ECONOMIC EFFECTS OF HORTICULTURE ON INCOME AND INVESTMENT IN KENYA

BY: JOSHUA GITONGA NGARI

C50/P/7634/2003

RESEARCH PAPER PRESENTED TO SCHOOL OF ECONOMICS, UNIVERSITY OF NAIROBI, PURSUANT TO THE FULFILLMENT OF THE AWARD OF MASTER OF ARTS (ECONOMICS) DEGREE

7TH JULY 2006

DECLARATION

This research paper is my original work and has not been submitted for a degree in any other University.

Signed : _____ Date 03/03/06

Mr. J.G. Ngari

This Research paper has been submitted for examination with our approval as University supervisors

Signed : _____ Date 4/03/06

Dr. S.M. Nyandemo

Signed _____ Date 07/7/06

Mr. G.K. Njiru

DEDICATION

To Mum, Dad, Mum Mutugi, Purity, Evans, Mercy, Duncan, Harriet, Peter and Anderson. Having you all brings so much joy to my life. I hope that someday you will remember even this great work done and be an inspiration for you all to achive more through God's help and guidance. God bless you all.

ACKNOWLEDGEMENTS

I take this chance to thank God the Almightly for honouring me with the opportunity, ability and enablement that is necessary to successfully complete my studies. I also wish to acknowledge with much gratitude all the people who facilitated the completion of this task in one way or another.

First, my special thanks to my two supervisors Dr. S M Nyandemo and Mr. G K. Njiru for their selfless and valuable contributions in the way of critique and guidance which were extremelly useful in accomplishing the task of completing this paper I truely appreciate their time and effort

Thanks are also due to Mr Odhiambo for spending time to proof read the various drafts and his honest comments, especially given the fact that he is an economist. Special thanks to Mr Muchai for his guidance towards selecting the great field of economics and Dr. Kiptui for helping in the special areas of econometrics and data analysis Thanks to Mr.E.K Ruteere for typing and printing the various drafts with great speed and efficiency.

I would also like to express my deep gratitude to my employer Charterhouse Bank Kenya Limited for the encouraging training policy which was an inspiration in pursuit of this programme.

Last but not least, great gratitude to my parents especially my father who taught me to believe in myself. For the support from my brothers and sisters, i can only hope that this work will inspire them to greater levels of academic achievement and excellence.

I wish also to express my thanks to all my M.A (2003/04) classmates for their material and moral support however any errors and omissions in this paper are mine. Great thanks to everyone.

TABLE OF CONTENTS

DECLARATION i
DEDICATION ii
ACKNOWLEDGEMENT iii
TABLE OF CONTENTS iv
ABBREVIATIONS AND ACRONYMS v
ABSTRACT vi
CHAPTER ONE: INTRODUCTION 1
1.1 BACKGROUND OF THE STUDY 1
1.2 STATEMENT OF THE PROBLEM 5
1.3 OBJECTIVES OF THE STUDY 7
1.4 JUSTIFICATION OF THE STUDY 7
CHAPTER TWO: LITERATURE REVIEW 8
2.1 THEORETICAL LITERATURE 8
2.2 EMPIRICAL LITERATURE 10
2.3 OVERVIEW OF LITERATURE 15
CHAPTER THREE: METHODOLOGY 17
3.1 EMPIRICAL MODEL 17
3.1.1 The model specification 17
3.2 HYPOTHESIS 18
3.3 ESTIMATION PROCEDURES 18
3.3.1 Univeriate Data Analysis 19
3.3.2 Unit Root Analysis 19
3.3.3 Cointegration Analysis 19
3.4 DATA SOURCES AND TYPES 19
3.4.1 Descriptions of the Variables Used 21
3.4.2 Limitations of the study 22
CHAPTER FOUR: RESEARCH FINDINGS 23
4.1 NORMALITY TESTS 23
4.2 STATIONARITY TEST 24
4.3 UNIT ROOT TEST 24
4.3.1 Augmented Dickey- Fuller (ADF) Test 25
4.4 COINTEGRATION ANALYSIS 27
4.5 DIAGNOSTIC TESTS 28
4.5.1 Jarque-Bera (JB) Residual Normality Test 28
4.5.2 The Whites Heteroscedasticity Test 29
4.6 REGRESSION ANALYSIS 29
4.6.1 Regressing GDP by OLS 30
4.6.2 Regressing INVESTMENT by OLS 32
CHAPTER FIVE: CONCLUSION, POLICY RECOMMENDATIONS AND AREAS OF FURTHER RESEARCH 34
5.1 CONCLUSIONS 34
5.2 POLICY IMPLICATIONS 34
5.3 LIMITATIONS OF THE STUDY AND AREAS OF FURTHER RESEARCH 35
REFERENCES 37
APPENDICES 39

ABBREVIATIONS AND ACRONYMS

CD	-	Cobb Douglas
CES	-	Constant Elasticity of Substitution
COMESA	-	Common Markets for East and Southern Africa
EU	-	European Market
EMS	-	Export Market Share
EAC	-	East Africa Community
EPA's	-	Economic Partnership's Agreement
EPC	-	Export Promotion Council
FDI	-	Foreign Direct Investment
FPEAK	-	Fresh Produce Exporters Association of Kenya
GDP	-	Gross Domestic Product
HCDA	-	Horticultural Crop Development Authority
IGAD		Inter governmental Authority on Development
IGA's	-	Income Generating Activities
KELPHIS	-	Kenya Plant Health Inspectorate Services
KARI	-	Kenya Agricultural Research Institute
KIPPRA	-	Kenya Institute for Public Policy Research and Analysis
KEPLO	-	Kenya Post Lome Trade
KFC	-	Kenya Flower Council
KBS	-	Kenya Bureau of Standards
KIRDI	-	Kenya Industrial Research and Development Institute
LDC	-	Less Developing Countries
SADC	-	Southern African Development Community
TARDA	-	Tana and Athi River Development Authority
UK	-	United Kingdom.

ABSTRACT

This research paper analyses the economic effects of horticulture on income and investment in Kenya over the period 1970-2004. The variables used are government expenditures on horticulture, which is divided into Cut-flower production expenditure, vegetable production expenditure and fruit production expenditures. These are used in this study as the independent variables while the dependent variables are GDP(Income) and the investment, which is both public and private investment aggregated together.

The main objective of the study is to analyze the effects of horticulture on income and investments in Kenya. The specific objectives of the paper are to assess the investment and income growth due to horticultural support and to make policy recommendations on the way forward for horticultural sector in Kenya.

The results show a great variation in horticulture expenditure as measured by cut flower production expenditure, vegetable production expenditure and fruit production expenditure. The explanatory variables (investment and income) are important in explaining the changes in the horticultural production expenditure since they are positively related to the horticulture. The investment and the income (GDP) are thus better explained by horticultural production expenditures of a country.

The study recommends that the ministry of Agriculture should increase the budget in real terms and the bulk of expenditure must be channeled towards the horticulture production so that the country can be able to earn foreign exchange. Greater finances and horticultural resources (including Cut flower production, vegetable production and fruit production) should be directed to areas where the horticulture performs well to improve the potential of the productive services.

CHAPTER ONE: INTRODUCTION.

1.1 BACKGROUND OF THE STUDY

Horticulture is the science and art of gardening and of cultivating fruits, vegetables, flowers, and ornamental plants (Dijkstra, 1997).It generally refers to small-scale gardening, and agriculture to the growing of field crops, usually on a large scale, although the distinction is not always precise (for example, market gardening could be classed either way) A horticultural variety of a plant is one produced under cultivation, as distinguished from the botanical species or varieties, which occur in nature (Jaffee, 1994). Although many horticultural practices are very ancient, comparatively recent knowledge of genetics, plant physiology, biochemistry, ecology, plant pathology, entomology, molecular biology, and soils, and the systematic application of such knowledge to practical use (e g , in plant breeding), has expanded horticulture into an extremely complex science(Kimenye,1995.).

Kenya was made a protectorate of Great Britain in 1895 and a British colony in 1920. Kenya's commercial horticultural production started taking root during this period According to Hill (1956), the Imperial British East African Company was experimenting with temperate fruits and vegetables as early as 1893 In 1901, colonial white settler farmers founded the East African Agricultural and Horticultural Society (presently the Agricultural Society of Kenya). At the same time, Indians recruited to construct the Kenya-Uganda railway had introduced Asian vegetables , which today accounts for about 10% of the total volume of the country's fresh horticultural exports.

In the late 1940s, two British companies built pineapple-canning factories in Kenya to supply the United Kingdom. When they started operations, both factories sourced their raw material from large-scale settler farms (Kimenyi, 1995). In 1954, the Swynnerton Plan called for government assistance to increase the participation of smallholders in the production of cash crops such as coffee

and tea. Part of this plan was to increase the role of smallholders in supplying raw materials to the pineapple processing plants. Smallholders were subsequently provided with planting materials, technical assistance, and a guaranteed market. Early efforts suffered a number of serious problems including under-staffing, production in inappropriate zones, and violence associated with the independence movement. In spite of these problems, smallholders accounted for 75 percent of the supply of pineapples to these factories by the early 1960s (Winter-Nelson, 1995).

