberalization of exchange rates.

The long-run supply volume coefficient estimate was found to be 0.86 with an expected negative sign. This implies that the responsiveness of Kenyan export demand to the total French beans supply volume in the European Union market was inelastic. The result suggests that a 1 percent increase in the supply of French beans in the European Union market leads to a decrease of 0.86 percent in the export demand in case of Kenya. The economic implication of this is that as the export supply of French beans in the European Union market increases, Kenya's French beans exports decline. This is consistent with expectation; as the volume of French beans in the European Union market increases, the price is expected to decline due to glut thus serving as a disincentive for producers and exporters to supply the market thus leading to a decline in the supply of Kenyan French beans in the European Union market. This result leads to the conclusion that the higher the volume of French beans supplied by other countries in the European Union market the greater is the disincentive for the Kenyan producers and exporters to increase supply to this market.

The short-run dynamics of the French beans export demand model were estimated using a Vector Error Correction Model. The coefficient on error correction term was found to be -0.77 and was statistically significant, implying existence of a stable equilibrium long run relationship among the variables. The negative sign of this coefficient indicates that the direction of correction is towards the long-run equilibrium while the size indicates the speed of adjustment towards the

long-run equilibrium. The economic importance of this finding is that the French beans exports adjust to correct for long run disequilibrium between itself and its determinants rapidly, since 77 percent of the disequilibrium is eliminated in one month. The conclusion is that the adjustment of French beans export volumes to any change in the independent variables of the export demand model takes a short period because market forces in the export market restore equilibrium quickly.

5.2. CONCLUSIONS AND RECOMMENDATIONS

A number of recommendations were derived from the results of this study. First, the results indicate that exchange rate volatility negatively influences export demand of French beans exports from Kenya to the European Union market. Therefore, French bean exporters in Kenya face exchange rate risk. Thus, policy makers in Kenya should endeavour to maintain a well-managed stable exchange rate regime to encourage exports. In order to cushion exporters from high exchange rate volatility, the government could set up a French bean export stabilization fund. The fund could be capitalized by charging exporters a tax so that during periods of high French beans prices and high exports earnings, the country would accumulate the fund which it would draw down during periods of low French bean prices. The government would set up a French beans price stabilization fund by imposing a tax on exporters. The French beans price stabilization fund would ensure a certain amount of predictability in French beans prices so that fluctuations would not affect French bean growers and exporters drastically in future.

The stability of the exchange rate is needed, not at a fixed level but by controlling exchange rate volatility using the exchange rate target band. By means of the exchange rate target band, there will be no government intervention as long as the exchange rate falls within the tolerance zone

and market forces will determine the exchange rate. However, as soon as the exchange rate moves above or below the set limits, the government ceases to allow the exchange rate to float freely and intervenes to move the price of the currency within the target zone.

The level of income in the importing countries was found to be a key determinant of the volume of Kenya's French bean exports, Kenya's policy makers need to diversify export market destinations. This can be realized through export market promotion initiatives and consistent compliance with quality standards. Innovative ways of meeting the standards and facilitation of smallholder farmers to meet these standards would be required. In addition, French bean export promotion incentives such as input subsidies and tax concessions need to be considered.

To limit over-reliance on exporting as a major channel for French beans produce in Kenya, the alternative is to produce for consumption in the domestic market. However, given Kenya's comparatively small market size and domestic consumers' taste and preference for French beans; there is limited scope to divert production away from exporting. In order to address this constraint, the government and key stakeholders in the industry need to be proactive in increasing utilization of French beans locally through value addition and creating awareness to the local consumers on the nutritive value of the vegetable coupled with research and extension initiatives.

An increase in the relative price of French bean exports from Kenya was found to decrease the demand for French beans in the European Union market. Therefore there is need for instituting measures that would contribute to increased productivity and the enhancement of international

competitiveness. Thus public and private policy measures to improve productivity and enhancement of international competitiveness needs to be pursued. An improvement in productivity improves the competitiveness of Kenya's French beans exports by making them cheaper through reduction of the unit production cost. To boost export competitiveness of Kenya's French beans exports; diversification of the range of export products, low interest on working capital loans, improvement of transport infrastructure, enhanced security, efficient customs clearance and easier freight handling need to be considered. In order to improve French bean exports, efficient delivery services are needed, such as power supply, energy resources and infrastructure.

5.3. CONTRIBUTION OF THIS STUDY

This study contributes to the existing body of literature on export trade in a number of ways. From the review of literature, this is the first study in Kenya that assesses the effects of exchange rate volatility on the volume of French beans exports; the crop being one of the leading vegetables in foreign exchange earnings. The most important finding from the descriptive statistics is that exchange rate liberalization led to reduced volatility and an increase in volumes and relative prices of French beans exports to the European Union market, thus providing the producers and exporters with higher incomes.

The overall contribution of this study to the existing empirical literature is to provide new evidence on the relationship between exchange rate volatility and French beans exports from Kenya to the EU. This study extended the existing empirical literature as it is the first to evaluate the relationship between exchange rate volatility and French beans exports from Kenya to the

EU. Understanding the degree to which exchange rate volatility has affected French beans exports in Kenya is important for designing export trade policies. The empirical evidence provided by this research enhances this understanding, and therefore, fills an important gap in the existing literature.

The results of this study provide strong evidence that exchange rate volatility has an economically and statistically significant negative impact on French beans exports from Kenya to the EU. The contribution of this thesis is that the findings of the research present an important guide for formulating trade policy in an export-led economy. This thesis advances the empirical discourse on the effects of exchange rate volatility on exports and provides literature to future research.

5.6. AREAS FOR FUTURE RESEARCH

Future research could extend the exchange rate volatility analysis to cover other key horticultural commodity exports in Kenya and other countries to evaluate whether particular industries or groups of firms are being affected by exchange rate volatility and provide more guidance for the targeting of policies. In addition, the theoretical relationship between exchange rate volatility on trade is still not yet resolved; thus further research on this issue is required.

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Appendix 1: List of European Union Countries

Bulgaria	Czech Republic

Denmark	Estonia
Ireland	Greece
Spain	France
Netherlands	Austria
Poland	Portugal
Romania	United Kingdom
Croatia	Italy
Cyprus	Latvia
Belgium	Lithuania
Luxembourg	Hungary
Malta	Slovenia
Slovakia	Finland
Sweden	Germany

Source: EUROSTAT