

**EXPORT PERFORMANCE OF THE HORTICULTURAL SUB-
SECTOR IN KENYA-AN EMPIRICAL ANALYSIS**

BY

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X50/63772/2011

A research paper submitted to the School of Economics, University of Nairobi, in partial fulfillment of the requirements for the award of Master of Arts in Economics degree.

September 2015

DECLARATION

This Research Paper is my original work and has never been presented for award of degree in any other university.

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This Research Paper has been submitted with our approval as the university supervisors.

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ACKNOWLEDGEMENTS

I thank God for his mercy and grace that has enabled me to complete this work successfully.

I sincerely thank my supervisors, DR. Daniel Abala and DR. Ruigu for their support, objective criticisms and great advice without which I could not have managed to complete this paper.

I also thank my parents and friends for the encouragement and motivation that enabled me to complete this Research Paper.

DEDICATION

This Research Paper is dedicated to my parents; Stephen Meme and Isabel Meme for the sacrifices they made to enable me reach this level of education.

LIST OF ACRONYMS

USA- United States of America

KHDP- Kenya Horticultural Development Program

GDP- Gross Domestic Product

HCU- Horticultural Co-operative Union

HCDA- Horticultural Crop Development Authority

UK- United Kingdom

EU- European Union

ECT-Error Correction Model

ADF-Augmented Dickey-Fuller test

USAID- United States Agency for International Development

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ABSTRACT

The horticultural sub-sector in Kenya has been characterized by sustained growth over the years. However there has been slow growth rate in horticultural exports over the last decade. The horticultural exports are the major exports from the agricultural sector alongside tea and coffee. The main objective of this study was to establish the factors that influence the horticultural exports in Kenya with a view of recommending policies that can be adopted to improve the horticultural subsector. Secondary time series data for horticultural exports, real exchange rate, agricultural GDP, real interest rate and foreign income for a period of 30 years (1984-2014) was used in the analysis. The data was collected from the various issues of Economic Survey and Statistical Abstract of KNBS, various issues of Statistical Bulletin of CBK, HCDA and the World Bank development indicators publications. Five major importers of the Kenya's horticultural produce (UK, Germany, Netherlands, France and Belgium) were selected. By use of cointegration analysis, an error correction model was adopted in the analysis. The results of the analysis indicated that real exchange rate, agricultural GDP and real interest rate are significant in influencing the horticultural exports. However the coefficient of the foreign income was not significant. Recommendations made is that government policies should be aimed at; increasing agricultural GDP, maintaining the exchange rate at a level that is competitive for horticultural exports and reducing the interest rate in the economy.

CHAPTER ONE

INTRODUCTION

1.1 Background

Exports are crucial in the process of growth and the expansion of the exports is an important part of economic growth process. Export promotion has been commercial policy issue that has attracted a lot of devotion both at national and international levels (Orindi, 2011). Many countries in the world are focusing on the export promotion of their products mainly due to the shrinking local markets. The export sector of a given country is very crucial as it is a source of growth which can be attributed to the foreign exchange earned. This is evident in the Kenyan horticultural sub-sector¹ which has been significant over the last decade in generation of the foreign exchange and also in employment creation. Horticultural export sub-sectors in a number of African countries are contributing significantly to economic development (Barrett *et al.*, 1999).

The horticultural sub-sector in the country has received a lot of interest from both international and local researchers, government and also donors due to its high growth rate and sustained exports growth to Europe (Muendo and Tschirley, 2004). In December 2011, the United States allowed Kenya to export French beans into its market. This was after five years of promotion by fresh produce growers. This implies that there is an opportunity for expansion of the market for the horticultural commodities in other regions outside Europe. The USA Department of Agriculture indicated that Kenya had improved on the conditions required before being allowed to export French beans to the country. These conditions were mainly washing, processing and packaging. This will be a good opportunity for the country to expand the export sub-sector. According to KHDP (2009), the Kenyan horticultural exports to USA accounted for less than 2 percent of the total exports of horticultural production during the period from 2003 to 2009. Therefore the market for French beans in USA will increase the total exports of horticultural production. The horticultural sector has significantly grown over the last decade to become the second biggest foreign exchange earner (after tea), employer (both directly

¹ The horticultural sub-sector is defined here to include fruits, vegetables and flowers

and indirectly) and contributor to the food requirements in the country. Therefore this sector needs to be studied closely in order to establish ways in which the sector can be further improved to continue to be significant contributor to gross domestic product. The horticultural subsector in Kenya is the fastest growing agriculture sub-sector. The European market is the largest export destination and the major importing countries are: the United Kingdom, France, Netherlands, Belgium and Germany.

It should be noted that even if the horticultural sector exports are significant, they only constitute a small percentage of the total horticultural production. This calls for close study of the export sector in order to find ways in which this sector can be expanded. The horticultural sub-sector in Kenya comprises of large firms and also small scale farmers who usually sell their produce to these large farms through their marketing associations or individually to brokers. The flower production and marketing chain is dominated by medium sized and large scale companies. The smallholder horticultural crop producers face many challenges mainly in production, post-harvest handling, and compliance with phytosanitary requirements such as Globalgap regulations. In addition, access to capital by the smallholder producers is difficult. Over 90% of smallholders in Kenya produce horticultural commodities in all regions of Kenya (apart from arid regions) but only fewer than 2% do so directly for export (Tschirley *et al.*, 2004). Kenyan smallholders producing for export face a lot of constraints in their efforts of seeking to remain in the sub-sector. The challenges are mainly from the consumers increased demand for quality and food safety (phytosanitary regulations) in Europe as well as from rising number of supermarkets in this region.

Although horticultural sector has achieved a significant growth it has stagnated in the past decade. The volume of horticultural exports declined by 15 percent from 423,129.5 metric tonnes in 2008 to 364,424 metric tonnes in 2009. This was mainly due to the reduction in the export volumes of vegetables and fruits, which were affected by the insufficient rainfall during the year (Ministry of Agriculture, 2010). The volume of exported vegetables decreased by 20 percent from 129,777 metric tonnes in 2008 to 104,111 metric tonnes in 2009. The volume of fruits export recorded the highest decline

of 22 percent over the same period. The volume of flowers exported went up by 1.5 percent, from 118,626.6 metric tonnes in 2008 to 120,395 metric tonnes in 2009. This was as a result of recovery in traditional markets from September 2009. In the year 2010, there was an increase in cut flower exports by 52.5%. Export of vegetables increased by 12.2 percent in 2010. However, there was a decrease in exports of fruits by 7.1% (Statistical Release, 2011). By looking at these trends, ways should be devised for stabilizing the output. According to a competitiveness report by USAID (2012), Kenya lags behind its neighbors in credit access, costs of labor, sea, and air freight costs in the horticultural sub-sector. This was concluded after studying the horticultural sub-sectors of Kenya, Uganda, Tanzania, Ethiopia, Egypt and Ecuador. The report indicates that high interest rate charged by the commercial banks in Kenya discourages borrowing by the growers. It was argued in the report that the high interest rate prevailed despite the allocation of Ksh700 million by the government to the producers under the credit guarantee system. The report further disclosed that transportation costs were higher in Kenya as compared to most of its competitors. It was argued that the transportation by sea in Kenya costs Ksh510, 000 for a 40-foot container. This was higher as compared to about Ksh425, 000 for South Africa and less than Ksh153, 000 in Egypt.

The growth in horticultural sub-sector has been attributed to the increased consumption of horticultural products in Kenya as compared to the exports and this is the reason why the exports form a smaller percentage of the overall growth in horticultural sector. Between 1992 and 2001, 98% of the fruits produced were marketed domestically. Also, 91% of the growth in production of vegetables was as a result of increased domestic demand. Even, taking into consideration the high prices in international market, the dominance of the local (Kenyan) market is still evident (Tschirley *et al.*, 2004).

The continued dominance of the local market and slower growth rate in the export sector and constraints that smallholder farmers face in their efforts to gain access to the international markets should be addressed in order to improve horticultural sub-sector.

There are two main channels in horticultural marketing; the wholesale chain and the supermarket chain. The former links small scale and medium scale producers with the international market. This is through various contracts and agreements with producers, representatives, freight agents and exporters. The wholesale chain links producers with the wholesale trade. In this channel of marketing, the produce is exported in large quantities. The exporters export the fresh produce only after they have bulked up sufficient quantity. The supermarket chain is either partially integrated or fully integrated. The wholesale chain of horticultural marketing is mainly used by large-scale growers. These large scale growers are also exporters. On the other hand, the supermarket chain involves production, exporting, and cargo handling being done by the same company. High level of technology is adopted by large scale producers in the supermarket chain in order to have high production and high quality as required by food safety regulations (Barrett *et al.*, 1999). The largest amount of the quantity exported is through supermarket chain. Fruits, vegetables and cut flowers are exported through this channel. Companies such as Finlay's Horticulture, (formerly Known as Homegrown Kenya Limited), Longonot Horticulture, AAA Growers, Del Monte and many others are involved in the supermarket chain. Over the years the wholesale chain has been declining.

The major regions in Kenya where horticultural crops are grown include; Naivasha, Thika, Nyeri, Nanyuki, Kirinyaga region (usually dominated by small-scale farmers), and Meru region (mainly Timau division).

