DETERMINANTS OF EXPORT VOLUMES OF UGANDA'S COFFEE, 1991-2007.

BY

BYANYIMA FAUSTINO BYANYIMA. BA (Educ) (KYU)

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FEBRUARY, 2011

DECLARATION

I, Byanyima Faustino Byanyima, declare to the best of my knowledge that; this work is original and has not been published or submitted for any other degree award to any other university.

Signed:…….

BYANYIMA FAUSTINO BYANYIMA

Date:……

This dissertation has been submitted for examination with the approval of the following supervisers;

1. Signature:…….

   Dr Tom Mwebaze

   Date:……..

2. Signature:……...

   Dr Mubazi, J. K. E, BA(Econ. Hons), MA(Econ), M.Phil(AEQT)

   Date:…….

DEDICATION

This dissertation is dedicated to my family members and friends for their encouragement and supports both morally and materially.

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I am grateful to the almighty God for enabling me to successfully complete Master of Arts in Economics degree of Makerere University.

My sincere gratitude and heartfelt thanks go to Abenaitwe, Sabiiti and the rest of the family members for their unfailing support, encouragement and material assistance given to me while pursuing this program.

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ACRONYMS

AIDS:	Acquired Immune Deficiency Syndrome
BCU:	Bugisu Co-operative Union
B.H.P:	Broken Half Pieces
CES:	Constant Elasticity of Substitution
COMESA:	Common Market for East and Southern Africa
CWD:	Coffee Wilt Disease
DRUGAR:	Dried Ugandan Arabica
EAC:	East African Community
ECM:	Error Correction Model
EU:	European Union
FAQ:	Fair Average Quality
FOB:	Free on Boat
FOM:	Farm Ownership Model
FOR:	Free on Rail
GCF:	Gross Capital Formation
GDP:	Gross Domestic Product
HIV:	Human Immunal Virus
ICA:	International Coffee Agreement
NAADS:	National Agricultural Advisory Services
NUCAFE:	National Union of Coffee Agribusiness and Farm Enterprises
PMA:	Plan for Modernisation of Agriculture
UBOS:	Uganda Bureau of Statistics
UCDA:	Uganda Coffee Development Authority

UCFA: Uganda Coffee Farmers Association

UCRA: Uganda Coffee Roasters Association

UEPD: Uganda Export Promotion Board

UNCTAD: United Nations Conference on Trade and Development

USA: United States of America

ABSTRACT

The study set out to investigate the determinants of export volumes of Uganda's coffee in an export supply framework. The hypotheses tested were that; an appreciation of real exchange rate and an increase in real interest rate reduce coffee export volume and an increase in international coffee prices, gross domestic product, and gross capital formation increase coffee export volume.

The study applied cointegration technique and error correction modeling to Ugandan quarterly data starting from 1991:1 to 2007:4. The results indicate the existence of long-run relationships. The econometric results show that the real effective exchange rate is negatively correlated with coffee export volumes with elasticity of -2.164. The international coffee price has a positive and statistically significant effect on coffee export volumes with price elasticity of 0.789. However, real interest rate, gross domestic product and gross capital formation have statistically insignificant effects in the short-run.

From the results, it is concluded that an increase in international coffee price and gross domestic product increase coffee export volumes while real effective exchange rate depreciation and increase in real interest rate reduce the coffee export volumes. The study recommends the establishment of agreements with international coffee buyers to increase prices, prevent exchange rate depreciation, expansion in gross domestic product and reduction in interest rate on loans to producers and exporters thereby encouraging coffee production and increase in coffee exports.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Uganda's export sector is dominated by primary products (about 74.1 %), (Roberta, 2004). These include agricultural products; mainly coffee, cotton, flowers, simsim, fish; unprocessed minerals such as gold; live animals, hides and skins among others. At independence time (1962), Uganda's traditional exports constituted agricultural commodities and unprocessed minerals. By the end of the 1970s, coffee was the largest foreign exchange earner accounting for about 51 percent leaving cotton, copper, tea and tobacco sharing the other portion of the earnings (Musinguzi, 2002).

The coffee plant is a woody perennial evergreen dicotyledonous that belongs to the Rubiaceae family. Because it grows to a relatively taller height, it is more accurately described as a coffee tree (Mitchell, 1988). While there are several different coffee species, two main species of coffee are cultivated today. These are; Arabica coffee (Coffea Arabica) and Robusta coffee (Coffea canephora). In Uganda, Robusta Coffee is mainly grown in the low altitude areas of Central, Eastern, Western and South Eastern Uganda up to 1,200 meters above sea level. Arabica coffee requires cool, moist and higher altitude. It is mainly grown on Uganda's mountain fringes, on Mount Elgon in the east (notably in Bugisu, on the western slopes of Mount Elgon in Mbale district) and on the Rwenzoris and West Nile (Nebbi and Okoro districts) on the border with Congo. Some Arabica is also grown in Mbarara district in Western Uganda (Sayer, 2002).

Coffee has continued to play a leading role in the economy of Uganda. It contributes between 20-30 percent of the foreign exchange earnings (Uganda Coffee Development Authority, 2009). In 1995, the National Union of Coffee Agribusinesses and Farm Enterprises (NUCAFE) was founded. This has led to the coming up of some large scale coffee farmers. Though large scale coffee producers are gradually emerging, the coffee sub-sector is almost entirely dependent on about 500,000 smallholder farmers, 90 percent of whose average farm size ranges from 0.5 to 2.5 hectares. The coffee industry employs over 3.5 million family members through coffee related activities.

From the 1920s, coffee was grown for export and in the 1950s an extensive coffee production programme was launched. In 1972, coffee production reached 4.2 million bags of 60Kgs each. Thereafter, coffee production declined tremendously because of civil strife, poor marketing systems, and low producer prices arising from government monopoly and controls (Rudaherenwa, et al 2003).

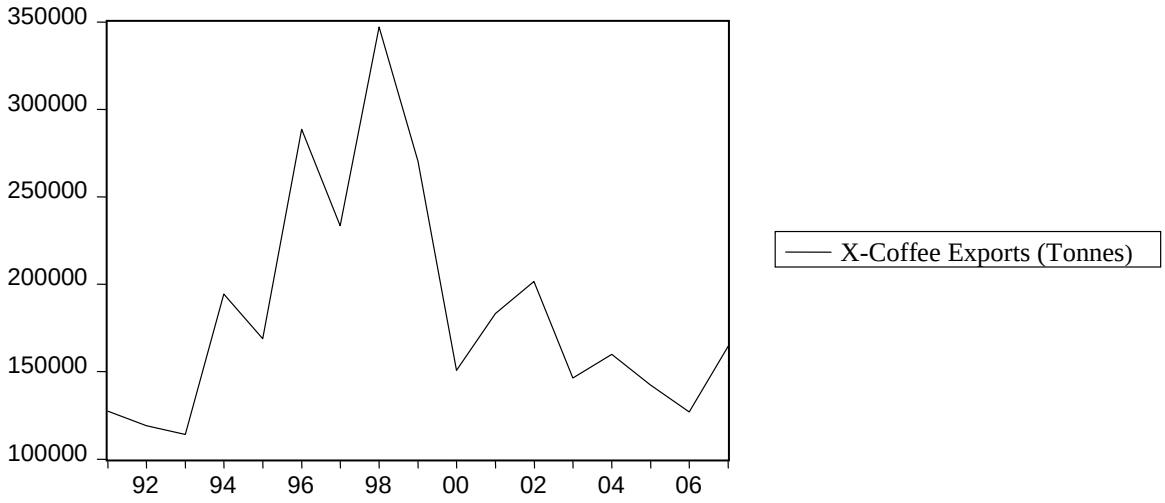
Coffee production began increasing in the 1980s through the 1990s. However, annual production remained below the 4.2 million bags recorded in 1972. The coffee wilt disease that affected coffee production in the past two decades, lack of adequate supplies of affordable farm inputs such as fertilizers, poor nursery capacity for the production of coffee seedlings, the fall in coffee prices following the suspension of International Coffee Agreement (ICA) export quota system in 1989 that seriously affected Robusta coffee earnings, among others, partly explain the low levels of coffee production.

A wide range of measures have been instituted with a view to increasing coffee production. These include; liberalization of the coffee industry, abolition of 25 percent export tax levied on coffee, licensing of foreign exchange bureaus, establishing the Uganda Coffee Development Authority (UCDA) as a regulatory and development agency for the industry, which promotes and oversees the coffee industry by developing research, controlling quality and improving the marketing of coffee and participating in regional integration in order to gain access to regional markets.

From 1991 to 1998, coffee exports increased mainly due to fair prices on the international market. Thereafter, coffee exports declined almost every subsequent year. This is mainly due to adverse prices on the international market, and there exists a huge value gap between the global revenues generated from coffee and what producing countries earn, due to a long supply chain with very many participants. For instance, in the year 2006/2007, the global coffee revenues were US$90 billion but farmers in producing countries all combined including Brazil earned only US$9 billion which is 10 percent of the global value share (UCDA, 2009).

Coffee farmers in African producing countries all combined earned less than US$2 billion, which is about 22 percent of the total value share that producing countries earned when all combined. Africa's total value share to global value was only about two percent. Uganda earned about US$170 million and the coffee farmers altogether earned less than US$90 million which is about 53 percent value share, while middlemen (occasional traders) and exporters earned 38 percent and nine percent respectively. This clearly shows that coffee farmers have to upgrade and increase their value share (UCDA, 2009).

Figure1.1: Performance of coffee exports after liberalization, 1991-2007.



Source: UBOS Agricultural Statistical Department.

From the figure 1.1, it is seen that coffee exports increased until 1998 and since then they have continued to decline. For instance, coffee exports registered growth rate in volume of -11 percent in 2005, -10 percent in 2006 and 29 percent in 2007. It is against this background that the study seeks to investigate the factors determining coffee export volumes in Uganda.

1.2 Statement of the Problem

Coffee exports have been declining since 1998 (refer to fig1.1) despite the measures undertaken by the government to boost the sector. It is not clear what the major factors behind this trend in Uganda's coffee export volumes are. It is therefore imperative to investigate the factors determining coffee export volumes in Uganda.

1.3 Objectives of the study

The general objective of the studyM is to investigate the determinants of coffee export volumes in Uganda. The specific objective is; to investigate the effect of real exchange rate, real interest rate, international coffee price, gross domestic product and gross capital formation rate on coffee export supply.

1.4 The Scope

The study focuses on determinants of export volumes of Uganda's coffee covering the period 1991-2007. The period was chosen because reforms in the coffee export sub-sector were introduced in 1991. These are expected to have contributed to a sustained increase in coffee production and exports by 2007.

1.5 Significance of the study

The study is to expand the existing stock of literature on determinants of coffee export volumes in Uganda. It is also intended to provide information to policy makers to enable them come up with appropriate policies to achieve a sustained increase in coffee production and exports.

1.6 Hypothesis of the study

In light of the objective and the statement of the problem, the study intends to test the following hypotheses;

(i) An appreciation of Real Exchange Rate and an increase in Real Interest Rate reduce Coffee export volume.