The horticulture sub-sector has continued to grow despite the overall decline in economic growth. It is the second foreign exchange earner after tourism and tea making Ksh 28 Billion ($360 million) last year (Tybout, 2001). This is as a result of enhanced participation of the private sector, appropriate government policies offering an enabling environment. Commercial horticulture is dominated by large scale growers, while the majority by volume of exports has declined from about 60% to 50% within the last few years due to technological and financial constraints. This situation has been aggravated by unpredictable weather for the last two years and strict export conditions. Horticultural technologies are dynamic; hence smallholder farmers should be equipped with appropriate technical information and skills for successful integration into commercial horticulture farming.

A wide range of horticultural crops are grown due to the diverse climatic conditions (Mutero and Murray, 1998). The crops include tropical crops – bananas, mangoes, tomatoes, brinjals, French beans, summer flowers; temperate crops – apples, plums, peaches, carrots, kales, cabbages, snow peas greenhouse flowers and crops suited to drier conditions such as local vegetables (amaranthus, cow peas). These crops are grown under both rainfed and irrigated conditions but production is inadequate due to seasonality and unreliability of rainfall.

Only about 20% of the country is arable while the rest is ASAL. The high and medium potential areas are characterized by high population pressure, small land sizes and competition for the limited land resource with other enterprises such as coffee, tea, dairy and food crops (Armar-Klemesu, 2000). This has led to settlement and farming activities in the ASAL which are characterized by high poverty levels, inadequate water for irrigation and intensive livestock production activities.

The yield and quality of horticultural crops especially by smallholder growers are below the expected potential. There is a tremendous potential for improving yields and quality of horticultural crops through irrigation using sustainable irrigation and crop husbandry practices (Pingali and Rosegrant, 1995). Coupled with an efficient marketing system, this will ensure the generation of improved farm incomes, hence, better living standards for farmers. Our major market outlets include the local market, processing and the high value export market. The main export market destination is the European Union (EU) and the Middle East while emerging or new markets like America, Japan and China take relatively smaller quantities of cut flowers, fruits and vegetables (Mbaye and Moustier, 2000).

To achieve greater growth in the horticulture sub-sector, there is need for continued collaboration by all industry stakeholders, and investment in "niche" products, packaging (e.g. prepacks, mixes, salads, fresh cuts) and value adding should be available and accessible to all end users (Maxwell, D. 2001). In addition issues of food hygiene, sanitary and phytosanitary regulations should be strictly observed in addition to maintaining a competitive edge in terms of quality, price and prompt deliveries and shipments. All development partners should therefore strive to network to keep abreast of the changing requirements. They should also adhere to business codes of ethics and codes of conduct in addition to observing due diligence at all levels of production and marketing as required by the consumers.

According to Griliches (1999), like elsewhere in the developing world, horticulture remains the most important sector in the Kenyan economy, contributing approximately 24% of the country's GDP and employing approximately 70% of the national labor force. The sector is also important as a major foreign exchange earner and provides nearly all the food requirements for the country. However, although the sector remains the most important in the Kenyan economy, its contribution to overall GDP has steadily declined over the years. The beneficiaries are the ordinary Kenyans who benefit from the spillover effect of the GDP growth in the whole country. Recent trends in the contribution of the sector to GDP in the last ten years are shown in Table 1

The horticultural sector in Kenya is dichotomized into large and small production systems. Overall, the small-scale sector contributes about 75% of the country's total value of agricultural output and about 85% of the total employment in the agricultural sector. It is estimated that there are about 3 million smallholder farms with an average of about two hectares in the country. Available statistics also show that the small-scale sector accounts for about 70% of the total marketed output and provides most of the employment in the sector (Meeusen, 1990).

Table 1 Agricultural GDP as a share of total GDP (1990-2000)

YEAR	Agricultural GDP $ million	Total GDP $ million	Agriculture's share in GDP %
1990	1,192.04	4,223.63	28.2
1991	1178.93	4311.50	27.3
1992	1134.83	4332.22	26.2
1993	1088.49	4342.79	25.1
1994	1119.29	4474.58	25.0
1995	1173.32	4690.13	25.0
1996	1225.35	4907.59	25.0
1997	1240.05	5022.56	24.7
1998	1256.08	5112.60	24.6
1999	1271.25	5185.10	24.5
2000	1244.80	5172.82	24.0
2001	1259.80	5234.85	24.0

Source: Statistical Abstract, 2002

The mode of production in Kenya's horticulture, like elsewhere in the developing world, differs widely by the kind of system. In the large scale production system, the techniques used are typically capital intensive that is mechanized. These techniques are in most cases inappropriate for the smallholders sector (Winter-Nelson, 1995).Large scale farmers also typically have higher use of inputs, better management skills and higher yields than the small-scale farmers Production in the small-scale sector has historically been characterized by high labor intensity and the use of traditional technologies (e.g. ox-drawn carts), seasonal employment and low use of productivity enhancing inputs such as fertilizers and pesticides. Consequently, productivity in the small-scale sector has not only remained low but also falls far short of the productivity in the large sector (Rae and Josling, 2003)

1.2 STATEMENT OF THE PROBLEM.

This research paper tries to discover the many economic effects that horticulture poses on income and investment in Kenya considering its pervasive impact on poverty levels, income generation and productivity in the household This research reveals how horticulture causes an increase in savings and investment, reduction on poverty levels, creation of more jobs during processing, development of professional skills, proper utilization of arable lands in Kenya, and proper improved health care services

While the agricultural sector performed exceptionally well in the early years of independence, its performance in recent years has been dismal. From an all time high average growth rate of about 6% in the 1962-1972 periods, the sector dramatically declined to below 2% in the 1990s (Barrows 1990) . In the more recent past, the sector actually contracted, recording a rate of -2.4% in the year 2000, down from 1.2% in 1999. The horticultural sector which in intricately linked to the rest of the economy; the performance affects other sectors and over-well being of the country. The poor performance of the agricultural sector, and particularly its declining productivity has been identified as an important determinant of poverty in Kenya.

The improvement of horticultural productivity has attracted the attention of policy makers, researchers and development practitioners in Kenya for two main reasons. First, Kenya relies heavily on agriculture for economic growth, export earnings and employment generation. The agricultural sector employs 70% of the Kenyan labor force, generates 60% of the foreign exchange, provides 75% of raw materials for industry, and provides about 45% of total government revenue. Besides, the sector is the growth engine for the non-agricultural sector with a multiplier effect of about 1.64. Second, indications in Kenya, and in many other sub-Saharan African countries, are that horticulture is becoming progressively productive. A declining trend in both labor and land productivity constitutes a major challenge and portends lower living standards in the farm sector and the rest of the economy.

Many factors have been associated with horticultural productivity and these include quantifiable factors like technical change, relative factor product prices, input use, education, agricultural research and extension, market access and availability of credit. Other factors include weather, farm production policies, land ownership patterns, inadequate involvement of beneficiaries in decision-making, insecurity and the legal and regulatory environment (Regmi and Gehlar, 2001). Many development programs and projects in Kenya have attempted to remove constraints associated with these factors by introducing facilities to provide credit, information, farm inputs, infrastructure, education and marketing networks. The removal of these constraints will result in increased productivity at farm level and an increase in farm incomes. This is important in alleviating poverty, increasing household food security, and stimulating growth in non-farm activities in Kenya. Indeed, declining agricultural productivity has been identified as a major cause of poverty in Kenya. Therefore, as the government implements new horticultural policies and programs aimed at increasing overall productivity, it is important that it access accurate agricultural data and analyses. Poor horticultural data analyses can lead to misallocation of scarce resources and formulation of policies that fail to resolve critical challenges in the sector.

1.3 OBJECTIVES OF THE STUDY.

The main objective of the study is to analyze the effects of horticulture on income and investments in Kenya. The specific objectives of the paper are;

- To assess the investment and income growth due to horticultural support.
- To make policy recommendations on the way forward for horticultural sector in Kenya.

1.4 JUSTIFICATION OF THE STUDY.

For sustainable economic growth, horticultural sector plays a key role in providing a huge foreign exchange. The analyses of this study will provide information that will enable the developed economies to grow under the contributions made by the horticultural sector The sector provides much employment opportunities, enhance rural – urban balance, promote and stimulate off-farm activities in the rural areas, capital formation, incomes for purchasing industrial goods and provide market for the industrial and agricultural output.

According to Barrows (1990), it is true that horticulture is the second foreign earner in Kenya but the sector has a greater potential if proper policies are put in place. An immediate development challenge for Kenya in the face of overall poor economic performance and deepening poverty is to reverse the adverse trends in horticultural growth and agriculture has a whole. Indeed, it in now widely recognized that increasing horticultural productivity is the single change with the greatest direct benefit to the poor, given that 82% of Kenyans live in the rural areas, the majority of whom are poor. This requires an understanding of what propels growth and productivity in Kenyan horticulture.

Jorgenson argues that, the current state of the horticulture sector in Kenya is a product of many factors including the country's colonial history, resource endowments, the prevailing socio-economic environment, regional economic relations and the general policy environment. The major challenge facing the horticulture sector remains that of inability to maintain sustainable level of competitiveness against cheaper imports from more competitive producers from the COMESA regions.

CHAPTER TWO: LITERATURE REVIEW

In this section, we shall review theoretical and empirical literature.