1.1.1 Evolution of Horticultural Sub-sector

Large scale production of horticultural commodities in Kenya began during the World War II with the main purpose of supplying food to the Allied Forces based in East Africa (McCulloch and Ota, 2002). During the independence period, horticultural exports accounted for only 0.3 percent of total export value. However, from the late 1960's, horticultural export sub-subsector expanded, both in volume exported and in variety of crops grown for export (Schapiro and Wainaina 1991; Jaffee 1995).

In 1901, East African Agricultural and Horticultural society (currently known as Agricultural Society of Kenya) was founded by colonial white settler farmers. During the same period, there was introduction of Asian vegetables by Indians constructing the Kenya-Uganda railway. Nowadays, the Asian vegetables constitute a significant percentage of the total horticultural exports. Formal research in horticulture in the country can also be traced to this period. By 1911, the colonial government had started conducting experiments on tropical fruits at Matuga which is located along the Indian Ocean coast (Presently known as Matuga Agricultural Research Station) (M'Ribu *et.al.*, cited in Minot and Ngigi, 2004).

In 1920, there was establishment of a second site for conducting experiments. This site was for experimenting on tropical fruits. It was established near Thika Research Station. The department of agriculture started focusing on introduction of plants in 1931 so as to facilitate adoption and increase in area planted with crops which had been introduced in the research stations (Minot and Ngigi, 2004).

The first significant horticultural export from Kenya was passion fruit juice in 1930's. In addition Kenya was a major exporter of temperate vegetables such as carrots, cabbages and tomatoes to the UK. In the 1950's a pineapple plantation and canning industry was established. In the late periods of the 1950's the first air shipments of the high value fresh produce were made to the UK. The produce was mainly directed to high class stores and hotels. These exports were facilitated by the Horticultural Co-operative Union. The Horticultural Co-operative Union (HCU) had been created with the objective of providing marketing services for European growers in Kenya and to import various commodities into the country. However there were many constraints involved e.g. there was insufficient air freight space, and until the end of the colonial period, the major export was pineapples (Harris and Muthungu, 1992).

The decade after Kenya got independence in 1963 witnessed a substantial diversification in horticultural exports. A vegetable dehydration plant was established at Lake Naivasha in 1964 (it has since collapsed) which exported almost all of its production. In addition it

was the main market outlet for the local producers. A large number of growers and wholesalers began exporting fresh produce in the UK from the mid 1960's. This was under the initiative of the HCU. By 1970's the pineapple canning was dominated by Del Monte. At first the company produced through a management contract and thereafter through a majority ownership by the Kenya Cannery Ltd. However the growth in canned products stagnated until the end of the 1970's when Kenya became a leading supplier of canned pineapple products (Harris and Muthungu, 1992).

The HCDA was formed in 1967 with a mandate of supporting and regulating the horticultural trade and also to engage in trade itself. The HCDA is the main regulator of horticultural sub-sector in Kenya. Its responsibility is promotion and development of horticultural crops and licensing the exporters of horticultural crops. HCDA also provides information on marketing of horticultural crops. Initially, the HCDA had the authority to fix and regulate prices. In addition, HCDA had authority on regulation of trade and operation of processing facilities and marketing of horticultural commodities. However this changed in 1986 after it pulled out of buying and selling of horticultural commodities.

In 1969 a firm from Denmark set up production of flowers near Lake Naivasha for exporting to Europe but initially the export volume was insignificant until the early 1970's when air cargo space increased. The increase in air cargo space combined with a great expansion in horticultural production led to a rapid expansion of fresh produce exports. This was followed by an increase in number of smallholders supplying large growers mainly through their local associations. There was also an increase in the number of new exporters.

By 1980 the flower export industry had grown significantly and earned the country a significant amount of the foreign exchange (about 10 million US dollars). However the exporters of off-season capsicum, aubergins and courgettes were losing the market share in Europe at an alarming rate to new competitors who had extended their harvest season in southern Europe, and in West Africa. Cheaper transportation allowed these

competitors to undercut the price of the Kenyan produce by a great margin. Kenyan exporters responded by concentrating on expansion of French beans and Asian vegetable production in which Kenya had a comparative advantage due to the quality standards and productivity due to the favorable climate. During the early periods of 1980's the growth in fresh produce exports continued to expand steadily and in 1988, it peaked sharply. The growth in the Kenyan tourism industry had a significant impact to the growth of fresh fruit and vegetable production (Harris and Muthungu, 1992).

The growth in the Kenyan horticultural export industry can also be attributed to the increasing participation of smallholder farmers in the sub-sector. In the 1970's, smallholders produced about 10-20 percent of the export volume but after the international prices of coffee and tea dropped it was of economic advantage to involve small scale farmers in the horticultural sector. There were approximately 13-16 thousand smallholders who were growing fresh produce in the mid 1980's. (Jaffee 1995, as cited in Minot and Ngigi, 2004). This constituted 40 to 65 percent of the quantity of French beans, mangoes, Asian vegetables, avocados, and passion fruit exports.

During the late 1980's there was rise in the supermarkets in Europe. For instance, in 1989 33% of vegetable exports to United Kingdom were sold through the supermarket channel. The share sold by supermarkets increased to about 70 percent by 1997 (Evans 1999, as cited in Minot and Ngigi, 2004). In addition, the market share for fresh fruits and vegetables by supermarkets has significantly increased. It is estimated that in 1994, the supermarkets had 63% of the market share for fresh juice and vegetables. However, this rose to 76% in 1997. Most often these supermarket chains want to deal directly with exporters instead of purchasing the produce from the wholesalers. This is a more efficient channel of distribution between consumers in the international markets and local producers. It also helps in imposition of restrictions and also in overall organization of the production in the exporting countries and hence quality can easily be monitored (Minot and Ngigi, 2004).

The horticultural sub-sector has expanded significantly over the last decade to become the second biggest earner of foreign exchange (after tea). The major export destination for the Kenyan horticultural products is Europe. According to HCDA export statistics, European market accounts for over 85% of exports of fresh vegetables, fruits and cut flowers from Kenya.

1.2 Horticulture and the Kenyan Economy

The Kenyan horticultural sub-sector is the fastest growing agricultural sub-sector in the country. In addition, the horticultural sub-sector significantly contributes to the economic development and poverty eradication. The Horticultural sub-sector is very important because of creation of job opportunities. Ongeru (2014) argues that close to 2.5 million people are employed in both formal and informal horticultural setups. In addition, multiplier effects can arise in horticultural production especially in production and packaging of produce. For example, the demand for packaging materials can lead to the development of local plastic and paper manufacturing industries. This is the case in the country. The horticultural industry has helped in reduction of poverty in rural areas as a result of higher incomes as compared to other crops. This is as a result of forward and backward linkages. Nyairo and Backman (2009) argued that high export growth which is mostly facilitated by the increase in agricultural production is widely considered to be an important pathway to the reduction of poverty. Horticultural production provides the small scale farmers with an opportunity for earning regular income. Nyairo and Backman (2009) recognized that an increase in production and export of horticultural exports in Kenya had resulted in increased incomes.

According to a household survey in Kenya by McCulloch and Ota (2002), the households that engaged in the production of horticultural crops were better off than the household which didn't. In addition, a simulation exercise in the same survey showed that facilitating more households in venturing into the horticultural sector could help in reducing poverty considerably, in rural and urban areas. The horticultural sub-sector is among the leading sub-sectors of agriculture in terms of income generation, contributing at least Ksh120 billion (\$ 1.85 billion) in 2009 (KHDP, 2009). Therefore it can be

concluded that horticultural sub-sector is very important to the Kenyan economy due to the foreign exchange earned by the country from horticultural exports.

1.3 The Statement of the Problem

Horticultural production in Kenya can be viewed as a success story but looking generally at the percentage of the horticultural exports in comparison with the total production, it is evident that the export sector constitutes a small percentage of the total production. Between 1993 and 2001, 98% of the quantity of fruit produced and 91% of the quantity of vegetable produced were marketed locally (Tschirley *et al.*, 2004). In addition over 80% of smallholders in Kenya produce horticultural crops but few do so directly for export. According to a competitiveness report by USAID (2012), Kenya's export performance is below its potential, taking into consideration overall agricultural output, size of economy, population, and arable land. It is indicated in the same report that horticultural exports constituted 5% of the total production in 2012. Over reliance on domestic markets has resulted to low domestic prices for the horticultural produce and hence there is need to exploit the foreign market for the horticultural commodities. Although the horticultural export subsector has achieved a significant growth, it has stagnated in the past decade. There is continued dominance of domestic horticultural production and the export sub-sector has experienced a slower growth rate over the last decade. The slow growth rate in the horticultural sub-sector implies that the country has not been able to maximize on the foreign exchange earned from the exports.

1.4 The Objectives of the Study

The general objective of the study was to identify the main determinants of the quantity exported and establish ways in which the horticultural export sub-sector could be improved so as to increase the contribution of the sector to the GDP (in terms of income, employment and foreign exchange).

The specific objectives were:

- (i) To determine the internal and external factors which influence the quantity of Kenya's horticultural exports to its major trading partners;

- (ii) To establish the responsiveness of horticultural exports to changes in the identified factors;
- (iii) To recommend policies to improve the horticultural export sub-sector based on the results of the study.