(ii) An increase in International coffee prices, Gross Domestic Product, and Gross capital formation increase coffee export volume.

1.7 Organization of the dissertation

This dissertation is divided into six chapters. Chapter one is the introduction. Chapter two gives an overview of the coffee sub-sector in Uganda. The third chapter reviews some of the theoretical and empirical studies related to the factors determining the export supply function. Chapter four is giving the data types, sources and methods of generating data for some of the variables and setting out the methodology used in estimating the coffee supply function. Chapter five gives the empirical analysis, where the descriptive statistics, unit root tests, cointegration tests and results interpretation are given. The last chapter gives a summary, the main conclusions reached and policy recommendations.

CHAPTER TWO

THE STRUCTURE OF UGANDA'S COFFEE EXPORT SUB-SECTOR

2.1 Export sector in general

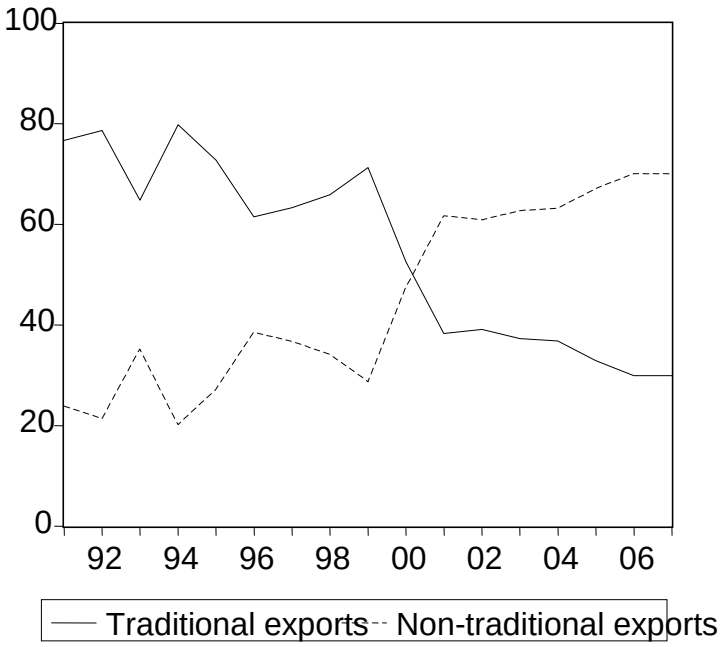
Uganda's export sector is one of the chief factors that boost Uganda's economy. The Uganda export sector forms an integral part of the economic infrastructure of the country. The main items of Uganda exports come from the agricultural produce of the country (refer to table 2.1). Some of these include; coffee, cotton, tea, tobacco, maize, cocoa, vanilla, live animals, animal hides and skins, flowers, oil seeds, among others. The estimated export value for Uganda was US$812.9 million F.O.B in 2005, US$962.2 million in 2006 and US$1.34 billion in 2007.

The traditional export items of Uganda are coffee, tea, cotton, and tobacco. These items were part of Uganda's export sector from quite an earlier period of time. However, these items have been overtaken as the main exports of the country. The list of export items of Uganda which have overtaken the traditional export items in the recent past constitute the non-traditional ones exported by Uganda. These include; fish and fish products, gold and gold compounds, animal/vegetable fats and oils, iron and steel, petroleum and petroleum products, sugar and sugar confectionery, maize and roses and cut flowers.

The non-traditional export sector has continued to register robust growth and its contribution to total export revenue was estimated to be over 67 percent in 2005, slightly over 70 percent in 2006 and over 70 percent in 2007 of the total export earnings in Uganda. This is partly attributed to Uganda Export Promotion Board (UEPB) product development programs and aggressive export promotion efforts. On the other hand, traditional exports as a share of total exports have

continued to decrease since 2001 (figure 2.1). This is because UEPB's activities do not focus traditional exports since the sector is taken to have specific agencies supporting it.

Figure 2.1: Percentage contribution of traditional and non traditional exports



Source: Uganda Bureau of Statistics: 1993, 1996, 1999, 2002, 2005, 2008.

Traditional and non-traditional export sector participation by companies has continued to grow. In 2005, 127 companies were engaged in export of traditional crops compared to only 89 companies in 2004. On the other hand, 414 companies were engaged in the export of non-traditional products compared to only 354 companies in 2004 (UEPB, 2006). This implies a growing interest in the export sector, with the non-traditional products drawing the most attention.

Table 2.1 Uganda's exports by percentage value 1999-2007

Traditional exports	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Coffee	60.1	31.2	21.6	20.7	18.8	18.7	21.3	19.7	19.9
Cotton	3.6	5.5	3.0	2.0	3.3	6.4	3.5	2.1	1.5
Tea	4.5	9.2	6.6	6.7	7.2	5.6	4.2	5.3	3.6
Tobacco	3.1	6.7	7.1	9.7	8.1	6.1	3.9	2.8	5.0
Non-traditional exports									
Maize	1.1	0.6	4.1	2.3	2.6	2.7	2.6	2.5	1.8
Beas & other legumes	1.8	1.1	0.5	0.7	1.0	1.3	1.1	0.8	0.8
Fish & fish products	5.2	7.1	17.3	18.3	16.5	15.5	17.6	15.2	9.3
Cattle hides	0.6	3.3	5.7	2.1	0.9	0.8	0.9	0.8	1.4
Sesame seeds	0.3	0.2	0.2	0.1	0.4	0.4	0.6	0.5	0.4
Soya beans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Soap	0.4	0.4	0.6	0.7	1.0	1.2	0.9	0.6	1.1
Electric current	2.8	4.6	2.3	3.3	2.6	1.8	0.5	0.5	0.7
Cocoa	0.3	0.3	0.4	0.4	1.3	1.0	1.2	1.0	1.2
Cobalt	0.0	2.7	2.8	1.5	0.0	1.7	1.8	1.9	1.3
Pepper	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.1
Vanilla	0.0	0.2	0.5	1.5	2.5	0.9	0.8	0.5	0.5
Live animals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Fruits	0.0	0.2	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Ground nuts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bananas	0.1	0.2	0.1	0.0	0.0	0.1	0.1	0.0	0.0
Roses & cut flowers	1.5	2.5	3.3	3.8	4.1	4.0	3.0	2.2	1.7
Ginger	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Gold & gold compounds	7.0	10.8	10.9	12.9	7.2	9.2	9.0	12.7	4.9
Other products	6.7	10.3	10.0	10.0	14.5	17.2	22.9	26.7	41.8
Petroleum	0.0	2.2	2.7	2.3	5.2	4.2	3.9	3.8	2.9

Source: Uganda Bureau of Statistics: 2001, 2004, 2008.

Europe (EU and other countries in Europe) is the major destination of Uganda's exports, followed by COMESA, accounting for 46.9 percent and 26.1 percent in 2005 respectively. On the whole, the African continent ranks second in importance, as a destination of Uganda's domestic exports after Europe. Exports to South America and the Middle East accounted for less than 10 percent combined from 2003 to 2005.

The informal export sector earnings were estimated at US$200.3 million and the official export earnings stood at about US$812.9 million. Overall, export earnings from both trading arrangements fetched the country about US$1.01 billion. In the informal export sector, Uganda is an exporter of beans, maize, sugar, other grains, bananas, fish, industrial products and other agricultural commodities. Kenya is the main informal trading partner with a total informal trade estimated at US$151.3 million, followed by DR Congo with estimated trade of US$94.5 million and Sudan comes in third with total informal trade standing at US$9.9 million in 2005 (UEPB, 2006).

2.2 Uganda's coffee sub-sector

Coffee continues to be Uganda's most important cash crop. It accounts for the largest individual share of export earnings. Two types of coffee are produced in the country, namely, Robusta and Arabica in the ratio of 4:1. Robusta coffee is the predominant type constituting about 80 percent of the total coffee production. Unlike Robusta whose native habitat is the Lake Victoria Crescent, Arabica coffee is an introduced crop originating from Ethiopia. Being astride the equator, Uganda has two distinct harvesting seasons; October/December and May/July, north and south of the equator respectively: the two hemispheres alternate in harvest.

Coffee is mostly grown in mixed stand where it is intercropped with food crops such as bananas and beans which ensure households' food security. It is also grown among shade trees that result into sustainable coffee production, (social, economic and environment), with minimal use of agro-chemicals (fertilizers, pesticides and fungicides). Coffee farmers in Uganda use the low input system and households strongly rely on family labor (UCDA, 2009).

At the household level, coffee is seen to contribute greatly. This contribution is in terms of household income, employment and other rural livelihoods. Coffee continues to provide essential income in Robusta and Arabica growing areas. There seem to be a balanced participation in coffee production and export processes by gender. For instance, in June 2008 to 2009, over 1,000 coffee farmers were reached and on average the participation of women was found to be 43 percent and 57 percent for men (Seaman, et al. 2004).

With liberalization in 1991, the marketing of coffee became an individual endeavor. The growers, buyers, processors and exporters are now free to contact each other as far as the production and selling are concerned. Marketing of coffee depends upon the individual farmer's level of production, the extent of co-operation amongst the local farmers, distance from the farm to the nearest mill and level of competition among local traders and buyers.

Coffee is sun dried to get kiboko (Robusta) and drugar (Arabica) to be taken to the mill. Farmers close to the mill can take their kiboko and drugar to the mill by bicycle or motorcycle bag by bag to avoid cash payments for transport. Farmers (neighbouring each other) who have many bags can decide to hire a pick-up to take their coffee to the mill or sell to a local trader.

To avoid high cost of transport due to long distances, independent local millers who also act as brokers or buyers contract to supply one of the large exporters. These hand-clean and screen the coffee to get fair average quality (FAQ) or green coffee. The coffee is then sent to the Kampala exporter for sorting and grading. The coffee is graded and bagged by the exporter (see Appendix G). The coffee is now attached prices, which may be declared ex-Kampala (for: free on rail) or may include transport cost to port Mombasa or Dar es Salaam (fob: free on boat). Transport to the port is usually arranged by the export company in the country.

There are challenges faced by key players (mainly farmers and exporters) in the coffee trading chain. For instance farmers lack cash to hire labour at busy times (especially harvesting), due to declining prices. They are also affected by the coffee wilt disease which has reduced the output levels. On the part of exporters, there is a major challenge of declining quality. This is mainly due to poorly regulated private traders who focus on short-term financial gains, rather than the long-term reputation of the nation's coffee.

Requirements associated with selling on the international markets present barriers to higher revenues for small producers. Export license, quantity quotas and quality requirements can operate as bottlenecks that effectively reduce the ability of producers to reap the benefits of the international trading system (United Nations Conference on Trade and Development, 2002).

2.3 Promoting institutions

These are institutions that are not direct producers of coffee but have significantly contributed to the progress of the coffee industry in Uganda. These help in organising of farmers groups, providing information and extension services, enforce quality measures among other things.

They include the National Union of Coffee Agribusinesses and Farm Enterprises (NUCAFE), National Agricultural Advisory Services (NAADS), Uganda Coffee Development Authority (UCDA), Uganda Coffee Roasters Association (UCRA) as elaborated on from 2.3.1 to 2.3.4.