2.1 THEORETICAL LITERATURE

Meensen and Broeck(1990) argued that horticultural production depends on land, labour, capital and management. Inadequate access to any of these will seriously affect horticultural production and productivity. Exploitation of these resources will be determined by the policy and institutional framework that has been put in place. These include policies aimed at ensuring appropriate innovations and providing incentives to investment in all sectors. Policy and legal framework determines the environment in which most stakeholders, especially farmers and traders operate. Through formulation and implementation of various policies, the government can provide various incentives to development. These include conducive macro-economic policies, provision of basic socio-economic infrastructure such as roads, electricity, water, telecommunications, education, health, sporting and entertainment. Good policies can also facilitate existence of appropriate institutional framework.

Ball (1999) noted that as the poverty levels continue to rise, the horticultural sector has progressively been performing well. Policies have been formulated to combat poverty and achieve sustainable high economic growth rate. More often than not, these have not yielded positive results.

Scherr (1999) stated that early poor performance of the horticultural sector had substantially contributed to worsening levels of poverty. So, poverty plays a critical role in agriculture because it compels the poor to concentrate their resources on low-value food crops and or livestock in an attempt to achieve household food self-sufficiency. It also ensures that the poor farmer has no resources to purchase farm inputs, employ labour and irrigate land, among others. In essence, the rural population is caught up in this vicious and spiraling circle of poverty which they are unable to break under the existing circumstances.

Wanzala (2002) put forward that despite the high priority accorded to the horticultural sector, the public resources allocated to horticulture have been progressively falling In 1986 87, for example, horticulture received 11.2 percent of total public expenditure that was highest ever However, the share dropped rapidly to 4.7percent in the year 2000 1 and further to about 4.0percent in2001 2. The ministry of agriculture and rural development received 74 percent of this allocation, leaving the ministry with the remaining 26percent or 1.2 percent of the development estimates.

According to Tybout (2001), horticulture as a sector holds much higher potential in production in Kenya Again, Kenya being not poor in resources and receiving substantial amounts of donor funding stands at a high score. However, these resources have not created any significant impact in the economy due to poor planning, mismanagement and misappropriation. Efforts to set up effective anti-corruption machinery have not yielded fruits. Infact, Kenya is currently among nations with the highest corruption levels in the world.

Jorgenson (2000) say that it is deplorable that many farmers continue to rely on inappropriate technologies, leading to poor yields and low gross margins This has immensely compromised the competitiveness of Kenyan goods in both international and local market. Moreover there seems little effort being directed to developing technologies that are appropriate for women who provide up to 70percent of agricultural labour force. Efforts to reverse this trend will go a long way in mainstreaming gender issues in technology development.

The major constraints facing research include poor research priority due to minimal involvement of stakeholders in research priority setting; low funding, heavy dependence on external funding, weak research extension farmer linkages and inadequate collaboration between researchers (Ebony Consulting International,2001). The theoretical studies define horticulture and its economical effect more rigorously and set precise relationships for evaluating these impacts. Many inputs must be put in place so that productivity in the horticultural sector can be achieved

In fact, horticultural growth has been shown to be a major source of growth of aggregate output (Solow, 1957) and of a agricultural output (Hayami and Ruttan, 1985). The horticultural growth can be in two ways: an increase in use of resources of land, labor, capital and intermediate inputs or through advances in techniques of production through which greater output is achieved through a constant or declining resource base

2.2 EMPIRICAL LITERATURE

According to Wanzala (2002), horticulture contributes in no small measure to the food security of major cities, both as an important component of the urban food system and as a means for vulnerable groups to minimize their food insecurity problems His several studies indicate a considerable degree of self-sufficiency in fresh vegetable and poultry production as well as other animal by-products.

He concurs with the findings of Brown et al (2002) that in Kenya, growth multipliers from horticulture, estimated at 1.64, are higher than those from other sectors (the growth multiplier for manufacturing is estimated at 1.23) Agriculture supplies indirect raw materials to other sectors and can stimulate substantial indirect growth effects in non farm incomes and employment such as processing Jua kali, trade vending, transport, clothing, all of which contribute to poverty reduction. Growth in horticulture is therefore a fundamental component in stimulating broad-based economic growth; poverty reduction and other inter related development objectives. The study observes that large holder horticulture is efficient in terms of its labour absorption capacity and would contribute efficiently to poverty reduction especially in labour abundant poor societies. Strengthening horticulture has substantial potential of addressing problems of hunger and malnutrition

Access to land constitutes a major constraint to horticulture (Maxwell et. al. 1998) The study discovered that most of land farmed in Rift-valley is not owned by the farmers but big companies. Maxwell (1996) asks that if then the urban poor lack effective access to

urban farming land, and then what other strategies do they use to minimize the consequences of food insecurity. Lack of land and alternative economic opportunities oblige farmers who need more land to farm on any land irrespective of its location, distance and size (Benoit 1999)

Studies that have undertaken actual measurements of the relationship between real GDP growth and expenditure in the horticultural sector support the hypothesis that urban agriculture does improve the food security of vulnerable households Maxwell (1998) observed that 95percent of all farming respondents noted that access to food for direct consumption is their primary reason for engaging in agricultural production in the city. About 35percent of households interviewed engage in some form of agricultural production within the city. Commercial production constituted a major part of some sectors of urban agriculture poultry in particular. But by far, the most common activity was staple food production for home consumption

The duality relationship between the production function and the cost function has also been used to estimate effects on income and investments The duality hypothesis stipulates that for every production function, there is a dual cost function relating factor prices to the cost of output. The dual cost function contains all the information that the production function contains (Varian, 1992). Biswanger (1974) has shown the cost function to be more desirable for econometric analysis than the production function for a variety of reasons. First, that by using the cost function approach, the problem of endogeneity in factor levels is eliminated since factor prices and output levels are exogenouws Second, that the cost function approach reduces the problem of mult-collinearity since less multi-collinearity exists among factor prices than quantities.

According to the government of Kenya (1999),the horticultural produce handling facilities being implemented by HCDA is expected to ease some of the problems affecting marketing as a result of inadequate pre- cooling and cold storage facilities in addition to poor post harvest handling The principle objective of this project is to

provide farmers with cold storage, transportation and market outlets for their produce However, the facilities can only benefit a limited number of farmers while the others will continue to rely on existing marketing channels.

The European Union continued to place stringent requirements for export produce and farmers continued to be sensitized or trained on Good Agricultural Practices to maintain the recommended levels of pesticide residues in produce. It is clear that the volume and value of exported fruits decreased by 0.5% and 6.3% respectively during the year, compared to the previous year (Howard, 2003). Pineapples, passion fruits, strawberries, apples, and plums registered a commendable increase in volume and value while avocado, bananas, coconuts, melons, pawpaw, citrus and macademia nuts experienced a drastic decrease in both volume and value of exports. This can be explained by the large volume of mangoes intercepted in various international markets as being below the required sanitary and phyto-sanitary standards and therefore destroyed at the airports without compensation.

Prices of farm inputs continue to be high, thereby hindering most smallholder farmers. Low utilization of inorganic fertilizers and pesticide chemicals was reported. This had the overall effect of low yields and quality of produce. Farmers are resorting to using a combination of organic techniques for plant nutrition, pests and disease control (Varian, 1999). The quality of most seeds is poor in terms of viability. Distribution of farm inputs stockist is also poor in most production areas leading to non-availability. Irrigation technology use was hampered by high capital investment, operational and maintainance costs. In addition, smallholder farmers have no access to suitable credit facilities. The effects of liberalization, lack of adequate technical and economic information on new varities to ascertain local viability and their performance locally, and competition for farm inputs with other enterprises has a profound effect to their continued utilization.
The quality of vegetable seeds is poor with regard to viability, germination percentage, variety mixing and freedom from diseases while for fruit tree seedlings, lack of high yielding varieties and adequate, clean planting materials is a constraining factor. General shortage of seeds, untimely supply of inputs, lack of adequate disease free fruit tree

provide farmers with cold storage, transportation and market outlets for their produce. However, the facilities can only benefit a limited number of farmers while the others will continue to rely on existing marketing channels.

The European Union continued to place stringent requirements for export produce and farmers continued to be sensitized or trained on Good Agricultural Practices to maintain the recommended levels of pesticide residues in produce. It is clear that the volume and value of exported fruits decreased by 0.5% and 6.3% respectively during the year, compared to the previous year (Howard, 2003). Pineapples, passion fruits, strawberries, apples, and plums registered a commendable increase in volume and value while avocado, bananas, coconuts, melons, pawpaw, citrus and macademia nuts experienced a drastic decrease in both volume and value of exports. This can be explained by the large volume of mangoes intercepted in various international markets as being below the required sanitary and phyto-sanitary standards and therefore destroyed at the airports without compensation.