1.5 Justification of the study

This study is important because the Kenyan economy is dependent on agriculture as a source of economic growth and in agriculture; the horticultural sector is among the leading subsectors of agriculture in terms of income generation. By closely studying the sector, the factors which affect the performance of the horticultural sector either positively or negatively would be identified and ways in which the sector could be improved would also be recommended. Also the study was driven by the fact that the largest quantity of what is produced in the horticultural sector is consumed locally and the country cannot rely entirely on the domestic market because of the need to capture wider markets in order to earn more income. The horticultural export subsector stimulates economic growth in a number of ways e.g. linkages between production and international demand, economies of scale, increased efficiency due to competition etc. In addition, when the horticultural exports increase, national goals such as the increase in GDP, rise in sectorial employment level, reduction in trade deficit and improvement in income distribution can be realized.

Also emphasis was laid on the horticultural sector because Kenya has comparative advantage in the production of horticultural produce especially in floriculture due to the agro-climatic conditions enhanced by the location of the country on the equator, which makes it possible for production of horticultural crops throughout the year unlike competitors such as Egypt and Morocco.

In addition, high dependence on one or few traditional exports e.g. coffee and tea can leave a country vulnerable to volatile international market conditions and hence the need for diversification.

Although much research has been carried out on the horticultural sector, few studies have empirically studied the sector. Most empirical studies had focused on the entire agricultural sector and therefore an empirical study that is specific to horticultural export subsector is required because of diversity among different subsectors. In addition an empirical study that is specific to horticultural export subsector is required to determine the variables which impact on the sector and the magnitude of the impact so that the recommendations can be made based on the research findings.

1.6 Scope of the Study

This study sought to establish the factors that influence Kenyan horticultural exports. Secondary annual time series data was used in the study. The data ranged from 1984 to 2014. This period is important as it covers the period in which the Kenyan horticultural sub-sector had achieved a significant growth.

1.7 Organization of the Study

This study comprises five chapters. The first chapter consists of; a basic introduction to the study, a brief discussion of evolution of the horticultural sub-sector, importance of the horticultural sub-sector to the Kenyan economy, objectives of the study, justification of the study and scope of the study. Chapter two consists of theoretical and empirical literature review. The chapter offers a background on theoretical and empirical concepts on exports and international trade. Research methodology has been discussed in chapter three. The chapter consists of; theoretical framework, the specification of the model and the sources and types of data used in the analysis. Chapter four comprises data analysis, results and discussion. Descriptive statistics, unit root test, cointegration analysis and error correction model have been discussed in this chapter. In addition, heteroskedasticity and autocorrelation tests and the results of the analysis have been discussed in this chapter. Chapter five consists of summary, conclusion and policy implications. The chapter is based on research findings.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section is a review of literature related to the horticultural export subsector. The section 2.2 is a theoretical review which discusses the major factors influencing the exports of agricultural products. Section 2.3 is an empirical review of literature while section 2.4 is an overview of the entire literature.

2.2 Theoretical Review

Diversifying agricultural production could be a feasible solution taking into account decline and volatility of prices of agricultural commodities. Diversification is a way by which a country reduces dependence on a narrow range of primary products. Most of primary products are exported before processing. In this respect horticulture provides a good opportunity for export diversification for many developing countries which are mainly dependent on exports of tea, coffee and cocoa. Farmers who engage in horticultural production in most cases earn higher income in comparison to producers of other crops. In addition the global production of horticultural commodities is increasing at a high rate (Gioe, 2006). Mold and Prizzon (2008) argue that agricultural commodity prices generally fall relative to others. They attribute this to inelastic demand for the agricultural commodities and also lack of differentiation among producers. This implies that the market for these commodities is competitive.

In their study about the determinants of agricultural exports of cocoa, coffee and bananas in Cameroon, Gbetnkom and Khan (2002) found that as a price taker, the only way Cameroon could increase the export revenues was by increasing the export supply. In their study they pointed out that the output is the major determinant of export performance. The income and price elasticity were insignificant in their study i.e. decreasing the price may not be effective in the expansion of the exports. This means that when there is a decrease in price, the export demand would increase by a smaller margin as compared to the margin of price decrease. Increased production would capture a wider

market in this respect than decreasing the prices. The authors also point out that prices received by producers are more important in increasing the export supply of cocoa and coffee than the prices received by exporters. Only the export price of bananas is important in promotion of export supply and they attribute this to lack of producer price for bananas. Therefore farmers should get satisfactory reward for their produce in order to increase the export supply. The authors also explained that improvements in the condition of the road network had positive effects on the supply of bananas, coffee and cocoa. They also argued that more credit to the exporters of these three crops had positive and significant influence in the supply. The authors also explained that rainfall has significant influence on the export supply of cocoa and coffee.

The retail prices of many agricultural commodities are usually very high to the low income class in most urban centers in Kenya. This generally reduces the market for these agricultural commodities (particularly the horticultural products). This situation leads to the aspect of policy dilemma in regard to setting the right prices. Getting prices right is not simple. The right prices can be described as the prices which offer the incentive for production to the producers and at the same time not being exorbitant to the consumers. Therefore there is a dual role of the food prices. This is because food prices serve as incentives for food producers and, at the same time, food prices are major determinants of the income of much of the population especially the lower income class in the urban areas who spend most of their income on food. Price determines domestic and export market performance of horticultural products. This is because it influences allocation of resources and rations available goods and services among consumers.

Changing weather conditions is one of the depressing factors that have led to reduction of potential for higher horticultural yields. This is due to insufficient and late rainfall. The changing weather conditions can be attributed to climate change. Therefore climate affects agriculture and this is through varying rainfall patterns. Consequently, farming activities that rely on rain fed agriculture are the worst affected. The low agricultural output in the East African region can be attributed to unpredictable rainfall (Nyairo and

Backman, 2009). Therefore there could be correlation between rainfall and agricultural output in the East African region.

In their study on analysis of Kenya's export performance, Were *et al.* (2002) acknowledge that there are many factors that affect the supply of primary commodities but most studies tend to narrow these factors to price variables. This is because many factors affecting supply are unquantifiable or there is difficulty in obtaining reliable and complete set of data. The authors argue that the factors that determine the supply of primary export commodities include cost and accessibility of consumer goods, research and extension, farm subsidies and taxes, infrastructure, availability of credit, among others. The variables used in most international trade studies are; the exchange rate which is used as a proxy for relative prices, and the foreign income which is actually a demand side variable. The price of agricultural inputs also affects the agricultural productivity. Nyairo and Backman (2009) argue that a rise in price of agricultural inputs has negatively affected agricultural output in East African region. The authors explain that there should be sufficient use of seeds, pesticides, fertilizers, and other inputs so as to realize high yields.

Marketing can be explained as the activities that are involved in the movement of goods and services from point of production to consumption. In case of raw materials, the consumption point is at the processing plant. According to Abbot (1973), marketing involves physical handling and transportation, as well as initial processing and packaging. Grading and quality control activities are also part of marketing. The author explains that initial processing and packaging is done so as enable easier handling while quality control and grading are done to meet expectations of customers and make sales transactions easier.

The potential of export-oriented horticultural production as a means of raising both national and household incomes depends on a vast range of factors which are external and internal to any individual country. Therefore, African countries must find commodities for which they have comparative advantage. However, this is becoming

difficult as a lot of countries in the developing world engage in horticultural production (Barrett and Browne 1996). In addition, many developing countries experience challenges in transportation and marketing of horticultural produce.

There is a wide range of econometric evidence that the exports of many less developed countries have low price elasticity and high income elasticity. This implies that the exports from these countries are sensitive to income level changes in the developed countries. The developed countries are the major export destinations for these countries. Typical demand functions of exports tend to yield biased estimates of the parameters if the supply side variables are not incorporated in the model (Riedel 1988, cited in Roy 1991). The models used to estimate the export flow should therefore incorporate both the demand and the supply side variables. Roy (1991) argued that such export functions cannot be referred to as export demand functions or export supply functions.

The performance of the exports not only depends on the income of the importing country but also on many other factors some of which cannot be quantified. These are mainly non-price factors. Roy (1991) points out that the non-price variables that influence exports are market imperfections which have negative effects on foreign demand. He adds that product differentiation, marketing and services, producer reputation, quality of the products and many other factors are important in the determination of promotion of trade and there is increased intensity by which all this is done as the exporter country grows in scale of production. For example, phytosanitary regulations and economic partnership agreements are important non-price factors that affect the performance of the horticultural sub-sector.

World demand and relative price of exports in the export function influences the performance of exports from the demand side while demand in domestic market, productivity of factors of production and real exchange rate are supply side variables. The real exchange rate is a determinant of international competitiveness of exports of a country. The productivity of factors of production (efficiency index) indicates the impact of technological advancements on the entire efficiency utilization of resources. Also,

developments in X-efficiency (a situation whereby competitive pressures cause firms to have an optimum factor combination in production) and gains from efficiency originating from the exploitation of economies of scale are also observed in total factor productivity indices (Roy, 1991).