2.3.1 National Union of Coffee Agribusinesses and Farm Enterprises (NUCAFE)

NUCAFE is a membership based national union of coffee farmers associations in Uganda, replaced the Uganda Coffee Farmers Association (UCFA). It is arguably the largest single representative body for Uganda's smallholder coffee producers. It was founded in response to members' needs as a result of needs assessment and strategic planning carried out in year 2003. NUCAFE has been in existence since 1995 and the union has grown. It has registered members in 19 districts from the major coffee growing regions of Uganda, namely Rukungiri, Bushenyi, Masaka, Rakai, Mpigi, Wakiso, Jinja, Kayunga, Iganga, Mbale, Sironko, Kapchorwa, Nebbi, Gulu, Mukono, Bududa, Manafa, Lira and Arua. Currently, NUCAFE has 125 coffee farmers associations at sub county level spread all over five main coffee growing regions of Uganda, with over 100,000 coffee farming families.

The vision of NUCAFE is "Coffee farmers profitably own their coffee along the value chain for their sustainable livelihoods". Its mission is "to develop and establish sustainable market-driven system of coffee farmer associations and groups that are empowered to enhance their household incomes". NUCAFE's system of operation is premised on the Farmer Ownership Model (FOM). This is implemented using the Farmer Group Association framework. This is designed to help small scale coffee farmers to adopt a business view of farming (to look at coffee growing as a business). It is also organizing coffee farmers to assume as many roles in the supply chain as possible to keep pace with market and consumer demands. NUCAFE has increasingly gained the

confidence from coffee sector stakeholders and is recognized as a true national representative of coffee farmers in Uganda. It has accordingly established and continues to harness partnerships with key stakeholders in the sector.

NUCAFE has developed a Strategic Plan which identifies four strategic goals that will be pursued in the period 2008-2012 and these are; to strengthen the institutional capacity of NUCAFE by strengthening its human resource capacity and putting in place a feasible sustainable plan to ensure its long term survival and service delivery effectiveness. The second is to promote membership development and strengthening through facilitating formation and strengthening of farmer groups and associations and improving communication and information sharing. Thirdly, to advocate and lobby the different stakeholders in the coffee industry on issues like promoting the adoption of farmer ownership model, government funding to the coffee sector, review of the UCDA law, quality control and adherence aspects, soil assessment facilitation to farmers, among others to ensure sustained increase in coffee production. And lastly to provide services that enhance production and profitability of coffee to farmers by disseminating information on pre and post harvest handling practices, promoting value addition, linking farmers to input suppliers and financial institutions, among others.

2.3.2 National Agricultural Advisory Services (NAADS)

It is an advisory and extension program instituted by the government as a key component of the Plan for Modernization of Agriculture (PMA). It is designed to increase farmer access to information, knowledge and technology for profitable agricultural production. NAADS is envisioned to become a decentralized, farmer owned and private sector serviced extension system contributing to the realization of the agricultural sector development objectives.

NAADS operations are guided by the following principles; Commercialization by gradually shifting farmers from subsistence, farmer empowerment, increasing institutional efficiency, fostering participation by actively involving all categories of farmers, poverty targeting, gender mainstreaming by making all NAADS interventions gender-responsive, managing natural resource productivity by transforming agricultural production and productivity without degrading the environment, HIV/AIDS mainstreaming by making all NAADS interventions responsive to the impacts of HIV/AIDS on the provision of agricultural advisory services, and harmonisation through liaising with other agricultural development programs, funded by different donors.

2.3.3 Uganda Coffee Development Authority (UCDA)

The Uganda Coffee Development Authority (UCDA) was established by statutory mandate in 1991 following the liberalization of the coffee industry. Its vision is to make Uganda a distinguished producer of high value coffee. UCDA has a statutory mandate to promote and oversee the development of the entire coffee industry through research, quality assurance, improved marketing and providing for other matters connected therewith.

UCDA performs the following roles; it distributes coffee plantlets to farmers for replanting in the coffee wilt affected areas, advises government on coffee matters and monitors the marketing of coffee to optimize foreign exchange earnings and payment to farmers and licenses coffee traders and exporters to ensure that the quality of coffee exports meets international standards.

UCDA has made the following achievements; it has put in place a framework for privately owned warehouses, developed a market information system which allows dissemination of

information on prices from international and key domestic markets, developed a quality assurance system through which provision of training materials and programmes for farmers regarding pre-harvest and post-harvest management practices is made to improve deliveries of coffee to the warehouses and has also developed a system for accessing inventory based credit.

2.3.4 The Uganda Coffee Roasters Association (UCRA)

It was incorporated on the 13th may 2002. The aim was to provide a common forum for Ugandan coffee roasters and allied industries. Secondly, it was aimed at promoting and providing benefit to their business or other interests and fostering the spirit of co-operation and to promote sound business relations. It was also meant to establish understanding and good will among the Uganda coffee roasters and the coffee industry in general. The association carries out research and development in the improvement of coffee roasting, packaging, distribution and consumption including the improvement of quality and enhancement of the coffee roasting capacity in Uganda.

UCRA engages in the promotion and publicity of Uganda coffee, including the promotion of Uganda's organic and specialty coffees, and register trademarks and promotes labels under which coffee should be promoted and sold internationally. UCRA co-operates with the trade groups and government agencies, both foreign and domestic, in the determination and enforcement of rules, laws and projects for improving the conditions under which the coffee industry operates in the country.

2.4 Exporting of coffee

Coffee is harvested and dried (in most cases), after which it is taken to be milled locally. It is then cleaned, screened, graded and bagged ready for export. The industry is dominated by major exporters like Volcane/Kyagulanyi coffee Ltd 13.8 percent, Ugacof 13.5 percent, Kawacom 12.0 percent, Savannah commodities takes slightly over eight percent, Job coffee exports eight percent, Nuaman/Ibero (U) Ltd takes over seven percent, Kampala Domestic store slightly over seven percent and Lake Holdings Ltd exports seven percent. Of these, Kawacom (U) Ltd and Kyagalanyi Coffee Ltd are the main exporters of Arabica. The top eight coffee exporting companies in Uganda collectively have a market share of about 80 percent. There is also Bugisu Co-operative Union (BCU), an independent exporter which deals specifically in Arabica.

For a company to qualify as an exporter of Uganda's coffee must employ or acquire the services of a certified quality controller who is passed by UCDA, must ensure adequate pest control measures to avoid infestation of the coffee they are holding, must ensure that the moisture content of coffee for export conforms to the Uganda coffee export grading standards set in the Coffee Regulations1994 namely; maximum moisture of 13 percent for specialty (wet processed) Robusta, 12.5 percent for dry processed Robusta or green coffee and 12 percent for all exportable Arabica, among other things aimed at maintaining the quality of coffee.

The exporters buy coffee from independent traders and also have set up branches around the country to buy the coffee during the harvesting seasons. They mill the coffee and transport the green coffee to their Kampala factories for grading and export. The grades attached to coffee include; Organic Rob, Washed Rob, Screen 18, Screen 17, Screen 15, Screen 14, Screen 12, BHP 1199, among others for Robusta and Organic Okoro, Organic Bugisu, Bugisu AA, Bugisu

A, Bugisu PB, Bugisu B, Bugisu C, Bugisu E, Arabica AB, Arabica CPB, Mixed Arabica, Wugar, Drugar, among others for Arabica coffee (Sayer, 2002).

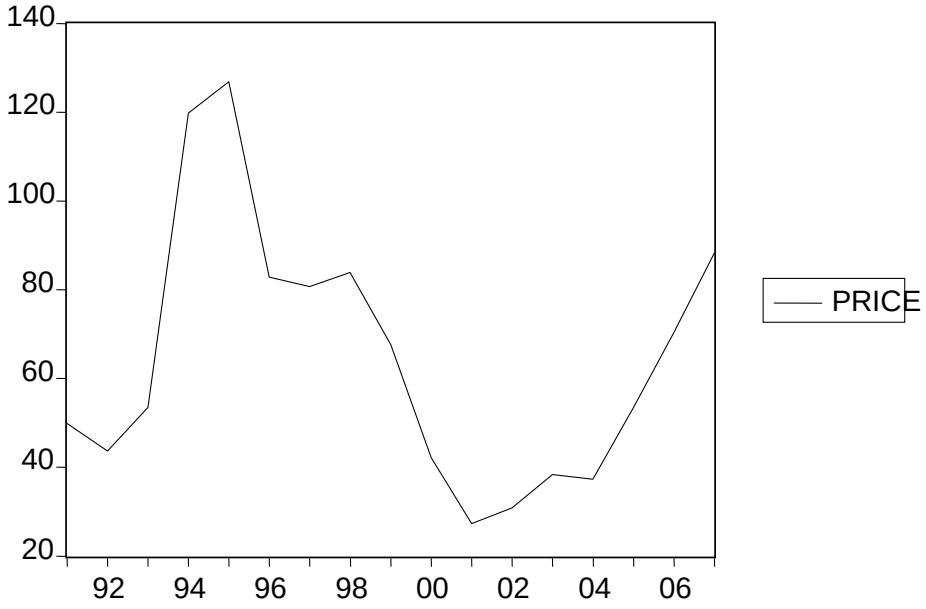
After the coffee (Robusta and Arabica) has been graded by the exporters, it is bagged ready for export. The coffee is now attached prices, which may be declared ex-Kampala (for: free on rail) or may include transport cost to port Mombasa or Dar es Salaam (fob: free on boat). Transport to the port is usually arranged by the export company in the country, but BCU leaves it to the overseas importer to arrange transport from its gate. Coffee is now sold by auction at the Uganda commodity exchange (UCDA, 2007).

2.5 Market destinations for coffee

Much of Uganda's coffee exports are destined to the European Union, Sudan, United States of American (USA), Switzerland, Japan, Australia, among others. Uganda has slightly over 83 percent of her coffee market in the European Union. Sudan comes in second, taking at over nine percent of Uganda's coffee exports (UCDA, 2007).

There have been no controls in the global coffee trade since 1989 when the buffer stock system run by the International Coffee Agreement broke down. As a result the international coffee prices started a gradual and continuous decline. The main reason for this was the gradual and steady increase in coffee production in the world; particularly the new coffee exporting nations entering the international market for instance Vietnam. This meant that the global coffee production grew faster than the demand leading to large surpluses.

Figure 2.2: Trends in World Coffee Price US cents per Pound 1991-2007



Source: International Monetary Fund, 2010.

From 1997 through 2001, the average price of coffee collapsed or reduced from $180 cents per pound to less than $40 cents per pound. Prices remained low until 2004 when they started to increase, but still remained well below the levels witnessed in the mid 1990s (UCDA, 2007).

2.6 Source of funds

It is difficult for coffee exporting firms to raise financial requirements by themselves. However, borrowing from Ugandan banks is almost difficult with interest rates of over 20 percent per annum. Because of this, Ugandan exporting companies like BCU depend upon pre-financed contracts or deals with overseas importers (traders and roasters) for cash to buy the coffee. These include Select Services (Switzerland), Louis Dreyfus, Drucafé, Teo UK, Utaka and Bumei from

Japan, Iconacafé from Spain and Remixl from Russia. On the other hand, the big international exporters have ready access to cheap capital from their parent companies at home (Sayer, 2002).