Prices of farm inputs continue to be high, thereby hindering most smallholder farmers. Low utilization of inorganic fertilizers and pesticide chemicals was reported. This had the overall effect of low yields and quality of produce. Farmers are resorting to using a combination of organic techniques for plant nutrition, pests and disease control (Varian, 1999). The quality of most seeds is poor in terms of viability. Distribution of farm inputs stockist is also poor in most production areas leading to non-availability. Irrigation technology use was hampered by high capital investment, operational and maintainance costs. In addition, smallholder farmers have no access to suitable credit facilities. The effects of liberalization, lack of adequate technical and economic information on new varities to ascertain local viability and their performance locally, and competition for farm inputs with other enterprises has a profound effect to their continued utilization.
The quality of vegetable seeds is poor with regard to viability, germination percentage, variety mixing and freedom from diseases while for fruit tree seedlings, lack of high yielding varieties and adequate, clean planting materials is a constraining factor. General shortage of seeds, untimely supply of inputs, lack of adequate disease free fruit tree

seedlings (passion fruit, macademia, mangoes, pineapples, temperature fruits) is highly noted

According to Jorgenson (2000), high incidence of pests cutworms, aphids, diamondback moth, mites, American bollworm is a issue especially during dry spells. Some of the diseases includes blights and bacterial wilt in tomatoes, black rot in cabbages, fusarium wilt in bananas, citrus greening. Farmers are constrained by inadequate technical knowledge regarding pest and diseases identification and control using integrated pest management (IPM) strategies to reduce the need for chemical sprays (Tybout,2001). Currently, there is growing consumer awareness to the harmful effects of pesticide residues in produce which may impact negatively on farmers using excessive or wrong products for crop protection without adhering to indicated pre-harvest intervals especially in export produce.

According to Economic Commission of East Africa (2002), the major problem for smallholder growers of cut flowers and other horticultural produce where middlemen exploited farmers especially in export oriented crops French beans, Asian vegetables, snow peas and produce for local market due to unreliable market outlets The problem is aggravated by lack of produce cold storage facilities and poor post harvest handling techniques. However, the completion of satellite depots and the Nairobi Horticultural Centre through the Horticultural Produce Handling Facilities Project implemented by HCDA is expected to alleviate this problem to a certain extent

Livingstone and Barrows (1999) argued that Poor road infrastructure has continued to contribute to high post harvest losses for horticultural produce The damage to our road by the heavy weather phenomenon in the last years which has resulted to higher transportation costs of produce. Some production areas are not accessible since the buyers don't want to risk taking their vehicles to those areas due to the high vehicle maintenance and repair costs This also affects availability of farm inputs provided by buyers to their contracted farmers

According to Grossman (1995), commercial horticulture continued to be constrained by inadequate technical information and skills with the extension staff and farmers especially smallholders who are not able to source information. The extension services are also constrained by other logistical support problems – inadequate staff, mobility and financial resources. This made it difficult to impart adequate knowledge and skills to farmers. The reduced level of funding for horticulture extension activities also led to adequate training to update horticulture extension staff on the dynamic horticulture technologies

The floriculture industry has been recording the highest growth in volume and value cut flowers exported every year (10,946 tons to 52,299 tons in 2003) due to the high returns in investments (Harrylyshyn, 1997). According to the Kenya Flower Council, Kenya is currently the leading exporter of the cut flowers to the EU. It contributes 25% of all flower sales followed by Columbia with 17% and Israel 16%. The main markets are Holland, Germany and UK. It is estimated that about 500,000 peopl (including 50,000 flower farm workers) depends on the flower industry. There are approximately 70 flower growers (excluding the small holders) mainly in Naivasha, Thika and Limuru. The production areas are in Rift valley province – Kericho, Trans Nzoia, Uasin Gishu, Nandi, Kajiado and Nakuru; Central province – Nyandarua, Kiambu, Muranga, Maragua and Thika; Eastern province – Machakos, Meru Central and Embu. In Embu, Kirin Agrobio grows mainly asters and chrysanthemum cuttings for export to Europe, US, Japan and South Africa. Main cut flowers grown are roses, statice, carnations, alstroemeria, eryngiums, solidago, chrysanthemums, arabicums, cut foliage and a range of summer flowers.

Ngeno et.al.(2003),argued that despite the constraints affecting floriculture, the industry has continued to attract investors due to the high level of cut flowers. Large and small scale growers have high management standards and invest heavily on technical skills. They utilize a high level of technology, for example, greenhouses, net shading, pre-cooling and cold storage facilities, drip irrigation, artificial lighting to increase day

length, grading/ packaging sheds, refrigerated trucks. The cost of acquiring planting materials through importation is limiting new farmers In addition, for varieties protected by Breeder's Rights legislation, farmers are required to pay royalty. On the other hand, the administration of Breeder's Rights allows the growers to access the most recent selections of varieties bred by breeders internationally

Owuor (1999) argued that most smallholder growers export their flowers through large and medium scale exporters but the flowers have to meet export quality standards. The smallholders also target local market outlets – hotels, offices and social functions In Nyandarua district, smallholder farmers market their cut flowers through the North and South Kinangop Flower Growers Associations. The decline in economic growth continues its toll on some medium scale growers requiring to service bank loans In addition, competition in market outlets abroad and the stringent quality regulations emanating from the European Union continues to hamper the industry

According to Livingstone (1999) the main importing countries for Kenyan fresh horticultural produce in 1999 were United Kingdom (49.1%), France (10.5%), Belgium (5.7%), West Germany (19.1%), and Switzerland (3.8%). Tropical fruits exported from Kenya include pineapples, mangoes and avocadoes and had an export volume of 3,846 tons in 1999 earning Kf 1.08million. The main off-season vegetables exported to those countries are French beans, courgettes and capsicums. French beans had a total volume of 4964 tons in 1999 earning Kf 2 5million. Vegetables of Asian origin which are mainly exported to UK had an approximate export volume of 5500tons earning Kf 1.6million Cut flowers including carnations, roses, alstroemeria, molucella and statice exported in 1999 reached a quantity of 3,788 tons and earned kf 4.9million (Howard 2003).

2.3 OVERVIEW OF LITERATURE.

Most of the literature reviewed on the role of horticulture in enhancing economic growth particularly Tybout (2001), Wanzala (2002), Brown et al (2002) reveal the overall relationship of income and investment. Policy and legal framework has been noted as possibly one way to reveal the extent of poverty levels in the country In his study, we

observe that good horticultural production can only be achieved if there is enough land for cultivation, skilled and unskilled labour force, capital and good management. We observe that with increasing levels of unemployment and landlessness, the poor resort to increased land clearing which lead to poorer performance of the horticultural sector hence contributing to higher levels of poverty.

Barrows (1998) strongly states that a tendency exists to underestimate the importance of non-marketed food production in Kenyan horticulture, and to over-emphasize that of cash crops (S Makings 1996). According to Havrylyshyn (1997), there are different reasons for horticultural failure in most parts of the country, some of which include drought levels, pests, late planting, using poor quality seeds but through knowing the seasons of the market and proper planning date and schedules, they can help avoid low crop yield in different seasons.

The weakness of other studies is that they did not concentrate on Governments may also tend to assumed either that subsistence output is adequate or that little scope exists for raising productivity in subsistence food production. In fact, the provision of food for families own consumption is frequently inadequate, and in sufficient to prevent the widespread malnutrition Increases in food production may permit increases in cash crop production or permit the benefit from export crops to be realized.

CHAPTER THREE: METHODOLOGY

3.1 EMPIRICAL MODEL

Horticulture is divided into fruits production, vegetable production and cut flower production. In this study, there are two dependent variables namely income and investments. The study therefore seeks to analyze the effects of horticulture (Expenditure on fruits production, Expenditure on vegetable production and Expenditure on cut flower production) on investment and income separately. Two equations with each dependent variable were therefore estimated. National income is assumed a function of expenditures fruits production, vegetable production and cut flower production. An investment is assumed a function of expenditures on fruits production, vegetable production and cut flower production

3.1.1 The model specification

The model can therefore be specified with two dependent variables as shown

$NI = F(VG_t, FRT_t, CTFL_t)$ 1

$INV = F(VG_t, FRT_t, CTFL_t)$ 2

Where:

NI - This is National income

INV-This is the investment measured by the GDP growth.

VG_t -Vegetable production expenditure

FRT_t = Fruit production expenditure

$CTFL_t$ – Cut flower production expenditure

Taking natural logarithms (Ln) on both sides, we have a double log equation of function 2 and 3 as follows:

$LnNi = \delta_0 - \delta_1 Ln\,VG_t + \delta_2 LnFRT_t + \delta_3 LnCTFL_t + U_t$ 3

$LnInv = \alpha_0 + \alpha_1 LnVG_t + \alpha_2 LnFRT_t + \alpha_3 Ln\ CTFL_t + E_t$.....4

Where

δ , α are the parameters to be estimated.

U_t and E_t are the error terms.

3.2 HYPOTHESIS

The hypothesis can be formulated as follows:

Null Hypothesis H_0: $\alpha_i = 0$ Horticulture expenditureare not related to income or investment.

Alternative Hypothesis H_1:$\alpha_i \neq 0$ Horticulture expenditures are related to income or investment

The relationship between explanatory and dependent variables are expected to have the following signs

Table 2: Expected signs of explanatory variables

Dependent Variables	Explanatory Variables	Expected signs
Log National income	Log Vegetable expenditure	+
	Log Fruit expenditure	+
	Log Fruit expenditure	+
Log Investment	Log Vegetable expenditure	+
	Log Fruit expenditure	+
	Log Fruit expenditure	+

Source: Authors own hypothesis

3.3 ESTIMATION PROCEDURES

The log-log regression analysis will be applied on time series data. The two equations with national income and investment as dependent variables will be estimated by OLS separately. Each dependent variable is regressed separately with the same explanatory variables to determine its outcome. The econometric package that will be used is E views In the analysis all, the independent variables are regressed on each of the dependent variables.