The factors that influence export supply can be divided into external and internal factors. The external factors that influence exports include the accessibility or entry conditions and the location of a country in respect to foreign markets. Internal factors that influence exports are related to supply-side variables. Demand in international markets is influenced by factors such as geography, which is a structural component. This implies that countries at the near region that has a high growth rate will benefit more than those which are far away. The second component is associated with trade policy and competition. According to Allaro (2010), competition and trade policy can be regarded as market accessibility condition. In addition, the quantity of and quality of physical infrastructure (the development component) impacts on performance of the export sector (Lages *et al.*, cited in Allaro, 2010).

2.3 Empirical Literature Review

The regression results of a study on the determinants of the Kenyan exports by Orindi (2010) indicated that explanatory variables namely, the importer's GDP and population provided most of the explanatory power in the regression. The coefficients of these variables had positive signs and hence they were consistent with theoretical expectations. The positive coefficient for the importer's GDP was due to the positive effects of foreign income on the level of Kenya's exports. The Kenya's GDP and population were found to be insignificant in the model and hence the two variables were dropped out of the regression model. The distance variable was found to be significant at 5% and had negative sign as was expected. In this study, the distance had been factored in as the proxy for the transportation costs. The distance in this case had inverse relationship with exports. This implied that the further away from the Nairobi the importing country is located the higher the transportation costs. High transportation costs have negative effects on the exports. However the author did not take into consideration of the fact that there

are countries which are nearer to Kenya and yet exports to these countries from Kenya are less than countries that are far away from Kenya. This implies that the level of trade between countries that have close proximity will be influenced by other factors such as; income, trade agreements, and similar comparative advantages. For example the exports from Kenya to countries in Europe and USA are more than exports to countries such as Somalia, Southern Sudan and Ethiopia. Fewer exports to these countries could be as a result of poor infrastructure, similarities in climate and output.

The COMESA dummy was found to be statistically significant at 1%. This implied that Kenya's exports were likely to be higher to COMESA member states than non-COMESA members. In addition, EU dummy was also found to be positive and statistically significant at 1%. This suggested that Kenya's exports to EU members were likely to be higher than exports to non-EU members. The coefficient for embassy was also positive and significant thereby implying that presence of an embassy/consulate in the importing country promoted Kenyan exports to that country. The significance of these three variables implies that economic partnership agreements are important in promoting exports.

However, the study by Orindi (2010) focused on all the Kenyan exports (exports from all the sectors) and hence a study specific to horticultural exports is required because different sub-sectors may respond differently to macroeconomic variables. In addition for a comprehensive and precise analysis, there is a need for disaggregation of the various sub-sectors in the economy.

In a study titled about the factors that influence Egyptian agricultural exports, Hatab *et al.* (2010), used the gravity model approach. The authors studied the pattern of Egyptian agricultural exports from 1994 to 2008 so as to identify the factors influencing agricultural exports in Egypt into the major importing markets. In that study, the authors carried out regression in three ways, which included; the fixed effect model, random effects model and the common intercepts model. The authors used the fixed effects model in the analysis (based on the Hausman test). According to the results in that study,

Egyptian agricultural exports patterns followed the basic gravity model. The Egyptian GDP was positive and significant, implying that an increase in Egyptian GDP would lead to an increase in the Egyptian agricultural exports. However the importer's GDP was not significant thereby suggesting that the foreign income had no significant effects in influencing the Egyptian agricultural exports. The coefficient of distance was negative and significant. Distance was used as a proxy for the transportation costs. The negative value of the coefficient of the distance variable implied that the transportation costs increases as the distance between two countries increases thereby negatively affecting the exports. The importer's GDP per capita turned out to be insignificant in determining the exports of agricultural commodities. However the Egyptian per capita income was negative and significant thereby suggesting that an increase in Egyptian GDP per capita would lead to a decrease in agricultural exports. The authors attributed this to an increase in local consumption as a result of an increase in household income.

The exchange rate in that study had been taken as the value of the currency of the trading partner in terms of the Egyptian currency. The regression results showed that a depreciation of the Egyptian currency against the currency of the trading partners stimulated agricultural exports. The co-efficient for speaking a common language was positive and significant. This implied that where the official language was Arabic, exports tended to be promoted. The co-efficient for regional trade agreements was positive but not statistically significant. They attributed this to the constraints within the regional economic groupings such as similar comparative advantages, consumption issues (less consumption), membership to different regional trade blocs, policy harmonization, and poor private sector harmonization.

Salasya (1989), in a study on analysis of factors that influence export of French beans from Kenya used linear regression of total French beans exports on price and air freight charges. The regression results showed that the co-efficient for price was positive but insignificant at 5% level. The air-freight co-efficient was negative and was significant at 5% significance level. She argued that price influenced the quantity of French beans exported by a small margin.

A study by Mold and Prizzon (2008) found that price impacted on agricultural exports by a small margin. The results of pooled regression estimates of unit price elasticity of African exports for the period 1980-2001 had a negative and significant co-efficient for agricultural exports implying that African countries increased agricultural exports as the international prices decreased.

Ndubuto *et al.* (2007) conducted a study on the competitiveness and determinants of cocoa exports in Nigeria. They used a multiple regression analysis. They fitted the four functional forms of the regression models (linear, double log, exponential and semi log) to the data by the method of the ordinary least squares. They took the exponential function as the lead equation (main equation) based on the econometric and statistical criteria (Coefficient of multiple determination). The authors employed export performance ratio (EPR) in the analysis of the export performance in which the trend was estimated inter-temporally. They estimated the export performance ratio to establish the comparative advantage of Nigeria in cocoa export sector.

The regression results for the factors influencing cocoa exports in Nigeria indicated that the coefficients of total world quantity, exchange rate of Nigerian currency (Naira) against the dollar and the Nigerian cocoa production (output) were statistically significant. The coefficients explained 70.3 percent of the variability in the export of cocoa from Nigeria. This had an implication that these variables are the major factors influencing the Nigeria's cocoa export. The coefficient value of the world volume, exchange rate and the Nigerian cocoa production were significant at both 5% and 1% level of significance. The coefficients of the world volume of cocoa and Nigeria's cocoa production were positive while the coefficient of the exchange rate was negative. The positive coefficients of world volume and Nigeria's cocoa production implied that the two variables positively influenced export of cocoa. The authors attributed the negative coefficient of the exchange rate to the declining productivity in the Nigerian economy during the period under study.

Were *et al.* (2002) in a study on analysis of Kenya's export performance used an error correction model in their estimation. They estimated three models in their analysis; tea exports model, coffee exports model, and model for other exports from Kenya. In the model for coffee, the error correction results showed that all the variables used in the regression had the expected sign. The coefficient for the real exchange rate and investment as a ratio of GDP were positive and significant. However the price effect was only significant at the 10 percent significance level. In addition, the authors found that the export supply was responsive to prices in the long run. The income of the trading partners was not significant. Manufactured exports are relatively more sensitive to foreign income than agricultural exports. This was evident from the results of analysis of determinants of other exports (excluding coffee and tea) from Kenya in the same study by Were *et al.* (2002). Unlike the regression for coffee exports, income of the trading partners was significant in the model for other exports. However private investment as a proportion of GDP was not significant. The authors partly attributed the significance of foreign income to exports of processed and manufactured goods to Uganda and Tanzania.

The exchange rate was not significant in the regression for tea exports. However investment as a proportion of GDP was significant and positive. This implied that investment had positive impact on tea exports. In this case, an increase in investment as a proportion of GDP would lead to an increase in tea exports. The exchange rate was not significant in the tea model but a one period lag was significant but had a negative sign. The authors attributed this to lack of adjustment to price responses in the short-run.

To measure the impact of the liberalization on coffee exports the authors introduced a dummy for the liberalization for the period 1993-1999. The liberalization impact as proxied by the dummy had a negative effect on the exports. Therefore trade liberalization impacted negatively on the exports of coffee. The authors attributed this to the nature of these crops i.e. longtime lags. In addition they linked this problem to the inefficiencies in the coffee institutions. They argued that these institutions are rigid and exhibit inefficiencies.

In a study about the export of gherkin and cucumber in India, Kumar *et al.* (2008) estimates the factors affecting cucumber and gherkin exports by use of a log linear demand function. The world volume of internationally traded cucumber and gherkin products and the exchange rate were found to be significant. According to that study, the world traded volume of these commodities was used to capture the change in international demand for these products. Therefore an increase in this variable was expected to lead to an increase in the quantity of exports of cucumber and gherkin products from India. Both coefficients were positive and significant. The regression results indicated that an increase in volume of international trade in cucumber and gherkin products (increase in international demand) would lead to an increase in exports of the same products from India. In addition the positive coefficient of the real exchange rate had an implication that depreciation of the real exchange would lead to an increase in the exports of these commodities.

2.4 Overview of Literature

From the reviewed literature it is evident that price cannot be used alone as a tool for increasing the level of agricultural exports. In addition, manufactured exports are more sensitive to foreign income than agricultural exports. Next is that the factors which affect the export potential of horticultural products of any given country are both external and internal. These factors need to be studied closely in order to fully exploit the export potential. This will be by mainly establishing the direction and magnitude by which these factors affect the horticultural exports. Diversification in agricultural exports is considered as a viable solution. This is because it cushions a country from the shocks associated with the fluctuations in international prices of the traditional exports of a given country. However Barret and Browne (1996) argue that the comparative advantage in production of horticultural commodities that is being exploited by many African countries is leading to difficulties as many countries in developing countries engage in horticultural production.