Following negotiations with Allied bank, a low cost inventory credit facility was sanctioned. This is meant to benefit farmer groups depositing five metric tones of coffee. The price or interest rate required is two percent per annum and it is available to any farmer group that presents a warehouse receipt to the bank (UCDA, 2007).

2.7 Conclusion

The coffee sub-sector contributes immensely to Uganda's export sector and the economy as a whole. Although its share in total exports has been declining over time, it is still the number one export item, contributing more than 19.8 percent of the total revenue in 2007. The price of coffee on the international market has been declining and this affects the revenue since revenue is a product of price and quantity. Uganda is a small producer and can not influence price. So, to increase revenue Uganda must improve on volume of exports. The contribution of coffee to the export sector and the whole economy can not be underestimated.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

This section reviews both theoretical underpinnings and the empirical work that has been undertaken on the factors determining the performance of exports. This literature includes; small farmers participation in export promotion, impact of liberalization on key markets in Sub-Saharan Africa, Uganda trade policy and export performance, monetary and exchange rate policy, Uganda coffee supply response and export demand and supply response of selected commodities in Uganda.

3.2 The theory behind production and export of commodities

The policy of openness to the external world, more specifically the impact of international trade on the development process has increasingly become popular. This has led to numerous theoretical studies. Although the direction of causality between economic growth and export earnings remains controversial, there is a relatively strong positive correlation between exports and real income growth across the Sub-Saharan countries (Svedberg, 1991).

The Heckscher-Ohlin version of international trade theory; the mutual interdependence theory, attempts to assess the basic cause of trade by putting emphasis on commerce between regions. The theory states that a region tends to export items the production of which requires relatively large amounts of the factors of production that the region possesses in relative abundance. It imports items which embody the scarce factors of production. The relative differences in factor

endowment among regions result in variations in international costs and thus provide a basis for trade between areas (Salvatore 1993).

According to Wakelin (1998) ‘neo-endowment’ models, export performance is determined by the firms' competitive advantage based on factor endowments and, 'technology-based' models in which competitive advantage derives from the quality of firms' products or services. Studies in the neo-endowment tradition argue that factor-based advantages may be important if the firm has either a natural monopoly of a particular factor or is, for example, located in a particular region where a factor is plentiful.

According to Branchi, et al. (1999) these effects may be magnified by the existence of a set of productive techniques, the most advanced of which require a certain non-labour investment and some additional skills on the part of the producer, as well as a suitable market, infrastructure, and technological and informational environment, and hence are not available altogether in the more backward areas and countries.

The price of the commodity that influences the producers’ decision to increase or decrease their supply is the real price they receive, that is the purchasing power that can be obtained by the sale of one unit of coffee (World Bank, 1994). The real producer price (RPP) is got by multiplying the real international price (pb), real exchange rate (RER) and the nominal protection coefficient (NPC). According to the small country assumption, pb (the ratio of the nominal international price of coffee over the world price index) can be taken as exogenously given.

Edwards (1989) contends that the RER reflects the average competitiveness of the country vis-à-vis the rest of the world. Any rise in the value of RER corresponds to a real depreciation of the domestic currency. Under the absence of supply constraints, this improvement in the country's competitiveness tends to translate into an increase in the supply of all exportable commodities, including coffee.

RER and NPC are key indicators of the impact of the economic policy pursued by the national governments in the realm of prices. NPC can be considered as an indicator of the influence of direct, sectoral price policies, and RER as an indicator of the indirect effect of the exchange rate policy, which is passed down to farmers through its impact on the real producer price (World Bank, 1994).

According to Ackah and Morrissey (2005), factors external to an individual country, such as world prices are typically more important determinants of the volume and value of exports than a country's own trade policies. This is because small country producers have no capacity to determine these prices on their own.

Price volatility together with rigidities of production and the consequent distribution of costs, make it extremely difficult for producers and policy-makers alike to determine optimal production strategies. Meanwhile, fiscal uncertainty at the local and national levels places a significant constraint on the generation of a stable economic base for development. World Bank (1984) noted that in most cases, governments widely intervened in markets and maintained a fixed exchange rate to acquire political support. However, the low producer prices and overvalued exchange rates led to under production for markets and withdrawal from industrial

production by manufacturers. In most cases the over valued exchange rates resulted into deterioration in agriculture and external accounts of African countries.

Cushman (1986) shows that an increase in exchange rate volatility has adverse effects on the volume of international trade, by increasing the riskiness of trading activity. Viaene and de Vries (1992) and Franke (1991) have demonstrated that increased exchange rate volatility can have ambiguous effects (negative or positive) on the volume of trade. They go on to say that an increase in risk has both a substitution and an income effect. The substitution effect decreases export activities as an increase in exchange rate risk induces agents to shift from risky export activities to less risky ones. The income effect on the other hand induces a shift of resources into the export sector when the expected utility of export revenues declines as a result of the increase in exchange rate risk.

Barkoulas et al. (2002) noted that the direction and magnitude of importers' and exporters' optimal trading activities depend upon the source of the uncertainty (general microstructure shocks, fundamental factors driving the exchange rate processes, or a noisy signal of policy innovations). And that exchange rate uncertainty emanating from general microstructure shocks and fundamental factors reduces the variability of trade flows, while that related to a noisy signal of policy innovation increases variability of trade flows.

Furthermore, the ability of a country to increase exports (its export supply response) is constrained by structural rigidities in production capacity, and infrastructure and institutional barriers to trade (trade costs). This is especially true in SSA, where exports are predominantly of

primary commodities subject to world prices and demand determined elsewhere and, in the case of agriculture, affected by weather and other natural phenomena (Ackah and Morrissey, 2005).

Requirements associated with selling on international markets also present significant barriers to higher revenues for smaller producers. For example, export license, minimum volume and quality requirements can operate as bottlenecks that effectively reduce the ability of producers to reap the benefits of the international trading system. Also, tariffs on processed forms of coffee in importing countries can also have an effect on the revenue captured by producer countries from the supply chain. The imposition of such tariffs effectively restricts producing country access to the higher value added associated with processing activities (United Nations Conference on Trade and Development, 2002).

The above theories explain the different factors that can influence the counties' decisions to produce and export commodities. There are also empirical studies which have been undertaken to investigate the determinants of export supply.

3.3 The empirical evidence

The export supply function is important that numerous empirical studies have focused on this question over a period of time (last two decades or so). Some of the numerous empirical studies that have investigated the determinants of export supply include; small farmers participation in export promotion, impact of liberalization on key markets in Sub-Saharan Africa, Uganda trade policy and export performance, monetary and exchange rate policy, the effects of exchange rate policy on Cameroon's agricultural competitiveness, export performance of Sub-Saharan Africa, among others.

3.3.1 Real exchange rate and export performance

Jebuni, et al. (1991) did a study on exchange rate policy and macroeconomic performance in Ghana. The elasticity of the real exchange rate was found be positive and significant (0.2552). From this, they contend that, apart from the real income effect, the supply of exports is positively related to the relative price of tradables to non-tradables (P_T/P_N). Fosu (1992) express this term as the aggregate agricultural export price relative to the aggregate food price (P_A/P_F). The real exchange rate measures the substitution effect of producing exports. The greater the ratio P_T/P_N the more tradables a country will produce and the lower the ratio, the less the tradables a country will produce as compared to non-tradables.

Kasekende and Ssemogerere (1994) investigated the role of exchange rate policy in export performance in Uganda. The study took center stage on the impact of devaluation as a form of exchange rate reform. Results showed that the elasticity of total export supply re-switching from a unit change in the real exchange rate was inelastic (0.28). This implies that a one percent increase (devaluation) in the exchange rate increases exports by only 0.28 percent.

Cline (2004) in his study used pooled data for over 100 developing countries for the period 1981-2001. He ran an Ordinary Least Squares regression and his results showed that real exchange rate has a significant effect (7.76) on export growth. This means that a depreciation of the real exchange rate greatly increases export growth. According to Njuguna, et al. (2002) in their analysis of Kenya's export performance, the supply response to price incentive (real exchange rate depreciation) for exports of goods and services is significant. This means that the depreciation of exchange rate increases the export of goods and services.

According to Edwards and Alves (2006), the exchange rate has a strong impact on manufacturing export performance in South Africa. This is shown by the positive and significant coefficient (2.33) in the long-run and (0.99) in the short-run) on the relative price variable (the real effective exchange rate) in the reduced form results. A one percent increase in the relative price of exports is estimated to raise average manufacturing export volumes by 0.99 percent to 2.33 percent in the long-run. The very elastic response of export volumes to changes in relative prices found in these estimates, suggests that much of the improvement in export performance during the 1990s can be attributed to the real depreciation of the currency during this period.

Yusuf and Edom (2007) analyzed the factors influencing the exports of timber in Nigeria with the aid of Error Correction Model (ECM) representation procedures. The analysis was carried out with the data collected on round wood and sawn wood over 33 years (1970 – 2003) using the long run restricted ECM. The study proved the lagged values of the official exchange rate to be one of the most important factors determining the quantities of export of sawn wood from Nigeria. Amin (1996) estimated the effects of exchange rate policies on Cameroon's agricultural export competitiveness. His estimates show that a 10 percent depreciation of real exchange rate stimulates about one percent increase in cocoa.

Rudaheranwa, et al. (2003), in their study of supply response of selected export commodities in Uganda, got the following elasticity 0.09 for maize and beans, 0.67 for cotton and tobacco and 0.03 for coffee and tea. The results confirmed that the inelastic nature of Uganda's agricultural commodities renders the exchange rate depreciation ineffective in terms of improving the competitiveness of agricultural products in external markets.

According to Faruk and Yavuz (2007), the real effective exchange rate is statistically significant and negative (-0.333). This means that a one percent increase in real exchange rate reduces export growth by 0.3 percent. This supports the hypothesis that exchange rate policies may not be successful in promoting export growth.

3.3.2 Gross Domestic Product and export performance

Kumar (1992) conducted a study on real effects of exchange risk on international trade and confirmed that GDP has a significant positive effect on volume of exports. Eita (2009) analyzed factors determining export flows between Namibia and its trading partners using a gravity model. The coefficients for Namibia's GDP are positive, that is 2.470 and 3.44 for the pooled model and fixed effects respectively and statistically significant. The results show that an increase in Namibia's GDP causes an increase in Namibia's exports.

Faruk and Yavuz (2007) investigated the determinants of Turkish export-boom in the 2000s using the generalized method of moments (GMM) dynamic panel data technique. They found GDP to have a positive (0.644) and significant effect on Turkey's exports. This means that increasing GDP by one percent increases Turkish exports by 0.6 percent. According to Babatunde (2009a; 2009b), GDP has a positive but not significant impact on export performance, that is 0.052 and 0.013 elasticity of the fixed and random effects respectively. The deduction here is that GDP has a very small effect on exports.