3.3.1 Univeriate Data Analysis

The univeriate data analysis is done with the aim of identifying data points that are potentially difficult However, the test for normality is done to ensure that the series follow a normal distribution

3.3.2 Unit Root Analysis

The unit root analysis was done on each of the variables to ensure that they are stationary The main methods used to analyze the unit root tests were the Dickey Fuller test and the Augmented Dickey Fuller test (Engle and Granger, 1987). This is because regression with non-stationary variables increases the chances for spurious regression (Green, 2003).

3.3.3 Cointegration Analysis

The model was subjected to cointegration analysis to ensure that there is a stable long-term relationship between the explained variable and the regressors This test is necessary to guard against the loss of information relating to possible long-term relationship in a model specified in first differences Testing for cointegration involves using the Engle-Granger (1987) two-step procedure due to its simplicity. Other cointegration tests procedures exist which are infact superior to the Engle-Granger approach but are normally applied in the VAR models The long run relationship among the level of variables is restated through the Error Correction Mechanism. In testing for cointegration, this study used the Engle and Granger DF and ADF Approach of the cointegration. An error correction mechanism is necessary to ensure a systematic disequilibrium adjustment processes through which the dependent and explanatory variables are prevented from shifting away from their mean values

3.4 DATA SOURCES AND TYPES

This study mainly uses secondary time series annual data covering the period 1970-2004 Most of the data will be collected from the GOK official documents such as Economic Surveys and Statistical abstracts The data in the analysis of effects of horticulture in Kenya vary widely by source and quality. The study has used three types of data: macro, meso and micro Macro and meso data are mainly obtained from the Ministry of agriculture. The central bureau of statistics and the department of resource surveys and

remote sensing have also been important sources of data used in the horticultural analysis. Macro and meso data in Kenya suffers from many problems which include:

- The real economic effects can not be obtained by physical measurement but by estimations done by field extension staff. The data may not be very accurate and could underestimate or overestimate actual results
- The macro data, which is compiled from various parts of the country, is highly inaccurate as is plagued with arithmetic errors and lack uniformity in the reporting system.
- The data is highly disaggregated and does not differentiate the policy relevant groups of producers, for example large and small farmers. Part of this deficiency is attributed to the dwindling capacity of central bureau of statistics in data collection due to serious financial constraints. Conclusions based on this kind of data should therefore be interpreted with caution.

Micro data collected by individual researchers are good especially if they are by multiple interview surveys. This is because the data can be as detailed as desired and can capture key determinants of the economic effect. This will however depend on whether farmers have the information. Where single interviews are used, long recalls to obtain household input and production data or information on farmers' knowledge, attitudes and practice are necessary. This is a potential cause of inaccuracy. The loss of inaccuracy in the data collected through single visit surveys should be weighted against the benefit of rapid analysis and reporting. There is also the issue of costs in terms of time and financial resources. Such costs should clearly be weighed against the alternatives.

Most studies in Kenya have used micro data collected by individual researchers. In certain cases, for example the study by Everson (1998) micro data collected by the central bureau of statistics is used. Compared to macro data, micro data sets are the best source of information for analyzing horticulture at the firm-level and can greatly improve estimates of horticultural productivity especially where micro data is missing (Kelly et al, 1995). A major weakness of micro data collected by the CBS is that it is collected on the basis of the NASSEP II frame which excludes some regions. As such, this data is not

comprehensive. The methodology used by CBS does not in any way apportion areas in mixed crop cases.

To bridge the gaps of horticultural production analysis in Africa, Kelly et al (1995) have proposed a number of measures. Among these is the need to use both micro and macro data in a complimentary manner. The authors have recommended the cross-fertilization of detailed micro studies and broad macro data collection and reporting efforts. Such an initiative is already underway in KIPPRA and should provide a sound basis for the surveillance of the country's agricultural production situation. Other sources of data could include: government annual reports made by provincial and district heads in the ministries of agriculture, planning and development, information from the recent trade seminars and use of the internet facility.

3.4.1 Descriptions of the Variables Used.

Investment- This is the use of resources for the purpose of making more resources, to gain income or increase capital. It can also be defined as Money spent now in order to make the economy grow and have more money-or goods and services-later. In this study, the investment is aggregated into public and private investment. Public investnet is the investment done by the government while private investment is the investment done by private individuals.

National Income- This is the measure of the money value of goods and services available to a nation from economic activity or income generated by a country's production, and therefore the total income of its factors of production. NI is the same as GDP. This study is all about how horticultural production has affected the countries GDP.

Expenditure on Vegetable Products-A Vegetable is a nutritional and culinary term denoting any part of a plant that is commonly consumed by humans as food, but is not regarded as a culinary fruit, nut, herb, spice, or grain. The most widespread vegetables are broad beans, leeks, lentils and chick peas, lettuces, cabbages, cress and mallows. Others are garlic, carrots, chicory, garlic, mushrooms, turnips, beets, parsnips, peas,

marrows, sorrel, pumpkins, cucumbers and radishes Beans, olives, and peas were grown in Italia In this, study the expenditure on vegetable products by horticultural firms.

Expenditure on Fruit Products- In botany, a fruit is the ripened ovary, together with its seeds, of a flowering plant. In cuisine, when discussing fruit as food, the term usually refers to just those plant fruits that are sweet and fleshy, examples of which would include plum, apple and orange. However, a great many common vegetables, as well as nuts and grains, are the fruit of the plants they come from

Expenditure on Cut flower Products- This is part of the agricultural sector and engages in growing flowers or foliage for cutting and display or growing flowers for seed collection This typically includes traditional flowers (roses, carnations and chrysanthemums); other exotic flowers; wildflowers or Australian native flowers; and flower seed growing

3.4.2 Limitations of the study

Data collection and measurement may sometimes not be accurate, it is likely that measurement errors will be obtained in the national account data used in this study. The limitation is availability of data. This is because Central Bureau of Statistics renews the data entry system but they never incorporate the earlier periods. The availability and the quality of data are the main constraints of the study. This is because secondary data will used.

CHAPTER FOUR: RESEARCH FINDINGS

This chapter analyses the regression results of the study. The tests that are carried out before the actual regression analyses are normality tests, stationarity tests and Cointegration analysis.

4.1 NORMALITY TESTS

This test is done to ensure that the variables used in the analysis are normally distributed. The common test for normality is the Jarque-Bera statistics test (Jarque, 1980). This test utilizes the mean based coefficient of skewness and kurtosis to check the normality of all the variables used. A normal distribution is assumed by many statistical procedures. Normal distributions take the form of a symmetric bell-shaped curve.

Table 3: Normality test results analysis of Jarque Bera tests

	LNCUTFE	LNFRTE	LNGDP	LNINVEST	LNVGE
Mean	21.85701	19.76925	25.10609	23.58511	21.47748
Median	21.90543	19.75547	25.17569	23.97168	21.35362
Maximum	23.41738	21.16282	25.53251	25.58317	23.05007
Minimum	20.70933	18.39475	24.51640	17.61492	20.34202
Std. Dev.	0.815343	1.006613	0.345932	2.031111	0.792005
Skewness	0.128575	0.016793	-0.363420	-1.155780	0.202745
Kurtosis	1.708718	1.411610	1.700251	3.656411	1.764647
Jarque-Bera	**2.528072**	**3.680995**	**3.234063**	**8.420688**	**2.465343**
Probability	**0.282511**	**0.158738**	**0.198487**	**0.014841**	**0.291513**
Observations	35	35	35	35	35

Source: E-views computation

Normality test uses the null hypothesis of normality against the alternative hypothesis of non-normality. If the probability value is less than the Jacque Bera chi-square at the 5% level of significance, the null hypothesis of the regression is not rejected. From the table 3, all the variables are normally distributed since all the probabilities are less than the Jarque Bera chi-square distribution.

4.2 STATIONARITY TEST

Stationarity means that the statistical properties of the process do not change over time (Engle, 1987). If the non-stationary time series data is used, it may lead to conclusion whose validity is questionable.

Time series data regression analysis is not complete unless stationary data is used. It is therefore important to test whether the data used is stationary or not. Most time series data used is non-stationary as indicated in the Appendices 1. This can be done by differencing to eliminate non-stationarity. Non-stationary series is integrated of order >1. Stationary series on the other hand is intergraded of order I (0). If I (>1), it can be differenced to obtain an I (0) series which is a stationary series.

Based on the graphs and Unit Root Test in Appendix 2, it can be seen that all the variables used are stationary after differencing. A unit root test has therefore to be conducted.

4.3 UNIT ROOT TEST

The unit root test indicates whether the variables are stationary or not. In carrying out a unit root test, a random walk model is used (Green, 2003). This variable assumes the same value as in the last period, modified by the current period shocks. The current period is analyzed by the past period plus a certain unpredictable value as indicated in equation 1.

$Y_t = \alpha Y_{t-1} + \varepsilon_t$ 1

Where, Y_t is the current period, Y_{t-1} is the past period and ε_t are shocks to the system and assumed to be the white noise with zero mean ,constant variance and non-autocorrelated and α is the coefficient of the past values and is the one used to measure the stationary

The null hypothesis: H_0:$\alpha>0$ Non Stationary (Unit Root Presence)

Alternative hypothesis: H_1: $\alpha<1$ Stationarity (No unit root)

Rejecting the null hypothesis would mean that the series is stationary and vice versa. My study uses Augmented Dickey-Fuller Test (ADF) to test for unit roots.