The cost of transportation is also important in determining the level of exports. The cost of transportation is negatively related with the exports. This implies that a rise in cost of

transportation will lead to a reduction in exports. This is evident from the reviewed literature where the cost of airlifting the horticultural products was found to have a negative impact on horticultural exports. The distance from exporting country to the importing country is the main determinant of the cost of transportation. In addition an increase in international price of oil is the main factor that causes an increase in the cost of transportation.

The real exchange rate also influences the exports. This is because real exchange rate affects the relative prices of goods between different countries. Depreciation of the real exchange rate makes the local goods to be cheaper in the foreign markets thereby increasing the foreign demand for the exports in that country. Therefore real exchange rate has a positive relationship with the exports because depreciation of the local currency against the currency of the trading partners will lead to an increase in exports to those countries. The opposite case happens with the appreciation of the currency. The real exchange rate is the main contributing factor to differences in price of similar goods in different countries. Engel (1993) explains that the volatility in consumer price of different goods relative to each other is usually lower in the same country than price volatility in similar goods relative to each in different countries.

There are many factors which affect the exports of a given country, some of which cannot be quantified. Some of these factors are; quality of packaging, seasonality in production of the horticultural products, availability of air cargo space for airlifting the horticultural exports, global gap quality standards and market access. These factors may have positive or negative effects on trade. In addition, the export performance can be assessed from the supply and demand side. The aggregate international demand and relative price of exports in the export function affect the exports from the demand side while demand in domestic market may be considered as a supply variable. The domestic demand pressure determines the price competitiveness of exports. Export promotion measures also can have an impact on the export sector of any given country. Therefore both demand and supply side factors should be studied so as to come up with a viable solution.

This study was focused on both the external and internal factors which affect the horticultural export sub-sector. The model that was used in the study incorporated both the demand and supply side variables so as to avoid the bias in estimated parameters.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter includes theoretical framework in section 3.2 and the specification of the model to be used in section 3.3. Both sections are based on the literature reviewed. The type and sources of data to be used has been described in section 3.4.

3.2 Theoretical Framework

International trade models usually incorporates both demand and supply variables. This is because both supply and demand factors influences the level of trade. In addition these models are based on the theoretical aspects of demand and supply. Demand side consists of the external factors/conditions that influence the flow of exports from the exporting country to the importing country. Generally the demand side deals with the conditions prevailing in the international market and also the geographical factors. Competition from other exporters, trade policy (access to the international market), foreign income and exchange rate are the main factors which prevail in the international market. On the other hand the geographical factor deals with the proximity of the exporting country to the international market. For example countries which are near a fast growing region will enjoy higher level of trade than those that are very far.

The supply side factors that influence the level of exports are the conditions which are within the exporting country. The price of the exports, economic policy issues, quality of the exports, weather conditions (in case of agricultural commodities), state of infrastructure and macro-economic environment are the main supply side conditions.

This study was focused on the effect of factors (both supply side and demand side) on the exports of Kenyan horticultural sub-sector. Generally the following are the main factors which influence the export of agricultural commodities.

- (i) Foreign income of trading partners (measured by the GDP per capita of the importers) ;
- (ii) Real exchange rate;

- (iii) The air freight cost for airlifting the horticultural produce;
- (iv) Real interest rate;
- (v) Output;

The manner in which the above factors affect Kenya’s horticultural exports has been discussed in detail in the section below.

3.3. Model Specification

In order to assess the relative impact of various factors on export performance, a multiplicative model will be adopted. The model to be adopted will be in the following form;

$$X_t = \beta_0 R_t^{\beta_1} Y_t^{f\beta_2} Ag_t^{\beta_3} I_t^{\beta_4} \varepsilon_t \dots\dots\dots 1)$$

Where:

X_t = Quantity of horticultural exports in tonnes

β_0 = Constant

$\beta_1 - \beta_4$ = Regression coefficients

R_t = Real exchange rate

Y_t^f = Foreign income captured by GDP per capita of major trading partners

Ag_t = Agricultural GDP over the years under study

I_t = Real interest rate

ε_t = Stochastic disturbance term

For estimation purposes, model (1) can be linearized by use of the double-log as follows:

$$\ln X = \beta_0 + \beta_1 \ln(R_t) + \beta_2 \ln(Y_t^f) + \beta_3 \ln(Ag_t) + \beta_4 \ln(I_t) + \varepsilon_t \dots\dots\dots 2)$$

The coefficients in the above log linear model are interpreted as elasticity (percentage change in dependent variable due to change in the independent variable). The choice of the above variables is based purely on empirical and theoretical aspects in economics and specifically in international trade. The explanation of these variables has been indicated below.

Variable Definitions

Real exchange rate

Real exchange rate is simply a nominal exchange which has been adjusted so as to cater for differences in the price level between countries. When the real exchange rate of a currency of a given country depreciates relative to the currencies of its trading partners, the exports of that country becomes cheaper because more units of the exporter's currency will be exchanged for a unit of the currency of importing country. This enhances the exporting country competitiveness in the international market as its exports will tend to be cheaper. On the other hand, an appreciation of the currency of the exporting country against the currencies of importing countries has negative effect on the level of exports because appreciation of the exporting country currency implies that the importers will need more units of their currency for each unit of the exporter's currency. The real exchange rate can be used as a proxy for the relative prices. The exchange rate in this study has been taken as the value of the Kenya shilling to the five major European trading partners over the successive years under review. The traditional definition of real exchange rate has been adopted. In this approach the real exchange rate is the nominal exchange rate multiplied by the ratio of domestic to foreign prices. The computation of the real exchange rate is as follows:

$$RER = E \frac{p}{p^*}$$

Where;

RER = real exchange rate

E = nominal exchange rate

p = foreign price level(world price index)*

p = Domestic price level(CPI)

The real exchange rate measures the exporter's competitiveness in the export market. When there is exchange rate depreciation it is expected that the quantity of exports will increase. The opposite happens when there is appreciation in the exchange rate. Therefore

the coefficient of the real exchange rate is expected to be negative when the Kenyan shilling appreciates against the dollar and vice versa.

Foreign income

Changes in national income in foreign countries affect the exports. This is mainly through the income effect. Income effect occurs when there is a change in consumption due to a change in real income. The income effect is clearly described by Engel curve which describes how expenditure by households on a particular good or service varies with household income. Therefore, a rise in the national income in foreign countries will lead to an increase in foreign demand of exports as a result of income effect and a decline in national income in foreign countries will lead to a decrease in exports demand.

Therefore the income of the Kenya's major trading partners as used in this study measures the absorptive capacity of those countries. An increase in the income of the Kenya's trading partners will lead to an increase in the exports. Therefore the co-efficient for the foreign income is expected to be positive.

Agricultural GDP

This is the gross domestic product for the agricultural sector. It is expected that as the agricultural GDP increases so do the exports. Increase in agricultural GDP implies increased productivity in the sector. Therefore the coefficient for this variable is expected to be positive. The exports are function of output and therefore an increase in the agricultural output will lead to the increase in exports. This variable can also be explained in terms of the capacity to produce in the agricultural sub-sector. An increase in the agricultural GDP therefore implies that there is an increase in capacity to produce and hence an increase in exports.

Real Interest Rate

Real interest rate is the interest rate after factoring in inflation. The real interest rate can formally be described by the Fisher equation which defines the real interest rate as the nominal interest rate minus the rate of inflation. Change in real interest rate affects

exports. When the real interest rate increases, there is an increase in cost of borrowing which discourages businesses from borrowing to finance their activities. This results to a decrease in aggregate demand thereby leading to decreased productivity. In addition a high interest rate leads to more savings than investments. This is because the high interest rate increases incentive to save rather than to invest. This leads to a decrease in production hence affecting the exports. The rise in the real interest rate is mainly as a result of measures taken by the monetary policy authorities to reduce the money supply so as to reduce inflation rate.

The horticultural sub-sector is relatively more capital intensive as compared to other agricultural sub-sectors. For example construction of greenhouses and cooling facilities and flood lights requires a huge sum of investment. This therefore implies that changes in the real interest rate will have an impact on the level of exports. The coefficient for the real interest rate is expected to be negative.

3.4 Data Sources and Types

Secondary data has been used in this study. The data is in time series from year 1984 to 2014. The quantity of horticultural exports (fresh vegetables, fruits and flowers) to the Kenya's five trading partners was obtained from the statistics office at HCDA headquarters. GDP per capita and the consumer price index of the five major importing countries was obtained from the World Bank development Indicators. The data on the exchange rate and real interest rate in Kenya was obtained from the Statistical Bulletin (various issues) of Central Bank of Kenya. The data on Kenya's consumer price index was obtained from the Statistical Abstract (various issues) at KNBS. The data on the Kenya's Agricultural GDP (constant Kenya shillings) was obtained from the Economic Survey (various issues) at KNBS.