3.3.3 The international price and export performance

Branchi, et al. (1999) analyzed the impact of price variable on coffee production and exports in a selected group of developing countries, with particular focus on a subgroup of Sub-Saharan

countries. They tested the long-run impact of policies on producers' behavior by means of a cross-country linear regression model. About one third of cross-country variability in planted areas is found to be attributable to exchange rate and, to a lesser extent, taxation policies. However, price policies do not appear to exert any significant impact on yields. Edwards and Golub (2004) in their study of export performance of manufacturing sector in South Africa, using time series data got a significant positive coefficient on foreign prices. Foreign prices appear to have a more significant impact with a one percent rise in foreign prices resulting in a positive impact of about 0.5 percent in the short run and 3.2 percent in the long run.

Morrissey and Andrew (2006) analyzed Africa's export performance using estimates of volume of exports, available from UNCTAD, to explain African trade performance. Using a dynamic panel data analysis for 48 African countries over the period 1987-2002, the key determinants of export performance were ascertained. These include; the unit price of exports with elasticity of 0.93, gross fixed capital formation with elasticity of 0.15, foreign direct investment with elasticity of 0.10 and real effective exchange rate with elasticity of 0.02. All these were significant, implying that exports respond to changes in these variables. Their analysis put center stage on the issue of commodity prices. They therefore, concluded that finding a solution for the problem of low commodity prices is thus more urgent than ever.

Maitha (1975) re-estimated the supply response of Kenyan coffee. Using changes in productivity as the dependent variable rather than the acreage. He used an aggregate production function of the constant elasticity of substitution (CES) and a fisher distributed lag to derive his productivity equation. The acreage productivity index was the dependent variable while the lagged price (derived through the fisher distributed lag method) and a time trend were his independent

variables. The results indicated that under the estate, the short-run elasticity was 0.657 and the long-run elasticity was 0.985. This implies that price has a more significant impact with a one percent rise in price resulting in a positive impact of about 0.7 percent in the short run and 0.98 percent in the long run.

Gbetnkom and Sunday (2002) investigated the determinants of three agricultural exports from Cameroon between 1971/72 and 1995/1996. Export supply functions were specified and estimated for the three export crops chosen: cocoa, coffee and banana. Quantitative estimates obtained from the ordinary least squares (OLS) estimation procedure indicate that the response of export supply of all the crops to relative price changes is positive, but fairly significant (elasticity of relative price was 0.14 for cocoa and 0.32 for coffee). This implies that an increase in the relative prices does not lead to a proportionate increase in export supply of agricultural products.

Jebuni, et al. (1991) found the elasticity of the international price to be positive but insignificant (0.1924). This means that, export unit values based on world market prices did not have a significant effect on export volumes. This suggests that in a regulated market system favourable world market prices may not be passed on to the producer.

Mold and Prizzon (2010) show that the performance of export volume is highly ambiguous with respect to price: positive, but not significant. This was based on the price elasticity of 0.09 which was insignificant. This means that a one percent increase in the international price marginally increases exports by about 0.1 percent.

Jaeger (1992) carried out an ambitious econometric study on 21 SSA countries in order to estimate the price responsiveness of total agricultural supply and of a few key crops taken individually. In the case of coffee, he found a positive short-run elasticity of 0.237 for SSA producers as a whole, but almost no significant results when examining each country separately. This implies that a one percentage increase in price leads to 0.2 percent increase in the supply of Sub-Saharan agricultural exports.

In another study (Gabriele, 1994) tried to estimate the price elasticity of traditional primary exports in four Central American countries over the 1960-1990 period. Short-term price elasticity varied between 0.08 and 0.19. This implies that traditional primary exports of Central American countries do not respond highly to changes in price.

3.3.4 Gross capital formation and export performance

Milner and Morrisey (1997) found out that high transport costs in Uganda help to explain why, despite significant trade liberalization, the supply response of most exporters has remained sluggish and limited. Aliguma (2003) noted that marketing of agricultural produce is constrained by inadequacy of physical infrastructure, such as feeder roads, communication facilities, power supply, education and health facilities, water supply and market infrastructure, which are responsible for the high market transaction costs.

Edwards and Alves (2006) in a comparative analysis of South Africa's export structure and performance and an economic investigation of the determinants of export volumes, found out that declining infrastructure (ports, railways and roads), have dampened the response of manufacturing exports to the more favourable trade environment in the 1990s.

Matama and Byarugaba (2007) analyzed the relationship between Uganda's supply side constraints and the performance of exportable products in the global market. Their findings indicate that there is a positive relationship between supply side constraints and the performance of exportable products in the global market. Morrissey and Rudaheranwa (1998) in their study of Ugandan trade policy and export performance in the1990s found out that the real problem facing Uganda is the severe lack of export diversification. They concluded that the principal trade policy reforms have been implemented, and the policy environment is now right for export support, through investment in infrastructure and institutional support.

3.4 Conclusion

The factors under review influence exports in general, and they are most likely to influence the volume of coffee exports in particular. These factors include: the real exchange rate, gross domestic product, the international price of coffee, the real interest rate and gross capital formation.

CHAPTER FOUR

METHODOLOGY

4.1 Data types

Quarterly time series secondary data were used for Real Effective Exchange Rate (REER), Real Interest Rate (RIR), international price of coffee (Px), and quantity of coffee exported (Qs). The base year for data is 2005/2006. Data on Gross Domestic Product (GDP) and Gross capital formation (GCF) is recorded in annual data series, yet the analysis was done using quarterly series. Thus the data for these variables was interpolated into quarterly series using Lisman and Sandee's (1964) method in Feijoo, et al. (2003).

4.2 Data sources

Qs is the dependent variable used and the data was obtained from Uganda Bureau of Statistics Agricultural Statistical Department. GDP, GCF, REER and RIR data was got from World Development Indicators data base, World Bank. The data for Px was obtained from the Energy and Commodities Surveillance Unit of the Research Department, International Monetary Fund's International Statistics.

4.3 Tests and Data Analysis

The time series data was analyzed using Ordinary Least Squares. Unit root tests were conducted using ADF to find out the existence of unit root. The variables were then tested to determine the presence or absence of cointegration. Error Correction Model was used to capture the short run effects. There after a short-run parsimonious model was estimated after isolating the

statistically insignificant variables from the error correction model. This was followed by performing diagnostic tests of serial correlation, stability and heteroskedasticity.

4.4 The model

Coffee export supply refers to how coffee export volumes produced and offered for sale vary as the factors that influence production, supply and export of coffee vary over time. Literature suggests that production and export decisions in the agricultural sector are based on the relative price (real exchange rate), the international price of the crops, gross domestic product, gross capital formation.

The study utilized a model used by Musinguzi et al (2000). International Coffee price, Real interest rate, and Gross capital formation /Gross capital investment were added to Gross Domestic product, Terms of Trade (T.O.T) and Real Effective Exchange Rate (REER) which were used by the trio as the explanatory variables of Export Growth Rate. However, the T.O.T was dropped because both T.O.T and Px are export prices. Hence the inclusion of both would lead to the problem of multicollineality in the model. The coffee export supply function was thus given by the following linear equation.

$$Q_s = \beta_0 + \beta_1 REER + \beta_2 RIR + \beta_3 P_x + \beta_4 GDP + \beta_5 GCF + U_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(1)$$

Where, Q_s = Quantity of coffee exports.

REER = Real exchange rate

RIR = Real Interest rate

Px = International Price of Coffee

GDP = Gross Domestic Product

GCF = Gross capital formation

U_t = Stochastic error term

The REER is defined with respect to Uganda's major trading partners. These include European Union (EU), United States of America (USA), the Sudan, Switzerland and Australia. The REER for a particular time is measured by;

$REER = NEER*P_T/P_N$…….. (2)

Where,

NEER = the nominal effective exchange rate. Real effective exchange rate depreciation leads to increase in real exports, so the expected relationship between REER & Qs is positive. This variable was added because it keeps track of the changes in the Uganda shilling with respect to her trading partners.

The RIR represents the cost of borrowing. It was chosen because the export of coffee requires a lot of money which an average citizen can not manage with own savings without borrowing and insurance. The RIR is computed as follows:

NIR - INF = RIR ……... (3)

Where, NIR = Nominal Interest rate

INF = Inflation rate

RIR = Real Interest rate

It was expected to have a negative relationship with coffee export volumes/quantity, because a rise in RIR leads to decline in coffee export credit.

The quantity of coffee exports supplied is specified as positive function of its own price. Px was added because in studying the coffee supply response, it is vital to understand the movements in the prices of coffee.

GDP is the measure of value of goods and services produced in an economy. It was used as a proxy for supply capacity. Other factors constant, the greater the supply capacity, the faster the growth of the export sector. This is supported by Oyejide (1986) and Eita (2009) who contend that high level of GDP indicates a high level of production in the exporting country which increases the availability of exports. GDP was expected to have a positive relationship with Qs. However, use of GDP is limited by the fact that some components of it (non tradables) do not directly influence coffee export volumes. It would have been better to use investment in the coffee sector but there was difficulty in obtaining data, making it appropriate to use GDP because of its data availability.

GCF was expected to positively affect coffee export supply. Improved infrastructure and institutional support are an important component of export support which reduces the adverse effects of natural barriers. This variable was be added because economic infrastructure such as transport, communication, power, water and sanitation systems provide foundation for economic activity in an economy. Provision of infrastructure also has important consequences for an economy's export performance. This is because it lowers the transaction costs associated with exporting, and facilitates the diversification of export production (Elbadawi, 1999; Collier, 2002).

For econometric analysis (in order to estimate the elasticities directly), equation 1 was written in log form to generate equation 2. The log transformation helps in measuring constant elasticity; that is, it shows that the change in log dependent variable per unit change in log independent variable remains the same no matter at which log independent variable, we measure the elasticity. Log transformation also reduces heteroskedasticity. However, RIR was not log transformed because it contains negative values, yet log of non positive numbers leads to missing data generated.

$$\text{Ln Qs} = \beta_0 + \beta_1 \text{ lnREER} + \beta_2 \text{ RIR} + \beta_3 \text{ lnPx} + \beta_4 \text{ lnGDP} + \beta_5 \text{ lnGCF} + U_t \quad \text{.....(4)}$$

After confirming that the variables were cointegrated, an error correction model which is constructed by including in the model, the lagged terms of the variables and the error correction term was constructed. Based on the theorem developed in Engle and Granger (1987), the existence of a cointegrated relationship among a set of I (1) series implies the following error correction representation of the data:

$$\Delta LQs_t = \alpha_0 + \alpha_1 ECT_{t-1} + \phi_i \sum_{t=0}^{k} \Delta LQs_{t-i} + \beta_i \sum_{t=0}^{k} \Delta LREER_{t-i} + \lambda_i \sum_{t=0}^{k} \Delta RIR_{t-i} + \gamma_i \sum_{t=0}^{k} \Delta LPx_{t-i} +$$

$$\varphi_i \sum_{t=0}^{k} \Delta LGDP_{t-i} + \delta_i \sum_{t=0}^{k} \Delta LGFC_{t-i} + \varepsilon \quad \text{.....(5)}$$

Where ECT_{t-1} is the lagged error correction term of the residual from the cointegrating regression equation. The error correction term, ECT ~*I* (0), captures the adjustment toward the long-run equilibrium. The coefficient α_1 represents the proportion of disequilibrium in coffee exports in one period corrected in the next period.