4.3.1 Augmented Dickey- Fuller (ADF) Test

The ADF test was specified by (Granger and Engle, 1987). The ADF test was performed by introducing lags of the dependent variables. To avoid spurious regression, the non-stationary variables are differenced to remove any stochastic trends in the series

The ADF test takes care of the intercept . The test is based on the following equation Y_t

$=\alpha_0+ \alpha_1 Y_{t-1}+ \varepsilon_t$ 2

Equating equation 2 and 3 we have $Y_t =\alpha_0- (\alpha_1-1) Y_{t-1}+ \varepsilon_t$.....3

Now letting $\alpha_1-1=\delta$.

The null hypothesis occurs when $\delta<0$ and Y_t is a non-stationary series. Under alternatives hypothesis, $\delta=0$.The t-statistic is the compared with t-critical. If t- calculated is less than t-critical, then reject the null hypothesis of non-stationery and accept that the series are stationary.

Table 4: The Unit Root Test using ADF

VARIABLE	ADF STATISTIC	5% CRIRICAL VALUE	NATURE
$LnVG_F$	-0.520515	-3.5468	NON-STATIONARY
$LnFRT_t$	-0.788344	-3.5468	NON-STATIONARY
Ln $CTFL_t$	-1.680898	-3.5468	NON-STATIONARY
Lninv	-2.400792	-3.5468	NON-STATIONARY
LnNi	0.262710	-3.5468	NON-STATIONARY

The result in table 4 shows that the variables are non-stationary because the ADF t-statistics is greater than the ADF t-critical at 5% level of significance. The variables are then differenced and subjected to the same tests. The results of the differenced ones are presented in the table 5. The graphs and the unit root test of these non-stationary series are shown in Appendix 2(a) and (b)

Table 5: Unit Root Test after Differencing (ADF)

VARIABLE	ADF STATISTIC	5% CRIRICAL VALUE	NATURE
$LnVG_t$	-6.075660	-2.9558	STATIONARY
$LnFRT_t$	-5.629972	-2.9558	STATIONARY
Ln $CTFL_t$	-3.135902	-2.9558	STATIONARY
Lninv	-12.02327	-2.9558	STATIONARY
LnNt	-5.190554	-2.9558	STATIONARY

The results from table 5 shows that the ADF t- statistics is less than the t critical and therefore we reject the null hypothesis of non-stationary and accept that the series are stationary. The first differencing of all variables is therefore stationary which implies

that these variables are integrated of order one. I(1) The graphs and the unit root test of these stationary series are shown in Appendix 3(a) and (b).

4.4 COINTEGRATION ANALYSIS

This analysis combines both short-run and the long run properties and at the same time maintains stationarity in all the variables. Such an analysis tests the existence of long run relationship between an independent variable and its explanatory variable. If two or more variables are integrated of the same order and their differences have no clear tendency to increase or decrease then this will suggest that their differences are stationary. Thus if non stationary series have a long run relationship they will be stationary. If the linear combination of the residual from the variables is integrated of order zero I(0),then this will be a case of cointegration (Green, 2003).

This study makes use of Engle-Granger procedure based on the Equation 1.

$Y_t = \alpha + \Phi X_t + U_t$ ..... (1)

Where Φ is the cointegrating coefficient, which must be tested prior to testing for a unit root in the error correction model

H_0: No Cointegration.....Non-Stationarity

H_1: Cointegration.....Stationarity

Test on stationarity is done on residuals. In this case, we first get the static equations of the variables in levels then we generate the residuals. If the residuals are stationary, then the two series are cointegrated. The Engle-Granger cointegration test results are at the Appendix 4.From the results ADF t-statistic is less than ADF t-critical value at 5% level of significance and therefore we reject the null hypothesis of no cointegration. Based on the results we can conclude that there is cointegration between the variables since both

the residuals of differenced LNGDP and differenced LNINVEST are stationary. These results suggest that an Error Correction Model (ECM) will provide a better fit than one without the error correction variable (Green, 2003).

4.5 DIAGNOSTIC TESTS

Diagnostic Tests are necessary to indicate whether the models are consistent or not. The following diagnostic tests are carried out in the analysis.

4.5.1 Jarque-Bera (JB) Residual Normality Test

This test is done to test for normality of the residuals. It focuses on the distribution of the first four moments (mean, standard deviation, skewness and kurtosis in addition to the minimum and the maximum values) of the series. The difference is distributed as chi-square distribution. This is then compared to the standard normal distribution. Since the error, terms explain the dependent variables, the normality tests are carried out on the dependent variables, which in this study are LNGDP and LNINVEST.

Table 6: Jarque Bera Test for Normality on the Residuals

	RESDLNGDP	RESDLNINVEST
Mean	1.63E-18	3.76E-17
Median	-0.001401	-0.037309
Maximum	0.051383	7.039252
Minimum	-0.038425	-7.083519
Std. Dev.	0.021238	1.763702
Skewness	0.385488	-0.022867
Kurtosis	2.540578	16.05877
Jarque-Bera	1.141084	241.5891
Probability	0.565219	0.000000

The results in table 6 indicate that the probability values of both the residuals are less than the Jarque Bera chi-square statitistics and therefore the residuals are normally distributed at 5% significant level (Jarque, 1980). The conclusion is that the error term is normally distributed

4.5.2 The Whites Heteroscedasticity Test

This is a test for heteroskedasticity in the residuals from a least squares regression (Green, 2003) Ordinary least squares estimates are consistent in the presence heteroskedasticity, but the conventional computed standard errors are no longer valid. White's test is a test of the null hypothesis of no heteroskedasticity against heteroskedasticity.The probability value of the F-statistic is then used in the analysis If the probability value is less than 0.05, reject the null hypothesis The results on the heteroscedasticity test are in Appendix 5. Since all the p-values of both the residuals are greater than 0.05, Heteroskedasticity is not a serious problem.

4.6 REGRESSION ANALYSIS

The data analysis is done using the Autoregressive Distributed Lag (ADL) model. Both the dependent and additional predictors (variables) have been lagged in this model The study makes the use of ADL (1, 1) model in that the dependent variable and the independent variables have been lagged once (Green, 2003)

$$Lninv = \alpha_0 + \alpha_1 Ln + \alpha_2 Ln + \alpha_3 Ln + E_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

4.6.1 Regressing GDP by OLS

Dependent Variable: DLNGDP

Method: Least Squares

Date: 12/30/05 Time: 11:20

Sample(adjusted): 1972 2004

Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.003817	0.016083	4.237336	0.0144
DLNGDP_1	0.253971	0.408036	3.073186	0.0052
DLNCUTFE	0.057031	0.083365	6.684109	0.0015
DLNFRTE	-0.029938	0.096831	-0.309179	0.7599
DLNCUTFE_1	0.015221	0.096847	3.157167	0.0264
DLNFRTE_1	0.040088	0.102877	0.389666	0.7002
DLNVGE	0.005122	1.096517	3.053069	0.0381
DLNVGE_1	0.086225	4.108896	0.791808	0.0436
RESDLNGDP_1	-0.641153	0.439899	2.457500	0.0079
R-squared	0.751672	Mean dependent var		0.029981
Adjusted R-squared	0.602229	S.D. dependent var		0.024114
S.E. of regression	0.018644	Akaike info criterion		-4.899631
Sum squared resid	0.008342	Schwarz criterion		-4.491493
Log likelihood	89.84392	F-statistic		3.691527
Durbin-Watson stat	1.668870	Prob(F-statistic)		0.006098

Gross domestic product was modeled using the ECM (RESDLNGDP_1). The variables were differenced and lagged to eliminate the non-stationarity problem. The residual (RESDLNEE) was generated and found to be stationary and hence cointegrated.

The results show that most of the coefficients had the expected signs as expected. The Durbin Watson statistics is 1.668870, which is closer to two signifying that there is no serial correlation among the residuals. The p-value of the constant, the differenced lagged exogenous variables and the original variables are significant except for the differenced

previous period of fruit production expenditure and the current period fruit production expenditure. The p-value is said to be significant if it is less or equal to 0.05, otherwise not significant. Some of the coefficients such as the current expenditure on fruit production and the error correction term (RESDLNGDP_1) are not matching with their expected signs

The R^2 is 0.751672 showing that the explanatory variables have a higher explanatory power of the variations in GDP (NI). The explanatory variables explain about 75 percent of the changes in the dependent variable. The results can be interpreted to mean that the changes in level of GDP depends on the extent of horticultural production variations. Since most of the coefficients of horticultural expenditures have positive signs it can be interpreted that an increase in horticultural expenditures leads to an increase. The lagged previous period GDP(DLNGDP_1), the current period cut flower expenditure (DLNCUTFE), the lagged previous period cut flower expenditure(DLNCUTFE_1), the lagged previous and the current period vegetable production expenditure(DLNVGE_1 have the expected signs and statistically significant at 5% level of significant. This shows how important they are in explaining the level of GDP of the country. However the current period fruit production expenditure (DLNFRTE) and the error correction term (RESDLNGDP_1) have the unexpected signs showing that they would determine the GDP. The probability of F-statistics is 0.006098 , which is clearly below .05 meaning that on average all the coefficients of the variables of the regression analysis are jointly significant at 5 % level of significance and explains the variations in life expectancy. The R^2 (0.751672) is less than the DW (1.668870) signifying that there is no spurious

regression. However if it could have been more than DW it would have signified the presence of spurious regression