CHAPTER FOUR
DATA ANALYSIS, RESULTS AND DISCUSSION

4.1. Introduction

The main factors influencing the horticultural exports have been analyzed in this chapter. The model developed in chapter 3 has been estimated in this chapter so as establish how each variable affect the quantity of horticultural exports and also the significance of each variable in the model. Descriptive statistics have been discussed in section 4.2 while unit root test has been carried out in section 4.3. Cointegration analysis has been carried out in section 4.4 while the estimation results for the error correction model are in section 4.5.

4.2. Descriptive Statistics

Table 4.2: Descriptive statistics

	LogExp	LogR	LogRealexrate	LogFY	LogAgGDP
Mean	11.21946	2.064427	2.710323	10.43769	23.94643
Median	11.33795	2.09586	3.222528	10.45002	23.94709
Maximum	12.13977	3.049099	4.160444	10.64292	24.30527
Minimum	9.846993	-0.0151136	-0.325527	10.1299	23.65824
Std Dev	0.6753469	0.7336376	1.457076	0.164815	0.144294
Skewness	-0.3972881	-0.8151923	-0.7929628	-0.3253102	0.209798
Kurtosis	2.018048	3.512498	2.224459	1.749088	2.965349
Observations	31	31	31	31	31

Where:

LogExp= logarithm of Exports LogAgGDP= logarithm of agricultural GDP

LogR= logarithm of real interest rate

LogRealexrate= logarithm of real exchange rate

LogFY=logarithm of foreign income

Table 4.2 above shows the descriptive statistics for the five variables used in the study. The number of observations is 31. The logarithm of exports (dependent variable) has a mean of 11.21946 and a median of 11.33795. In a normally distributed dataset, the mean and the median should be equal. The mean and the median of the logarithm of exports are almost equal. The difference is 0.11849. This implies that the logarithm of exports is normally distributed. The kurtosis for the logarithm of exports is 2.018048 which fall in the range of -3 to 3 for a normally distributed series. The kurtosis measures whether the data is peaked or flat in relation to a normal distribution. The maximum value of the logarithm of exports is 12.13977 and the minimum value is 9.846993. This implies that the values lie closely in the series. The skewness of the logarithm of exports is -0.3972881. This suggests that the series is slightly skewed to the left but this falls into the acceptable range of -2 to 2 for a normally distributed series. The standard deviation of the logarithm of exports is 0.6753469. This indicates that the values are not wide spread out from the mean and hence there are no outliers in the dataset.

The mean and the median of the logarithm of the real interest rate is 2.064427 and 2.09586 respectively which implies that the series is normally distributed as the two measures of central tendency are almost equal. The difference between median and the mean of the series is 0.031433. The maximum and the minimum value in this series is 3.049099 and -0.0151136 respectively. This implies that there are no outliers as the difference between the maximum and the minimum value is not very large. Presence of outliers in a dataset can give rise to heteroskedasticity. The skewness of the logarithm of the real interest rate is -0.8151923 while the kurtosis is 3.512498. The skewness falls in the acceptable range -2 to 2 for a normally distributed dataset. The kurtosis of this dataset is 3.512498. This is slightly above the value of 3 for a normally distributed dataset which implies that the series is more peaked in relation to normal distribution. The standard deviation of the logarithm of the real interest rate is 0.7336376. This implies that the series is not widely spread out from the mean.

The logarithm of the real exchange rate has a mean of 2.710323 and median of 3.222528. The difference between the mean and the median is 0.512205 which is less than one. The minimum and the maximum values are -0.325527 and 4.160444 respectively. This

suggests that there is no big difference between the minimum and maximum value and hence there are no outliers. The skewness of this series is -0.7929628 while the kurtosis is 2.224459. Both the skewness and the kurtosis lie within the acceptable range for normal distribution (-2 to 2 for skewness and -3 to 3 for kurtosis). The standard deviation for this series is 1.457076.

The logarithm of the foreign income has a mean of 10.43769 and median of 10.45002. The difference between the median and the mean of this series is 0.01233. This is an indication that the series is normally distributed as the two measures of central tendency are almost equal. The maximum value in this dataset is 10.64292 while the minimum value is 10.1299. This is an indication that there is no outlier in this series as the difference between the highest value and the lowest value is not big. The skewness for this dataset is -0.3253102 which lies in the accept range of -2 to 2 for a normally distributed dataset. The kurtosis of this series is 1.749088. This value lies in the acceptable range of -3 to 3 for normal distribution. The standard deviation of the logarithm of foreign income is 0.164815. This implies that the data points are close to the mean. Therefore there are no values that are extremely high or extremely low in the dataset.

The mean and the median of the logarithm of the agricultural GDP is 23.94643 and 23.94709 respectively. The two measures of central tendency are almost equal implying that the series is normally distributed. In addition the minimum and the maximum values in the series are 23.65824 and 24.30527 respectively. This is an indication that there are no outliers in the dataset as the difference between the two values is not big. The skewness for this series is 0.209798 while the kurtosis is 2.965349. Both the skewness and the kurtosis fall in the acceptable range for normal distribution (-2 to 2 for skewness and -3 to 3 for skewness). The standard deviation of this series is 0.144294. This suggests that the data points are close to the mean.

4.3. Unit Root Test

Most time series data is usually non-stationary (the data exhibit trending behavior or non-stationarity in the mean). This implies that when estimation by use of Ordinary Least Squares (OLS) is applied directly, spurious regression results are yielded. Spurious regression results are as a result of using time series data that is not stationary. In this case, the values of the time series do not fluctuate around a constant mean or with a constant variance. In spurious regression, a high R^2 is generated even if the explanatory variables have no relationship with the dependent variable. In addition, the t-statistics in spurious regression are likely to be significant even if there is no causal relationship between the dependent and the independent variables. In this case the usual t-ratios do not follow t-distribution. This implies that hypothesis testing for the regression parameters cannot be done because the results derived will be misleading. To avoid the problem of spurious regression, Phillips-Perron unit root test was carried out on the variables. In this test the null hypothesis of a unit root is rejected if the absolute value of the test statistic is greater than the critical values at the significance levels provided.

Table 4.3a: Phillips-Perron Unit Root Test (Levels)

Variable	Test statistic	1% Critical value	5% Critical value
LogExp	-0.803	-17.540	-12.660
LogR	-12.375	-17.540	-12.660
LogRealexrate	-2.031	-17.540	-12.660
LogFY	-1.558	-17.540	-12.660
LogAgGDP	-0.003	-17.540	-12.660

At levels, since the absolute value of the Phillips-Perron test statistic is less than the absolute critical values at 1% and 5% level of significance, the null hypothesis of the presence of a unit root cannot be rejected. This has an implication of non-stationarity of all the variables used in the model and hence the variables should be differenced. The

order of integration is known after differencing the variables. The results of Phillips-Perron unit root test for the first differenced variables are shown in the table below.

Table 4.3b: Phillips-Perron Unit Root Test (First Difference)

Variable	Test Statistic	1% Critical Value	5% Critical Value
LogExp	-38.699	-17.472	-12.628
LogR	-21.374	-17.472	-12.628
LogRealexrate	-40.223	-17.472	-12.628
LogFY	-39.331	-17.472	-12.628
LogAgGDP	-17.506	-17.472	-12.628

From the results above the absolute values of the test statistics are greater than the absolute critical values at all levels of significance for all the variables. This implies that all the variables have one order of integration.

4.4. Cointegration Analysis

Application of normal OLS to differenced variables leads to loss of information about the relationship of the variables in the longrun. This implies that a way should be devised so as to correct for this problem. If a dependent variable y and an independent variable x have one order of integration ($I(1)$), but the error term in the linear relationship between them is stationary, the two variables are said to be cointegrated. A detailed theoretical basis for representation, testing, estimation and modeling of non-stationary variables that are cointegrated has been discussed by Engle and Granger (1987). Cointegration is vital to the analysis of the long run relationships between time series economic variables. Economic theory proposes that the time series economic variables should move together. This implies that these variables should have long-run economic relationships. An error correction representation exists if there is cointegration. Cointegration can be tested by using Engle and Granger (1987) two step approach. The first step involves applying OLS

to the non-stationary variables (estimation of the long-run equation). The second step involves testing for the presence of unit root in residuals. The residuals are obtained from the long-run regression. ADF test or Philips-Perron test can be used to test for the unit root in the residuals. In this test the null hypothesis of cointegration is tested against the alternative hypothesis of absence of cointegration. The traditional diagnostic tests for the long-run equation estimated in the first step of Engle and Granger two step procedure are not important because the only important issue is testing for cointegration. The table below shows the results obtained from the long-run (cointegrating regression).

Table 4.4a: Long-run Relationship (Cointegrating regression)

Dependent Variable: LogExp

Sample: 1984-2014

Number of observations=31

Variable	Coefficient	Std Error	t-statistic	Prob
LogR	-0.0468552	0.0265934	-1.76	0.090
LogRealexrate	0.2253049	0.0458974	4.91	0.000
LogFY	1.146259	0.4947531	2.32	0.029
LogAgGDP	1.220964	0.3206258	3.81	0.001
Constant	-30.49649	6.163422	-4.95	0.000
R squared	0.9802	Sum of Squared residuals	13.6828011	
F Statistic	321.15	Adjusted R squared	0.9771	
Prob(F Statistics)	0.0000	Residual sum of squares	0.271440498	
Durbin-Watson statistic	2.171346	Mean Dependent variable	11.21946	

The absolute value of t-statistic determines the level of significance of a variable. From the regression results of the above long-run cointegrating equation the real exchange rate and the agricultural GDP are statistically significant at both 1% and 5% level of significance since the t-statistic of both variables is greater than 1.96 (at 5% level of

significance) and 2.57 (at 1% level of significance). The foreign income is significant at 5% level while the real interest rate is not significant.