The above model was estimated using the ordinary least squares (OLS) method. In particular, a multiple regression equation relating quantity of coffee exported and the quantitative factors affecting the performance of the coffee export sector was run and results are presented in section 5.1. There after, diagnostic tests were performed to find out whether the model conformed to classical linear assumptions. Specifically the autocorrelation tests, heteroskedascity test and normality test were carried out respectively.

4.5 Limitations of the study

The data set for GDP and GCF were recorded in annual basis, whereas the analysis was done on quarterly basis. To address this, the geometric means of annual data series were interpolated. Taking geometric means in interpolation of annual series to convert them to quarterly series compromises the reality of the series. However, this problem was not expected to have a significant effect on the analysis.

CHAPTER FIVE

EMPIRICAL RESULTS AND THEIR DISCUSSION

5.1 Empirical results presentation

This section reports the estimates for Uganda's coffee export function. In order to detect the long-run co-movement among the variables included in equation (4), the cointegration procedure developed in Johansen and Juselius (1990) and Johansen (1991) was employed. An error-correction model for the coffee exports was used.

5.1.1 Basic exploratory data analysis

This involved establishing the basic descriptive statistics and the correlation matrix. The descriptive statistics of all the variables in logarithms are displayed in Table 5.1, while the correlation matrix in table 5.2 demonstrates the relationship between quantity of coffee exported (LQs) and the other variables used in the study.

Table 5.1 Descriptive statistics of the series; sample period 1991:1-2007:4

	LQS	LREER	RIR	LPX	LGDP	LGCF
Mean	10.669	4.653	11.253	7.306	28.444	26.932
Median	10.582	4.629	14.065	7.257	28.463	26.958
Maximum	11.676	5.056	27.840	8.272	29.029	27.735
Minimum	10.188	4.411	-22.990	6.631	27.916	26.287
Std. Dev.	0.360	0.173	11.297	0.411	0.328	0.408
Skewness	0.834	0.697	-1.649	0.234	-0.027	0.040
Kurtosis	3.042	2.721	5.188	2.156	1.926	2.309
Jarque-Bera	7.894	5.728	44.385	2.637	3.276	1.368
Probability	0.019	0.057	0.000	0.267	0.194	0.504

The Jarque-Bera tests the hypothesis that the series is normal. Since the Probability value for real effective exchange rate (LREER), international coffee price (LPX), gross domestic product (LGDP) and gross capital formation (LGCF) is greater than five percent significant level, the null can not be rejected meaning the series is normal. However, quantity of coffee (LQS) and real interest rate (RIR) are not normal since the Probability value is less than five percent significant level.

Table 5.2 Correlation matrix

	LQS	LREER	RIR	LPX	LGDP	LGCF
LQS	1.000					
LREER	-0.654	1.000				
RIR	0.396	-0.638	1.000			
LPX	0.090	-0.244	0.287	1.000		
LGDP	0.024	-0.128	0.501	0.454	1.000	
LGCF	0.052	-0.160	0.529	0.559	0.980	1.000

From table 5.2, the quantity of coffee is strongly but negatively correlated with real effective exchange rate. On the other hand the quantity of coffee is positively and weakly correlated with real interest rate, international coffee price, gross domestic product and gross capital formation. Real effective exchange rate is negatively correlated with real interest rate, international coffee price, gross domestic product and gross capital formation. Real interest rate is positively correlated with international coffee price, gross domestic product and gross capital formation. There is a positive correlation between international coffee price and gross domestic product. However, gross domestic product is strongly correlated with gross capital formation. This implies that there is no multicollinearity among the independent variables.

5.1.2 Unit root test results

Unit root tests were carried out using the augmented Dickey-Fuller and Phillips-Perron test statistic. These were carried out to check whether the series were stationary (integrated) or not. This is because standard inference procedures do not apply to regressions which contain an integrated dependent variable or integrated regressors. The test statistics tested the hypothesis that the time series has a unit root against the alternative that there is no unit root. The test statistic values are compared to the critical values at five percent significant level. The test statistic values less than the critical values at five percent level of significance indicate that the series are non-stationary otherwise they are stationary.

Table 5.3 Unit Root tests of the series 1991:1-2007:4

	Variable in level		**Variable in 1st difference**		**Order of integration**
	ADF	**PP**	**ADF**	**PP**	
LQS	0.174 (3)	0.129 (20)	-7.869 (2)	-32.875 (65)	I(1)
LREER	-0.509 (0)	-0.388 (4)	-5.663 (0)	-5.780 (3)	I(1)
RIR	-1.970 (1)	-2.188 (5)	-4.981 (0)	-4.940 (3)	I(0)
LPX	0.783 (0)	0.789 (3)	-8.032 (0)	-8.033 (3)	I(1)
LGDP	-2.398 (1)	-2.096 (5)	-4.067 (0)	-4.060 (3)	I(1)
LGCF	-2.501 (1)	-2.013 (5)	-3.754 (0)	-3.772 (4)	I(1)
Critical value at 5%	**-1.945**	**-1.945**	**-1.945**	**-1.945**	

Note: Lag Length for the Augmented Dickey-Fuller test statistic and Bandwidth for Phillips-Perron test statistic in parentheses.

In the table 5.3, the quantity of coffee, real effective exchange rate, international coffee price, gross domestic product and gross capital formation are non-stationary in levels but become stationary after the first difference. In other words, each of the five variables is integrated of order I (1). On the other hand, real interest rate is stationary in levels (before the first difference). In other words it is integrated of order I (0).

5.1.3 Cointegration tests

Among the variables that are integrated of order I (I), an attempt was made to check whether cointegration holds. The purpose of the cointegration tests was to determine whether a linear combination of a group of non-stationary series is stationary. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. The linear combination of quantity of coffee, real effective exchange rate, international coffee price, gross domestic product and gross capital formation was checked to find out whether the residuals were stationary. The static equation, whose residuals were modeled, tested for stationarity and thereafter formed the error correction term after the first lagging is presented in table 5.4.

Table 5.4 Regression results. Sample: 1991:1- 2007:4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LREER	-1.389	0.202	-6.8765	0.000
LPX	-0.118	0.122	-0.969	0.336
LGDP	-0.590	0.634	-0.930	0.355
LGCF	0.484	0.549	0.883	0.380
C	21.747	4.771	4.557	0.000

The next attempt involved testing the residuals for the order of integration. The application of the Augmented Dickey Fuller and Phillips-Perron test statistics revealed that the residuals are stationary in levels (table 5.5). This confirmed that the linear combination of quantity of coffee, real effective exchange rate, international coffee price, gross domestic product and gross capital formation is indeed stationary.

Table 5.5 Testing residuals for cointegration

	Augmented Dickey-Fuller	Phillips-Perron	Order of integration
Residuals	-6.849 (0)	-6.831 (4)	I (0)
Critical value at 5%	**-1.945**	**-1.945**	

Note: Lag Length for the Augmented Dickey-Fuller test statistic and Bandwidth for Phillips-Perron test statistic in parentheses.

The Johansen procedure was also applied to confirm a cointegrating relationship for all the variables specified in the model. Table 5.6 reports the results from the Johansen likelihood ratio tests for cointegration. The two common likelihood ratio tests, the trace and maximum eigenvalue (λ-max), were used to determine the number of coitegrating relations in the time series. For the λ-max and trace statistics, the null hypothesis is that there is *r* or fewer cointegrating vectors (H_0: $r = 0$, $r \leq 1$, $r \leq 2$, $r \leq 3$, $r \leq 4$, $r \leq 5$), whereas the alternative hypotheses are *r+1* (H_1: $r = 1$, $r = 2$, $r = 3$, $r = 4$, $r = 5$, $r = 6$) and at least *r+1* (H_1: $r \geq 1$, $r \geq 2$, $r \geq 3$, $r \geq 4$, $r \geq 5$, $r \geq 6$) respectively.

The λ-max results indicate that, the null hypothesis of $r = 0$ (no cointegration) is rejected in favour of the alternative hypothesis $r = 1$. On the other hand, the null hypotheses of $r \leq 1$, $r \leq 2$, $r \leq 3$, $r \leq 4$ and $r \leq 5$ cannot be rejected in favour of the alternative hypotheses of $r = 2$, $r = 3$, $r = 4$, $r = 5$ and $r = 6$ respectively. These results indicate the presence of only one cointegrating relationship.

Table 5.6: Johansen cointegration test results

Hypothesized	**Trace test**			**λ-max test**		
No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Eigenvalue	λ-max test Statistic	0.05 Critical value
None *	0.560	139.935	117.708	0.560	51.738	44.497
At most 1	0.382	88.197	88.803	0.382	30.356	38.331
At most 2	0.310	57.840	63.876	0.310	23.463	32.118
At most 3	0.230	34.376	42.915	0.230	16.546	25.823
At most 4	0.145	17.830	25.872	0.145	9.883	19.387
At most 5	0.118	7.946	12.517	0.118	7.946	12.517

Notes: Trace test indicates 1 cointegrating equation(s) at the 0.05 level

Max-eigenvalue test indicates 1 cointegrating equation(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

Similarly, the trace results indicate the rejection of the null hypothesis of $r = 0$ in favour of $r \geq 1$. Furthermore, the null hypotheses of $r \leq 2$, $r \leq 3$, $r \leq 4$ and $r \leq 5$ cannot be rejected in favour of the alternative hypotheses of $r \geq 2$, $r \geq 3$, $r \geq 4$, $r \geq 5$ and $r \geq 6$ respectively. The trace test results indicate the presence of only one cointegrating relationship. The results from both tests suggest a

long-run equilibrium relationship among coffee exports, real effective exchange rate, real interest rate, international price of coffee, gross domestic product and gross capital formation.

The cointegrating equation, whose coefficients are normalized with respect to the quantity of coffee exports (Qs), together with their respective t-values, is given in table 5.7. The results of this normalization yielded estimates of long-run elasticities.

Results of long-run relationship model are presented in the following regression equation (t-values are in parentheses).

LQS = 0.670 - 7.201 LREER - 0.107 RIR + 0.864 LPX + 43.758 LGDP + 3.745 LGCF

(-6.754) (-6.298) (2.359) (3.596) (1.761)

The real effective exchange rate is negatively related to quantity of coffee and the coefficient is statistically significant. According to the rule of thumb, t-value equal to two or greater than two (absolute value) implies that the variable is statistically significant. This result is consistent with estimates found in other studies such as Rudaheranwa, et al. (2003), but inconsistent with those of Jebuni, et al. (1991) and Cline (2004).

The estimated gross domestic product has the expected positive sign and it is statistically significant. The findings are consistent with those of Musinguzi et al (2000) who are the pioneers of the model adopted for the study, Kumar (1992), Eita (2009) and Faruk and Yavuz (2007). The positive sign of the coefficient for international coffee price and a negative sign for real interest rate were as expected. In addition, the positive sign of the coefficient for gross capital formation

was expected. However, its statistical insignificance does not match any of the empirical findings reviewed in the course of this study.