This is a clear indication that horticulture expenditure which is composed of expenditure on cut flower production ($CTFL_t$), expendituture on vegetable production (VG_t) and expenditure on fruit production (FRT_t) have a direct positive relationship with on income (GDP) of a country. As expenditure on horticulture increases, the income is expected to increase. As the country spends more on horticulture, the more will be produced and sold to earn foreign exchange and create employment which boosts the GDP in the country

4.6.2 Regressing INVESTMENT by OLS

Dependent Variable DLNINVEST
Method Least Squares
Date 12/30/05 Time 11 23
Sample(adjusted) 1972 2004
Included observations 33 after adjusting endpoints

Variable	Coefficient	Std Error	t Statistic	Prob
C	1 185873	3 359183	2 055333	0 0563
DLNINVEST 1	0.852760	7 798921	0 237566	0 8142
DLNVGE	0 560523	9 411416	5 059558	0 0130
DLNVGE 1	0 356106	1 78791	3 025827	0 0296
DLNCUTFE	0 464836	8 004659	4 058071	0 0542
DLNCUTFE 1	-0.198747	10.04403	-0.019788	0.9844
DLNFRTE	0 784560	8 496312	4 210039	0 0354
DLNFRTE 1	0 046050	5 32971	2 153495	0 0493
RESDLNINVEST 1	-2.327974	7.804817	-0.298274	0.7681
R-squared	0 730945	Mean dependent var		0 168273
Adjusted R squared	0 625406	S D dependent var		1.795339
S.E of regression	1 818002	Akaike info criterion		4 260354
Sum squared resid	79 32317	Schwarz criterion		4 668493
Log likelihood	-61 29584	F-statistic		0 900893
Durbin Watson stat	2 297611	Prob(F-statistic)		0.001421

The value of R^2 is 0 730945 which shows that the explanatory power is about 73% The DW test is 2.297611 which shows no serial correlation of the residuals because it can be approximated to 2. Since R^2 is less than the DW there is no spurious regression suspected

Most of the coefficients in the equation have taken their expected signs that they are positively related to investment expenditure except the lagged previous period expenditure on cut flower production and the error correction term, which do not have the expected signs showing that they influence investment negatively. All the variables in the model are significant except the previous lagged period investment expenditure (DLNINVEST_1) and the lagged previous period expenditure on cut flower production (DLNCUTFE_1) The F-statistic has a significantly low probability value meaning that all the coefficients are on average statistically significant

This is a clear indication that horticulture expenditure which is composed of expenditure on cut flower production (), expendituture on vegetable production () and expenditure on fruit production () have a direct positive relationship with investment. As expenditure on horticulture increases, the investment is expected to increase. As the country spends more on horticulture the more will be produced and sold to earn foreign exchange and create employment, which boosts the investment in the country.

CHAPTER FIVE: CONCLUSION, POLICY RECOMMENDATIONS AND AREAS OF FURTHER RESEARCH

5.1 CONCLUSIONS

The focus of the study was to estimate the economic effects of horticulture on income (GDP) and investment period 1970-2004. The results as indicated in this paper show a great variation in horticulture expenditure as measured by cut flower production expenditure, vegetable production expenditure and fruit production expenditure. The study shows that the explanatory variables (investment and income) are important in explaining the changes in the horticultural production expenditure since they are positively related to the horticulture. The investment and the income (GDP) are thus better explained by horticultural production expenditures of a country

5.2 POLICY IMPLICATIONS

The study has established the significance of horticultural expenditures on the income and investment of the country. This has great policy ramifications, which must be addressed by the agricultural policy makers with a view of improving the horticultural production and boost the GDP (Income) and the investment rate the country. The study recognizes the fact that the declining trend in Agriculture could not only have been caused by inadequate horticulture production expenditures but on such factors as poverty and poor health conditions caused by other factors such as HIV/AIDS. In order to improve the agricultural sector in particular the horticultural sector, the government of Kenya should re-think about the horticulture sector expenditure allocation critically, since some of the policy impact negatively on Agriculture.

In terms of expenditure allocations, the ministry of Agriculture should increase the budget in real terms and bulk of expenditure must be channeled towards the horticulture production so that the country can be able to earn foreign exchange. Greater finances and horticultural resources (including Cut flower production, vegetable production and fruit production) should be directed to areas where the horticulture performs well to improve the potential of the productive services

In the case of education to the farmers, it is true that the knowledge dissemination to farmers on how to deal with horticulture production has not been adequate The quality of education to farmers on the flower and vegetable farms should be intensified in order to achieve the desired production. More resources should be allocated to agricultural extension services to ensure the farmers get adequate knowledge on the production All horticultural farmers should be given equal access to education on crop production by the government. The private sector should also come up with some funds to horticulture to enable them increase their production. The government should stop directing more resources to areas with no direct effect on Agricultural production and especially the horticultural sector. The Government should provide more fertilizers and insecticides to the flower farms to bolster the production process

5.3 LIMITATIONS OF THE STUDY AND AREAS OF FURTHER RESEARCH

Despite the efforts on ensuring the study is complete, it must be conceded that the study has some limitations. Since data collection and measurement may not have been accurate,

it is likely that measurement errors were obtained in the national account and HCDA statistics data used in this study. The major reliable situation as a major limitation is availability of data. It is difficult for the study to make recommendations on this issue because Central Bureau of Statistics renews the data entry system especially on GDP and Investment but they never incorporate the earlier periods. The availability and the quality of data are the main constraints of the study This is because secondary data was used Furthermore, data on Cut flower production, vegetable production and Fruit production variables are not easy to come by because most of them are estimations.

The areas of further research should be to study the economic effects of other sectors on Agriculture such as Dairy husbandry, poultry husbandry, cash crop production and food crop production and test their effect on the income and investment of the country.

REFERENCES.

Armar-Klemesu, M. (2000). Urban agriculture andfood security, nutrition and health. In: N. Bakker,et al. (eds.), Growing cities, growing food: urbanagriculture on the policy agenda. Feldafing:Deutsche Stiftung für Internationale

Barrows, R. and M.Roth (1990)." Land tenure and investment in African agriculture: theory and evidence". Madison; LTC University of Wisconsin.

Ball, V.E, C.A.K Lovell (2000). Incorporating environmental impacts in the measurement of agricultural productivity. School of Economics, University of South Wales, Sydeny.

Clifford M. Mutero and Hammond Murray-Rust, (1998). The changing face of irrigation in Kenya: Opportunities for anticipating change in eastern and southern Africa Colombo, Sri Lanka: International Water Management Institute.

Dijkstra, T. (1997). Trading the Fruits of the Land: Horticultural Marketing Channels in Kenya. Ashgate Press. Aldershot, U K

Ebony Consulting International (2001) "The Kenyan green bean subsector." Report preparedfor the Department for International Development (DfID), Nairobi, Kenya.

Engle, R. F. and C.W.J. Granger (1987), *Cointegration and Error-Correction: Representation, Estimation and Testing. Econometrica*

Greene, E. W. (2003), *Econometric Analysis*, 5th ed., Prentice Hall

Hills, M.F. (1956). Cream Country: The Story of the Kenya Co-operative Creameries Limited KCC, Nairobi

H.W Livingstone (`1999) Economics for eastern Africa" Heinemenn Kenya limited Heinemenn educational books limited, London wc.

Howard W.(2003). "Concepts and perceptions of human well being: Vol 31, No 2 .

Havrylyshyn, O. (1997). "Trade policy and productivity gains in developing countries: Asurvey of the literature."World bank research observer, Vol.5:1-24

Jaffee, S. (1994). "Contract farming in the shadow of competitive markets: The experience ofKenyan horticulture." In Little, P. and M. Watts Living under Contract: ContractFarming and Agrarian Transformation in Sub-Saharan Africa. University of Wisconsin Press. Madison, Wisconsin.

Jarque, C. M. and A. K. Bera. (1980). *Efficient Tests for Normality, Homoskedasticity and Serial Independence of Regression Residuals*, Economic Letters

Jorgenson, D.W and Griliches (2000) "The explanation of productivity change". Review of economics studies, 34(3) (July): 249-282.

Kamau, M. (2000). "The way forward in export oriented small-holder horticulture."Background paper for a Stakeholder Consultation Meeting, Norfolk Hotel, Nairobi.

Kimenye, I. (1995). "Kenya's experience promoting smallholder production of flowers and vegetables for European markets." African Rural and Urban Studies 2 (2-3): 121-141

Meeusen W and J.Van den Broeck (1990). "Efficiency estimation from cobb-Douglas production functions with composed error". International economic review, 18(2): 435-444.

Owuor, J. (1999) Determinants of agricultural productivity in kenya. Kenya agricultural marketing and policy analysis project. Tegemeo Institute Michigan StateUniversity.

Pingali, P., and M. Rosegrant. (1995). Agriculturalcommercialization and diversification:processes and policies. Food Policy 20(3):171–185

Rae, A. and T. Josling. (2003). Processed food trade and developing countries: protection and trade liberalization. Food Policy 28(2):147-166.

Regmi, A. and M. Gehlar. (2001) Consumerpreferences and concerns shape global food trade. Food Review: Global Food Trade24(3):2-8.