However the variables in the above regression are not stationary and therefore the regression results are spurious. This is evident from R^2 of 0.9802 which is very high. In addition the significant t-statistics reported suggests that there could be the problem of spurious regression. Therefore the t-statistics and the R^2 in the above regression are not appropriate for hypothesis testing. In addition the traditional diagnostics tests such as autocorrelation, heteroskedasticity etc., are not reliable. The only important thing in the estimation of the above model is to test for cointegration. Testing for cointegration in the above model is done by testing for the stationarity of the residuals. ADF unit root test results are shown in the table below.

Table 4.4b: Stationarity Test for the Residuals of the Cointegrating Regression

ADF Test	1% Critical Value	5% Critical Value	10% Critical Value
Statistic			
-4.533	-3.723	-2.989	-2.625

The critical values at 1%, 5% and 10 % confidence levels are greater than the ADF test statistic. This implies that the variables used in the regression in Table 4.4a are cointegrated because the residuals are stationary as shown by the ADF unit root test results in Table 4.4b above. When the time series variables are cointegrated, an error correction model (ECT) can be adopted.

4.5. Error Correction Model Estimation

Following Engle and Granger (1987) approach on cointegration, variables that are cointegrated can be modeled by an error correction model. This involves running regression with first difference of dependent variable on independent variables that have been differenced once as well as one-period lagged equilibrium residuals that have been generated from the long-run (cointegrating) equation. All the variables in the error

correction model are stationary. Standard hypothesis testing using t-statistics and diagnostic test for error term are also appropriate when using this model. The ECM describes how the dependent variable and the independent variables interact in the short-run consistent with a cointegrating long-run relationship. The results from the regression of the error correction model are given in the Table 4.5 below.

Table 4.5: Error Correction Model (Short-run relationship)

Dependent Variable: DLogExp

Sample: 1984-2014

Number of Observations: 30

Variable	Coefficient	Robust std. Error	t-statistic	Prob.
DR	-0.0421578	0.0213614	-1.97	0.060
DLogRealexrate	0.1721776	0.0559782	3.08	0.005
DLogFY	0.361853	0.2892747	1.25	0.223
DLogAgGDP	1.207116	0.3749718	3.22	0.004
ECT	-1.097314	0.1281172	-8.56	0.000
Constant	0.0146862	0.0254561	0.58	0.569
R-squared	0.6157	Mean Dependent Variable	0.0696018	
Adjusted R-squared	0.5356	S.D Dependent Variable	0.1354547	
Sum of squared residuals	0.53209101	F-statistic	28.87	
Durbin Watson stat	1.749949	Prob(F-statistic)	0.0000	

The Letter “D” in front of the variables is the difference operator (shows first difference) and ECT is the error correction term.

From the regression results in Table 4.5, the real interest rate, the real exchange rate and agricultural GDP are significant in explaining the export performance of horticultural sub-sector. The real exchange rate and agricultural GDP are significant at 1% and 5% level of significance while the real interest rate is significant at 5% level of significance.

From the regression results, an increase in real exchange rate (depreciation) by 1% will lead to approximately 0.17% increase in horticultural exports. The sign is positive and is theoretically consistent. Depreciation of the local currency against the currencies of the Kenya's trading partners makes the horticultural exports to be competitive in the international markets and hence an increase in the demand. An increase in the agricultural GDP by 1% leads to an increase in the horticultural exports by approximately 1.21%. The sign of the co-efficient is consistent with theoretical aspects of supply. An increase in the agricultural GDP will lead to an increase in the quantity of horticultural exports but this will be subject to other factors that affect the horticultural exports. An increase in the real interest rate by 1% will lead to a decrease in the quantity of horticultural exports by approximately 0.04%. The sign of the coefficient for the real interest rate is negative hence being consistent with economic theory.

The coefficient of foreign income had the expected sign but it is not statistically significant at either at 1% or 5% in explaining the growth of exports. The t-statistic for this variable is 1.25 which is less than 2.57 (at 1% significance level) and 1.96 (at 5% level of significance). This could be attributed to the income inelastic demand that agricultural commodities have.

The Error correction (ECT) had the expected sign and is statistically significant at 1% and 5% level of significance. The ECT must have a negative co-efficient. According to Granger Representation Theorem, the coefficient for the ECT term should be negative and statistically significant in error correction models. The adjustment to equilibrium is captured by the coefficient of the error correction term.

In the above model autocorrelation is not a problem. This is evident from the Durbin Watson statistic of 1.749949 which falls into the acceptable range of 1.5-2.5. The robust standard errors were used so as to correct for the problem of heteroskedasticity. The table below shows the results of Breusch-Pagan test for heteroskedasticity.

Table 4.6: Breusch-Pagan test for Heteroskedasticity

Ho: Constant variance
Variables: Fitted values of DLogExp
Chi ² (1) = 0.88
Prob.> Chi ² = 0.3486

The results of the Breusch-Pagan test show that there is no heteroskedasticity. Since the Prob.> Chi² of 0.3486 is greater than 0.05 (5% significance level) the null hypothesis of constant variance is accepted. However due to the fact that in some circumstances, heteroskedasticity is hard to detect, robust standard errors becomes more appropriate to use than usual standard errors. In addition, the robust standard errors are valid even under homoscedastic conditions.

Heteroskedasticity occurs when the variance of the error term varies across the observations. This implies that the variance of the error term is different for different values of explanatory variables when there is heteroskedasticity. The OLS estimation under heteroskedasticity is still unbiased and consistent. In addition R^2 and adjusted R^2 are also not biased but the standard errors of the estimates are biased and the OLS is no longer BLUE. This implies when there is heteroskedasticity the standard errors cannot be used in hypothesis testing because wrong inferences will be made. This problem can be corrected by use of robust standard errors. Even if there is no heteroskedasticity, the robust standard errors can still be used.

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

5.1 Introduction

The summary, conclusions, policy implications, and limitations of the study have been discussed in this chapter. Section 5.2 is the summary of the study while section 5.3 is the conclusions. Policy implications based on the findings have been discussed in section 5.4 while section 5.5 consists of limitations of the study.

5.2. Summary

This study sought to examine the factors which affect the horticultural exports from Kenya to Netherlands, United Kingdom, France, Germany and Belgium. According to the export statistics, the four countries are the major importers of horticultural products from Kenya. A double log multiplicative model was adopted in the analysis. Four independent variables namely; weighted average foreign income of the four major importers of horticultural exports from Kenya, Kenyan agricultural GDP, real exchange, and real interest rate in Kenya were used in the analysis. The independent variable was the quantity of horticultural exports to the four major importers of horticultural exports from Kenya. All the variables were converted to the logarithm form. Unit root test was carried out by the use of Phillips-Perron test and it was found that all the five variables had one unit root (integrated of order one). Cointegration test was then done by applying Engle and Granger (1987) two step approaches. The results indicated that the variables were cointegrated and hence an error correction model was adopted in the analysis.

The results of the analysis indicated that agricultural GDP, real exchange rate, and real interest rate were significant in influencing the Kenyan horticultural exports to the four major importers. The coefficient of the real exchange rate and agricultural GDP were significant at both 5% and 1% level of significance and had positive sign as expected. In addition, the error correction term was significant at both 5 percent and 1 percent level of significance and had the expected negative sign. However, foreign income was not significant.

5.3 Conclusions

Based on the results of the study, real exchange rate, agricultural GDP and real interest rate are important factors that influence horticultural exports from Kenya. Real exchange rate and agricultural GDP have positive influence on Kenyan horticultural exports while real interest rate has negative influence on horticultural exports. The foreign income had a positive relationship with the horticultural exports but it was not significant in influencing the horticultural exports.

The results of the study imply that an increase in the real exchange rate (depreciation) and agricultural GDP would lead to an increase in the horticultural exports from Kenya. However, real interest rate had a negative relationship with the horticultural exports. This implies that an increase in real interest rate would lead to a decrease in Kenya's horticultural exports. This is mainly because of an increase in cost of borrowing as a result of an increase in the real interest rate. The significance of the real interest rate in influencing the horticultural exports can be attributed to the fact that horticultural sub-sector is relatively more capital intensive as compared to other agricultural sub-sectors. For example, a significant amount of capital is required to set up green houses, cooling facilities, pack houses, irrigation system as well as purchase of fertilizers, agrochemicals and other inputs.

5.4 Policy Implications

The results of the analysis suggest that agricultural GDP, real exchange rate and real interest have significant influence on the Kenya's horticultural exports. Therefore, policy implications in respect to the three variables will be discussed.