5.1.4 The short-run model results

Equation (5) was estimated with a general specified lag structure for all the variables in equation (1), a constant term and one-lagged error correction term (Error correction model). The analysis began with five lags of the regression which were reduced basing on the Akaike AIC up to when significant variables were achieved. The estimation results are presented in appendix A. From the error correction model, the statistically insignificant variables were isolated. Another regression was performed to generate a parsimonious model (table 5.8).

Table 5.7: Results of the short-run parsimonious model

Variable	Coefficient	t-Statistic	Prob.
DLQS4	0.314	3.003	0.004
DLREER2	-2.163	-2.406	0.019
DLRIR_3	-0.019	-1.838	0.071
DLPX4	0.788	3.963	0.000
ECT_1	-0.741	-4.718	0.000
C	-0.015	-0.416	0.678
R-squared		0.673	
Adjusted R-squared		0.646	
Durbin-Watson stat		2.181	
F-statistic		9.905	
Prob(F-statistic)		0.000	

5.1.5 Auto correlation test results

This was done to check the classical linear assumption that the errors entering the regression function were random or uncorrelated (Gujarati, 1988). Breusch-Godfrey serial correlation LM

test was performed to establish whether serial correlation existed in the model. The null hypothesis of no serial correlation ($H_{0:}$ No serial correlation), was tested against the alternative hypothesis of serial correlation. The null hypothesis is rejected in favour of the alternative hypothesis if the probability F-statistic of Breusch-Godfrey serial correlation LM test statistic is significant at five percent.

The results from Breusch-Godfrey serial correlation LM test are presented in appendix C. The probability F-statistic of the test (0.096) is statistically insignificant at five percent level. From this result, we fail to reject the null hypothesis and conclude that there is no serial correlation.

The ARCH test was also conducted. The null hypothesis of no serial correlation ($H_{0:}$ No serial correlation), was tested against the alternative hypothesis of serial correlation (H_1: there is serial correlation). The null hypothesis is rejected in favour of the alternative hypothesis if the probability F-statistic of ARCH test is significant at five percent.

The results from ARCH test are presented in appendix D. The probability F-statistic of the test (0.111) is insignificant at five percent level. From this result, we fail to reject the null hypothesis and conclude that there is no serial correlation.

5.1.6 Heteroskedasticity test results

The test was conducted in order to ascertain that the disturbances or errors had the same variances such that the Ordinary Least Squares estimators were efficient or had minimum variance. The White heteroskedasticity test was performed to find out whether heteroskedasticity existed in the model. The null hypothesis of no heteroskedasticity ($H_{0:}$ No heteroskedasticity),

was tested against the alternative hypothesis of heteroskedasticity (H_1: there is heteroskedasticity). The null hypothesis is rejected in favour of the alternative hypothesis if the probability F-statistic of the White heteroskedasticity test statistic is significant at five percent.

The results from White heteroskedasticity test are presented in appendix E. The probability F-statistic of the test (0.054) is insignificant at five percent level. From this result, we fail to reject the null hypothesis and conclude that there is no heteroskedasticity.

5.1.7 Stability test results

This was aimed at testing for specification errors or non-normality which violate the assumption that the disturbances are distributed N (0, I). It tests for the omitted variables (that is; the vector of the regressors does not include all relevant variables), incorrect functional form and the correlation between the dependent and independent variables. Under such specification errors, Ordinary Least Squares estimators would be biased and inconsistent, and conventional inference procedures would be invalidated (Ramsey, 1969).

The Ramsey RESET test was performed to find out the stability of the model. The null hypothesis that the model is stable ($H_{0:}$ Model is stable) was tested against the alternative hypothesis of no stability in the model (H_1: No stability in the model). The null hypothesis is rejected in favour of the alternative hypothesis if the probability F-statistic of the Ramsey RESET test statistic is significant at five percent.

The results from Ramsey RESET test are presented in appendix F. The probability F-statistic of the test (0.089) is insignificant at five percent level. From this result, we fail to reject the null hypothesis and conclude that the model is stable.

5.2 Discussion of the results

A comparison of results in the short-run (Error correction model) and parsimonious regressions indicates an improvement in the F-statistic from 2.598 to 9.906. This implies an increase in the explanatory power of the regression. The short-run parsimonious model fulfills the conditions of non serial correlation, homoskedasticity and no specification errors. The Adjusted R-squared of 0.646 implies that the model captures about 65 percent of the variations in the volume of coffee exports. The probability of the F-statistic is statistically significant at five percent which implies that the model was well specified. The signs of the coefficients of the short-run parsimonious model were as in the theory apriori, except for real effective exchange rate.

The coefficient of real effective exchange rate (-2.163) implies that a one percent increase in real effective exchange rate is likely to cause a decline in the volume of coffee exports by about two percent (in the short-run).The coefficient of real effective exchange rate is negative and statistically significant both in the short-run and the long-run. This is in agreement with the findings of Faruk and Yavuz (2007). However, the result does not conform to the null hypothesis.

The real interest rate coefficient (-0.019) is negative and statistically insignificant and agrees with theory apriori. This implies that a one percent increase in real interest rate is likely to cause about 0.02 percent decline in the volume of coffee exports in the short-run. However, it is

statistically significant in the long-run (-0.107). This implies that a one percent increase in real interest rate reduces coffee export volumes by one percent in the long-run.

Looking at the coefficient of international coffee price (0.789), results indicate that it is positive and statistically significant at five percent level at the fourth lag. This means that a one percent increase in the international price of coffee leads to an increase in volume of coffee exports by about 0.78 percent. The results conform to those of Oyejide (1986) who contend that high and attractive prices are an incentive to producers and exporters to increase the volume agricultural exports in Nigeria.

The coefficient of gross domestic product is positive and statistically significant at five percent in the long-run. This suggests that an increase in gross domestic product leads to increase in coffee exports in the long-run. This is in agreement with Eita (2009) who contends that a high level of gross domestic product indicates a high level of production in the exporting country which increases the availability of exports. However, the coefficient of gross domestic product is statistically insignificant in the short-run.

The coefficient of ECT _1 is negative and statistically significant at five percent level. This further confirms that the variables are cointegrated. The magnitudes of ECT_1 indicate the change in the volume of coffee exports per quarter that is attributed to the disequilibrium between the actual and equilibrium levels. Thus, the coefficient of ECT_1 (-0.741) means that about 74 percent of adjustment occurs in one quarter. In other words, any disequilibrium to the equilibrium coffee export supply function causes the coffee export supply function to return to its equilibrium down wards at a rate of about 74 percent per quarter.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

6.1 Summary of the findings

This section gives a brief report of the findings with regard to the factors determining the export volumes of Uganda's coffee from the first quarter of 1991 to the last quarter of 2007. Based on the econometric analysis, the results show that depreciation of the exchange rate reduces coffee export volumes.

Increase in real interest rate increases the cost of borrowing or loans from commercial banks and other financial institutions. As a result producers and exporters can not raise the financial requirements to increase production and coffee export volumes.

Increase in international coffee price leads to a great increase in coffee export volumes. This is because increase in price acts as an incentive to producers and exporters alike to increase production and exports of coffee.

Increase in gross domestic product expands the supply capacity or level of production in the country which in turn increases coffee export volumes, but the increase is minimal from one quarter to another.

6.2 Conclusions

The empirical results based on cointegration analysis show that the coffee export volumes have a long-run relationship with real effective exchange rate, real interest rate, international coffee

price, gross domestic product and gross capital formation. In other words, there is a long-run equilibrium relationship among these variables.

In establishing a static equation (short-run analysis), gross domestic product and gross capital formation turned out to be statistically insignificant, yet gross domestic product was statistically significant in the long-run relationship model. The deduction is that for Ugandan case, the coffee export supply function responds more effectively to changes in the real effective exchange rate, real interest rate and international coffee price in the short-run.

From the results, it can be concluded that real effective exchange rate depreciation leads to a big reduction in the coffee export volumes while an increase in international coffee price greatly increases coffee export volumes. On the other hand, the increase in real interest rate leads to a small reduction in the coffee export volumes.

6.3 Policy recommendations

The findings of the study lead to the following policy recommendations necessary to ensure steady and sustainable increase in the coffee export volumes. The policy proposals are as follows:

In view of the statistical significance of international coffee price, the exporters should initiate the establishment of agreements with international coffee buyers. This will help in increasing coffee prices thereby encouraging coffee production and increase in coffee export volumes. Also, the exchange rate should not be allowed to depreciate to avoid reduction in coffee export volumes.

A condusive environment should be created in the country to expand gross domestic product (supply capacity) to increase coffee exports. Likewise, interest rate on loans should be reduced to enable producers and exporters to raise the financial requirements to increase out put and exports of coffee.

6.4 Suggestions for further study

It has been found out in this study that the real effective exchange rate, real interest rate, international coffee price and gross domestic product have a greater impact on the volume of coffee exports in the long-run than in the short-run. The researcher could not establish why the Uganda's coffee exports respond more in the long-run to these factors. A study should be done to establish why Uganda's coffee exports are more affected by these factors in the long-run than in the short-run.

Moreover, the researcher only looked at the coffee export supply function. The coffee demand function also need be tackled and then the equilibrium position established by use of simultaneous equations. It is therefore suggested that a future study focuses on this kind of analysis so as to derive improved results.

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Appendix A Error correction model

Dependent Variable: DLQS				
Method: Least Squares				
Date: 08/13/10 Time: 10:17				
Sample (adjusted): 1992Q4 2007Q4				
Included observations: 61 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLQS1	1.611816	0.960790	1.677595	0.1038
DLQS2	1.294046	0.720535	1.795953	0.0826
DLQS3	0.673008	0.499319	1.347850	0.1878
DLQS4	1.159640	0.504289	2.299315	0.0286
DLREER	-1.012432	1.287178	-0.786564	0.4377
DLREER1	3.247590	1.642920	1.976718	0.0573
DLREER2	-3.171886	1.456225	-2.178156	0.0374
DLREER3	1.221967	1.795105	0.680722	0.5013
DLREER4	2.139445	1.918014	1.115448	0.2735
DRIR	-0.028318	0.018140	-1.561107	0.1290
DRIR1	0.031451	0.020337	1.546490	0.1325
DRIR2	-0.001089	0.017302	-0.062914	0.9503
DRIR3	-0.042165	0.019771	-2.132599	0.0413
DRIR4	0.028733	0.020063	1.432135	0.1624
DLPX	0.245934	0.300322	0.818899	0.4193
DLPX1	-0.304650	0.338055	-0.901185	0.3747
DLPX2	-0.132625	0.363579	-0.364776	0.7178
DLPX3	-0.495428	0.329424	-1.503923	0.1431
DLPX4	1.744132	0.498141	3.501282	0.0015
DLGDP	2.887616	13.30636	0.217010	0.8297
DLGDP1	-19.78888	14.97898	-1.321110	0.1965
DLGDP2	4.749890	12.85604	0.369468	0.7144
DLGDP3	7.556555	12.85183	0.587975	0.5609
DLGDP4	-19.89557	15.41838	-1.290380	0.2068
DLGCF	-5.840050	4.069311	-1.435144	0.1616
DLGCF1	4.538425	4.092042	1.109086	0.2762
DLGCF2	2.552973	4.125718	0.618795	0.5407
DLGCF3	3.580458	2.881107	1.242737	0.2236
DLGCF4	-6.367207	4.357190	-1.461311	0.1543
ECT_1	-2.256318	0.955712	-2.360877	0.0249
C	0.434439	0.388374	1.118612	0.2722
R-squared	0.722074	Mean dependent var		0.004746
Adjusted R-squared	0.684149	S.D. dependent var		0.379210
S.E. of regression	0.282721	Akaike info criterion		0.618007
Sum squared resid	2.397940	Schwarz criterion		1.690746
Log likelihood	12.15080	F-statistic		2.598086
Durbin-Watson stat	2.412040	Prob(F-statistic)		0.005439