Agricultural GDP measures productive capacity in the agricultural sector. Therefore, an increase in agricultural GDP implies an increase in the agricultural productivity in the country. An increase in agricultural productivity leads to an increase in the agricultural output in the country. The positive relationship between the agricultural GDP and the horticultural exports implies that an increase in productivity in the agricultural sector leads to an increase in Kenya's horticultural exports. In this regard, policies for

increasing the horticultural output should be formulated. For example, investment in research and agricultural extension especially with regard to smallholder farmers is very crucial for increasing the horticultural production. It should be noted that most smallholder farmers have less financial ability to pay for private research.

Agricultural extension by the government has been declining overtime. Declining public agricultural extension is one of the factors that have affected the growth of the horticultural sub-sector among the small-holder farmers. Inefficient public extension system has led to the slow growth rate of horticultural exports. In this regard the government should participate more in agricultural extension and research. In addition efficient linkage should be created between research, extension and farmers. The government also needs to come up with effective policy guidelines on horticultural research and act on the issues raised in various agricultural research programs. In addition the government should work hand in hand with the private research institutions, institutions of higher learning and donors so as to come up with clear policy guidelines for the horticultural sub-sector.

The findings of the study suggest that there is a negative relationship between the real interest rate and Kenya's horticultural exports. This implies that an increase in the real interest rates in the country leads to a reduction in the horticultural exports. This is because when the real interest rate increases the cost of borrowing goes up thereby discouraging investors to borrow to finance their investment activities. In addition the investors who will be already financing their loans will have less disposable income because they will be spending more on payment of interests. This will lead to a reduction in investment activities thereby resulting to a decline in the aggregate demand thereby leading to a decrease in horticultural exports. Compared to other agricultural subsectors, the horticultural sub-sector is relatively more capital intensive. Due to the negative effects of high interest rates on the horticultural exports, efficient policies for stabilization of the interest rates should be put in place. High interest rates affect almost all sectors of the economy and therefore the negative impact of the high interest rates is felt across all the sectors of the economy. The interest rate charged by commercial banks and other

financial institutions is very high and this discourages investors from borrowing to finance their horticultural farming. This in turn affects the performance of the horticultural sub-sector.

The government should establish the factors that lead to high interest rate and formulate policies for reducing the interest rates in the economy. Inflation has been the main cause of high interest rate. Inflation leads to loss of time value for money and financial institution responds to this by raising the interest rates thereby leading to an increase in cost of borrowing which discourages investors from borrowing. In addition the investors face an increase in cost of servicing the loans which negatively affects the productivity of their businesses. Therefore the policies for lowering inflation rate should be adopted. In addition ceiling on lending rates should be put in place. This is because most financial institutions charge exorbitant interest rates so as to cover up for management inefficiencies.

Next is that depreciation of the real exchange rate leads to an increase in the horticultural exports. This is because of an increase in competitiveness of the horticultural exports in the international due to depreciation of the real exchange rate of the Kenyan currency against the currencies of the trading partners. The positive and significant relationship between the real exchange rate and the horticultural exports is in line with the Hausmann, Pritchett, and Rodrik (2005) who found a significant relationship between economic growth (due to an increase in exports) and depreciation. Therefore, monetary authorities should formulate policies that maintain the real exchange rate at a level that is competitive for the horticultural exports.

5.3. Limitations of the Study

There were some limitations in this study. For example there were extreme values in the Economic Survey and Statistical Abstract especially after the change in reporting from the pound to Kenya shilling. In addition some variables were left out of the model because they were not quantifiable. For example the effects of quality of packaging and quality of processing on the horticultural exports could not be measured.

REFERENCES

- Abbot, J.C (1984) *Marketing improvement in the developing world: what happens and what we have learned*. Rome, Italy: FAO
- Allaro, H.B (2010) Export Performance of Oil Seeds and its Determinants in Ethiopia. *Journal of Cereals and Oil Seeds*, 1(1), 1-15.
- Barrett, H. and Browne, A. (1996) Export of Horticultural Products in Sub-Saharan Africa: The Incorporation of Gambia. *Geography*, 81(1), 47-56.
- Barrett, H.R, Ilbery, B.W, Browne, A.W, Binnst, T. (1999) Globalization and the Changing Networks of Food Supply: The importation of Fresh Horticultural Produce from Kenya into the UK. *Transaction of English Geographers*, New Series, 24(2), 159-174.
- Engel, C. (1993). Real Exchange Rates and Relative Prices: *An Empirical Investigation*. *Journal of Monetary Economics*, 32, 35-50.
- Engle, R.F. and Granger, C.W.J. (1987). Cointegration and Error Correction: Representation, Estimation and Testing, *Econometrica*, 55, 251-276
- USAID. (2012). Global Competitiveness Study: Benchmarking Kenya's Horticulture Sector for Enhanced Export Competitiveness. Nairobi, Kenya: Fintrac Inc.
- Gbentnkoum, D. and Khan, S.A. (2002) *Determinants of Agricultural Exports: The Case of Cameroon*. AERC Research Paper 120. Nairobi, Kenya: African Economic Research Consortium.
- Gine, X. (2005). DrumNet Case Study. Nairobi, Kenya: The World Bank.
- Gioe, M. (2006) Can Horticultural Production Help African Smallholders to Escape Dependence on Export of Tropical Agricultural Commodities? *Crossroads*, 6(2), 16-65.
- Harris, R.S. and Muthugu, T. (1992). Kenya Horticultural Subsector Survey. Kenya Export Development Support Project. Nairobi, Kenya: KEDS.
- Hatab A.A., Romstad, E. and Huo, X. (2010) Determinants of Egyptian Agricultural Exports: A Gravity Model Approach. *Modern Economy*, 1, 134-143.
- Hausmann, R., Pritchett, L. and Rodrik, D. (2005). Growth Accelerations. *Journal of Economic Growth*, 10(4), 303-329.

- Jaffe, S. (1995). The Many Faces of Success: The Development of Kenyan Horticultural Export. In Jaffee, S. and Morton, J. (eds), *Marketing Africa's High Value Foods*. Washington, D.C.: World Bank.
- Kenya Horticultural Development Program (2009) Final Report. Nairobi, Kenya: Fintrac Inc.
- Kenya National Bureau of Statistics (2011). Gross Domestic Product Third Quarter Release. Statistical Release. Nairobi, Kenya: KNBS.
- Kumar, R.N, Rai, A.B, Rai, M. (2008). Export of Cucumber and Gherkin from India: Performance, Destinations, Competitiveness and Determinants. *Agricultural Economics Research Review*, 21, 130-138.
- McCulloch, N. and Ota, M. (2002). *Export Horticulture and Poverty in Kenya*. IDS Working Paper 174. Sussex, U.K.: Institute for Development Studies.
- Ministry of Agriculture (2010) Economic Review of Agriculture. Nairobi, Kenya: MOA.
- Minot, N. and Ngigi, M. (2004) *Are Horticultural Exports a Replica Success Story? Evidence from Kenya and Ivory Coast*. Washington DC, U.S.A.: Environment and Production Technology Division and Markets, Trade and Institutions Division. International Food Policy Research Institute.
- Mold, A. and Prizzon, A. (2008) *Explaining Africa Recent Performance and Limited Gains from the Commodity Boom*. Paris, France: OECD Development Centre.
- Muendo, K.M. and Tschirley, D. (2004). *Improving Kenya's Domestic Agricultural Production and Marketing System: Current Competitiveness of change, and Challenges for the Future*. Working Paper No 08C/2004. Nairobi, Kenya: Tegemeo Institute of Agricultural Policy.
- Ndubuto, I.N., Agwu, N. and Nwaru, J. (2007) *Competitiveness and Determinants of Cocoa Exports from Nigeria*. Abia State, Nigeria: Department of Agribusiness and Management. Michael Okpara University of Agriculture.
- Nyairo, N., and Backman, S. (2009). *Analysis of Factors Affecting the Supply of Agricultural Products: Market Liberalization, Agricultural Policies, Bioenergy Policies, Population Growth, Input Price Development, Trade Policies and Other Relevant Factors*. Discussion Paper No. 36. Helsinki, Japan: University of Helsinki, Department of Economics and Management.

- Ongeri, B.O. (2014). Small Scale Horticultural Farming along the Kenyan Highways and Local Economic Development. *International Review of Research in Emerging Markets and the Global Economy*.1 (3), 102-119.
- Orindi, M.N. (2011) Determinants of the Kenyan Exports: A Gravity Model Approach. *International Journal of Applied Economics*. 1(1):3-14.
- Roy, D.K. (1991). Determinants of Export Performance of Bangladesh. *The Bangladesh Development Studies*. 19(4), 27-48.
- Salasya, B.S. (1989) Economic Analysis of the Major Factors Influencing Exports of French Beans from Kenya. MSc. Thesis (unpublished), University of Nairobi.
- Schapiro, M.O. and Wainaina, S. (1991). Kenya's Export of Horticultural Commodities. *Public Administration*, 11(3): 257-261.
- Tschirley, D., Muendo, M.K., and Weber, T.M. (2004). *Improving Kenya's Domestic Horticultural Production and Marketing System: Current Competitiveness, Forces of Change, and Challenges for the Future*. Working Paper No. 08B/2004. Nairobi, Kenya: Tegemeo Institute of Agricultural Policy and Development.