Appendix B Parsimonious model

Dependent Variable: DLQS				
Method: Least Squares				
Date: 08/13/10 Time: 10:24				
Sample (adjusted): 1992Q4 2007Q4				
Included observations: 61 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLQS4	0.314243	0.104609	3.003972	0.0040
DLREER2	-2.163969	0.899186	-2.406588	0.0195
DLRIR_3	-0.019721	0.010727	-1.838391	0.0714
DLPX4	0.788989	0.199074	3.963289	0.0002
ECT_1	-0.741683	0.157185	-4.718521	0.0000
C	-0.015562	0.037340	-0.416756	0.6785
R-squared	0.673835	Mean dependent var		0.004746
Adjusted R-squared	0.646002	S.D. dependent var		0.379210
S.E. of regression	0.287299	Akaike info criterion		0.436596
Sum squared resid	4.539748	Schwarz criterion		0.644223
Log likelihood	-7.316179	F-statistic		9.905992
Durbin-Watson stat	2.181764	Prob(F-statistic)		0.000001

Appendix C: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	3.022733	Prob. F(4,51)	0.096299
Obs*R-squared	11.69022	Prob. Chi-Square(4)	0.019810

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 08/13/10 Time: 10:55
Sample: 1992Q4 2007Q4
Included observations: 61
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLQS4	0.063323	0.174228	0.363447	0.7178
DLREER2	1.234281	0.962847	1.281908	0.2057
DLRIR_3	0.001693	0.010225	0.165611	0.8691
DLPX4	-0.219828	0.237206	-0.926738	0.3584
ECT_1	0.366012	0.270432	1.353436	0.1819
C	0.013232	0.035197	0.375949	0.7085
RESID(-1)	-0.517717	0.261061	-1.983125	0.0528
RESID(-2)	-0.175026	0.136758	-1.279822	0.2064
RESID(-3)	-0.413728	0.137224	-3.014979	0.0040
RESID(-4)	-0.242093	0.226637	-1.068198	0.2905

R-squared	0.191643	Mean dependent var	-2.73E-18
Adjusted R-squared	0.048992	S.D. dependent var	0.275068
S.E. of regression	0.268245	Akaike info criterion	0.354992
Sum squared resid	3.669737	Schwarz criterion	0.701037
Log likelihood	-0.827261	F-statistic	1.343437
Durbin-Watson stat	1.962688	Prob(F-statistic)	0.238698

Appendix D: ARCH Test:

F-statistic	1.925900	Prob. F(4,52)	0.119961
Obs*R-squared	7.354751	Prob. Chi-Square(4)	0.118287

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/13/10 Time: 10:56
Sample (adjusted): 1993Q4 2007Q4
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.050865	0.023134	2.198752	0.0324
RESID^2(-1)	0.367212	0.138303	2.655126	0.0105
RESID^2(-2)	-0.042804	0.147014	-0.291155	0.7721
RESID^2(-3)	-0.053828	0.147046	-0.366064	0.7158
RESID^2(-4)	0.076045	0.137993	0.551080	0.5839

R-squared	0.129031	Mean dependent var	0.077872
Adjusted R-squared	0.062033	S.D. dependent var	0.128058
S.E. of regression	0.124022	Akaike info criterion	-1.253082
Sum squared resid	0.799838	Schwarz criterion	-1.073867
Log likelihood	40.71284	F-statistic	1.925900
Durbin-Watson stat	1.986793	Prob(F-statistic)	0.119961

Appendix E: White Heteroskedasticity Test:

F-statistic	1.993351	Prob. F(10,50)	0.054029
Obs*R-squared	17.38715	Prob. Chi-Square(10)	0.066224

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/13/10 Time: 11:04
Sample: 1992Q4 2007Q4
Included observations: 61

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.046898	0.024642	1.903156	0.0628
DLQS4	0.085620	0.047593	1.799003	0.0781
DLQS4^2	-0.044618	0.064794	-0.688606	0.4943
DLREER2	0.334414	0.404924	0.825869	0.4128
DLREER2^2	-2.509736	4.976608	-0.504307	0.6163
DLRIR_3	0.006758	0.004795	1.409603	0.1648
DLRIR_3^2	0.000355	0.000658	0.539211	0.5921
DLPX4	0.099404	0.087564	1.135212	0.2617
DLPX4^2	0.055737	0.213947	0.260519	0.7955
ECT_1	-0.075913	0.074992	-1.012291	0.3163
ECT_1^2	0.521783	0.193099	2.702151	0.0094

R-squared	0.285035	Mean dependent var	0.074422
Adjusted R-squared	0.142042	S.D. dependent var	0.124533
S.E. of regression	0.115350	Akaike info criterion	-1.319881
Sum squared resid	0.665285	Schwarz criterion	-0.939232
Log likelihood	51.25637	F-statistic	1.993351
Durbin-Watson stat	1.428069	Prob(F-statistic)	0.054029

Appendix F: Ramsey RESET Test:

F-statistic	2.992879	Prob. F(1,54)	0.089344
Log likelihood ratio	3.290479	Prob. Chi-Square(1)	0.069683

Test Equation:
Dependent Variable: DLQS
Method: Least Squares
Date: 08/13/10 Time: 11:03
Sample: 1992Q4 2007Q4
Included observations: 61

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLQS4	0.372854	0.108205	3.445824	0.0011
DLREER2	-2.044276	0.886030	-2.307231	0.0249
DLRIR_3	-0.021345	0.010580	-2.017563	0.0486
DLPX4	0.961160	0.219429	4.380269	0.0001
ECT_1	-0.800594	0.158123	-5.063104	0.0000
C	-0.063022	0.045805	-1.375855	0.1745
FITTED^2	0.670735	0.387709	1.729994	0.0893

R-squared	0.501466	Mean dependent var	0.004746
Adjusted R-squared	0.446073	S.D. dependent var	0.379210
S.E. of regression	0.282232	Akaike info criterion	0.415441
Sum squared resid	4.301351	Schwarz criterion	0.657672
Log likelihood	-5.670940	F-statistic	9.052919
Durbin-Watson stat	2.140676	Prob(F-statistic)	0.000001

Appendix G: Uganda coffee grades

Robusta

Grading of FAQ (milled green Robusta coffee) sorted coffee by size and weight into the main screen sizes. Moisture content for all grades should be not greater than 12.5 percent.

Screen 18: By weight not less than 92 percent retained by screen 15 (18/64"), with up to eight percent passing through but retained by screen 15 and containing no more than seven percent weight of defective beans.

Screen 17: Newly introduced in 2000/01 to re-screen screen 15 and secure a price premium.

Screen 15 (Standard): By weight not less than 90 percent to be retained screen 15 (15/64"), with up to 10 percent passing through but retained by screen 12 and containing no more than 12 percent weight of defective beans.

Screen 14: Newly introduced in 2000/01 to re-screen screen 12 and secure a price premium.

Screen 12: By weight not less than 85 percent to be retained by screen 12 (12/64") and containing no more than 20 percent by weight of defective beans.

Screen 11.99: Mainly broken pieces or whole small beans passing screen 12 and light beans rejected from the standard grade and free from husks and extraneous matter.

Screen 18.99: Rejects of screen 18 mainly broken pieces, withered of malformed beans, or whole beans hat are lighter than normal screen 18.

Screen 15.99: Rejects of screen 15 mainly broken pieces, withered of malformed beans, or whole beans hat are lighter than normal standard grade.

B.H.P 10.13: Broken Half Pieces and light beans from grades 12, 15, 18.

Bugisu Washed Arabica

All to have moisture content of no more than 12 percent.

Grade AA: By weight not less than 90 percent to be retained by screen 17 (17/64") with up to 10 percent passing through but retained by screen 16 (at least 8 %) and screen 12 (up to 2 %) and containing no more than 10 percent weight of defective beans.

Grade A: By weight not less than 90 percent to be retained by screen 16 (16/64"0 with up to 10 percent passing through but retained by screen 15 (at least 8 %) and screen 12 (up to 2 %) and containing no more than 10 percent weight of defective beans.

Grade PB: Pea-berry of which not less than 85 percent weight shall be retained by screen 15 (15/64") with up to 15 percent passing through but retained by screen 14 (at least 10 %) and screen 12 (up to 5 %) and containing no more than 10 percent weight of defective beans.

Grade B: By weight not less than 90 percent to be retained by screen 15 (15/64") with up to 10 percent passing through but retained by screen 14 (at least 8 %) and screen 12 (up to 2 %) and containing no more than 10 percent weight of defective beans.

Grade C: By weight no less than 80 percent to be retained by screen 14 (14/64") with up to 20 percent passing through but retained by screen 13 (at least 15 %) and screen 12 (up to 5 %).

Grade E: In size larger and heavier than grade AA, composed of two beans which have formed into a single bean. By weight not less than 85 percent to be retained by screen 18 (18/64") with up to 15 percent passing through but retained by screen 16 (at least 10 %) and screen 14 (up to 5 %).

Grade G: Equal to the sample as approved from time to time by the Uganda Coffee Development Authority.

OKORO (West Nile) Washed Arabica:

All to be produced in the districts of Nebbi and Okoro and to have moisture content of no more than 12 percent.

Grade 5 (Pea-berry): By weight over 75 percent of beans to be of pea-berry form and 25 percent to be retained by screen 17, 60 percent by screen 15 and 10 percent by screen 14 with up to five percent weight passing through screen 14 but retained by screen 12.

Grade 10: By weight no more than two percent shall pass through screen 14, but should be retained by screen 12.

Grade 15: Of lower density than grade 10 and containing some broken beans from grade 5 and 10.

Okoro Triage: Mainly broken pieces equal to the samples as approved from time to time by the Uganda Coffee Development Authority.

DRUGAR: Dried Ugandan Arabica

Unwashed beans to have moisture content of no more than 12 percent.

Drugar A: Evaluated at between plus forty and minus thirty on the established chart of values.

Drugar B: Evaluated at between minus 26 and minus 60 on the established chart of values.

Drugar C: Evaluated at minus 61 or below on the established chart of values.

Triage: Mainly broken pieces equal to the samples as approved from time to time by the Uganda Coffee Development Authority.

Mixed Arabica: Both washed and dried Arabica produced in Uganda.

Source: UBOS Agricultural Statistical Department