Republic of Kenya (2001). Poverty Reduction Stragey Paper. Nairobi: Ministry of Finance and Planning.

Tybout, J.R. (2001). "Linking trade and productivity" New research directions." World bank economic review, 11 (2):151-177

Varian, R.H. (1999). Microeconomic analysis (3rd edition). New York: W.W Norton and company.

Wanzala, M. et al (2002). "Fertiliser markets and agricultural production incentives:Insights from Kenya ." Tegemeo Institute of Agricultural policy and development,working paper No.3.

Winter-Nelson, A. (1995) "A history of agricultural policy in Kenya " In Pearson, S. R, E.

APPENDICES

APPENDIX 1: EXPORT STATISTICS FOR FRESH FRUITS, VEGETABLES AND CUT FLOWERS FROM KENYA BY AIR AND SEA TO ALL COUNTRIES IN 2003/2004.

COMMODITY	VOLUME(KG)	VOLUME(KG)	VALUE (KSH)	VALUE(KSH)
	2003	2004	2003	2004
FRUITS		12,889,807		
Avocadoes	15,372,674	7,081,738	759,578,713	682,745,535
Mangoes	3,166,181	336,461	485,353,365	341,371,410
Pineapples	318,622	1,023,557	23,972,705	33,055,201
Passion fruits	800,022	17,823	102,411,491	161,418,813
Bananas	20,622	43,942	2,754,463	2,094,998
Strawberries	31,759	-	5,667,749	200,556,009
Coconut	394	19,010	23,242	-
Melons	41,012	-	11,641,786	2,163,615
Horned melons	-	5596	-	-
Pawpaws	8,331	99,028	588,888	337,949
Apples	8,391	1,489	1,618,403	7,102,426
Plums	619	62	58,383	162,690
Limes	366	2,879	52,672	7642
Oranges	5,816	2,491	6,516,618	89,915
Other citrus	53,074	916,489	181,866	41,999
Macadamia nuts	2,716,727	81,862	154,628,769	22,977,756
Other fruits	50,845		4,757,285	7,464,078
SUB- TOTAL	22,595,455	22,482,260	1,559,797,598	1,461,600,544

VEGETABLES

Broccoli	-	187,466	-	61,197,457
French beans	15,407,192	19,055,585	4,827,598,808	4,466,737,087
Canned Frozen bean	-	1,576,868	-	18,586,899
Cucumber	-	1,312	-	66,683
NF beans	-	-	-	-
Mixed vegetables.	-	4,708,729	-	2,703,003,219
Runner beans	4,018,035	4,327,553	633,812,405	264,326,765
Snap peas	1,253,076	1,274,525	253,073,020	243,967,603

Snow peas	1,875,544	2,425,107	398,577,619	741,583,795
Peas	1,123,085	-	240,086,578	-
Asparagus	139	10	14,364	2,422
Ravaya	850,839	841,246	112,793,857	132,767,755
Aubergines	416,341	354,457	50,704,043	56,704,520
Capsicums	14,852	377,731	1,066,224	67,601,219
Courgettes	47,319	19,372	12,237,638	5,974,737
Dudhi	137,208	209,272	13,628,228	15,216,807
Guwar	636	1,799	55,976	270,336
Karella	1,267,762	1,352,809	184,222,271	187,465,864
Okra	2,281,137	2,382,309	344,274,278	332,509,121
Valore	209,445	187,237	30,138,592	34,190,202
Baby corn	69,135	81,381	6,412,950	18,651,351
Sweet corn	3,358	6,803	899,875	1,050,490
Beetroot	3,719	21,073	104,524	854,398
Other asian veg.	772,701	1,041,201	100,217,026	169,209,716
Leeks	407,922	666,248	9,686,616	98,028,381
Tropical salads	20,572	54,077	1,174,108	7,846,785
Cabbages	13,670	82,740	1,336,756	3,614,409
Carrots	28,186	23,318	5,271,035	3,178,293
Onions	550,690	723,835	128,612,786	235,558,482
Spinach	4,421	2,634	433,383	701,978
Tomatoes	13,479	33,068	9,332,685	2,036,022
Other vegetables	3,130,674	1,949,916	549,700,101	372,246,882
SUB- TOTAL	33,921,137	43,969,681	7,914,664,946	10,245,150,000

HERBS/SPICES

Chillies	818,950	622,377	112,809,132	74,018,078
Celery	2,175	1,171	102,491	69,567
Ginger	339	190	29,736	21,094
Parsely	3,118	2,908	229,495	150,384
Coriander	3,624	33,555	675,949	7,881,817
Curry leaves	20,093	42,293	5,949,449	15,845,949
Others	1,442	10,315	41,601	2,331,242
SUB - TOTAL	849,741	712,809	119,837,853	93,318,131

CUT- FLOWRS

Alstroemeria	723,199	563,786	66,017,882	112,012,575
Carnations (std)	1,240,289	1,130,325	320,374,437	346,515,996
Carnations(spray)	449,253	160,666	112,895,754	32,487,939
Cut foliage	118,656	287,374	23,914,150	106,387,225
Roses	30,252,987	40,412,205	9,270,012,117	9,727,751,684
Ammi majus	59,159	50,372	8,849,960	6,027,291
Lillies	67,697	57,222	12,183,601	9,574,523
Molluccella	46,719	91,816	5,546,083	12,920,837
Papyrus	95,113	161,547	9,319,792	22,501,042
Statice limonoum	1,483,158	1,065,581	272,670,546	200,260,236
Solidago	13,933	5,217	2,449,426	1,931,710
Solidaster	38,553	66,385	7,069,015	11,350,202
Arabicum	141,457	213,093	21,231,140	48,367,334
Bupleurum	68,927	84,803	11,400,440	11,209,482
Eryngium	330,877	488,337	28,084,589	38,758,987
Chrys'm cuttings	817	36,689	145,661	77,672,829
Carthamus	30,423	143,383	3,234,746	11,049,671
Rudbeckia	1,411	1,009	141,521	123,521
Delphinium	100,789	108,629	30,744,584	36,825,228
Gypsophilia	158,289	219,392	29,835,631	56,608,035
Lisianthus	208,753	431,365	33,015,320	240,149,904
Ornighogalum	113,905	123,088	16,126,542	20,322,608
Hypericum	119,230	415,071	44,251,548	121,036,593
Mixed flowers	4,704,565	4,512,682	197,691,970	3,119,718,970
Veronica	483,366	465,348	49,415,641	60,396,167
Zantedeschia/calla	301,667	474,122	43,133,710	268,650,439
Carcitting-unrooted	-	43,437	-	40,747,521
Dried flowers	-	138,530	-	4,754,963
Other flowers	58,818	145,888	7,136,545	54,287,984
SUB- TOTAL	41,396,010	5,687,305,358	10,626,892,350	14,792,400,000
GRAND TOTAL	93,283,196	119,464,112	20,221,189,950	26,592,468,675

Source: HCDA Statistics 2003/2004

Appendix 2: Export Destinations for Kenya's Produce 2004

COMMODITY				
FRUITS	AFRICA	ASIA	EUROPE	AMERICA
	Seychelles	Japan	France	USA
	Reunion	Dubai	Holland	
	South Africa	China	UK	
	Mauritius	Kuwait	Switzerland	
VEGETABLES	AFRICA	ASIA	EUROPE	AMERICA
	Seychelles	Dubai	UK	
	South Africa	UAE	France	
	Mauritius	Saudi Arabia	Holland	
	Djibouti	Bahrain	Germany	
	Others	Others	Others	
CUT FLOWERS	AFRICA	ASIA	EUROPE	AMERICA
	South Africa	UAE	Holland	Canada
	Reunion	Dubai	UK	USA
	Nigeria	Japan	Germany	
	Zimbambwe	Lebanon	Switzerland	
	Others	Others	Others	

APPENDIX 3(A) NONSTATIONARITY – UNIT ROOT TESTS

(i) Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNINVEST)
Method: Least Squares
Date: 12/29/05 Time: 13:38
Sample(adjusted): 1971 2004
Included observations: 34 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INVEST(-1)	-0.281701	0.117337	-2.400792	0.0225
C	-7.43E+09	5.78E+09	-1.284277	0.2088
@TREND(1970)	1.40E+09	5.62E+08	2.483338	0.0186
R-squared	0.168409	Mean dependent var		3.78E+09
Adjusted R-squared	0.114758	S.D. dependent var		1.40E+10
S.E. of regression	1.32E+10	Akaike info criterion		49.53143
Sum squared resid	5.41E+21	Schwarz criterion		49.66810
Log likelihood	-839.0342	F-statistic		3.138980
Durbin-Watson stat	2.176990	Prob(F-statistic)		0.057359
ADF Test Statistic	-2.400792	1% Critical Value*		-4.2505
		5% Critical Value		-3.5468
		10% Critical Value		-3.2056

*MacKinnon critical values for rejection of hypothesis of a unit root

(ii)Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNGDP)
Method: Least Squares
Date: 12/29/05 Time: 13:41
Sample(adjusted): 1971 2004
Included observations: 34 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP(-1)	0.016954	0.064534	0.262710	0.7945
C	-0.370211	1.581144	-0.234141	0.8164
@TREND(1970)	-0.001448	0.002223	-0.651315	0.5196
R-squared	0.135934	Mean dependent var		0.029886
Adjusted R-squared	0.080188	S.D. dependent var		0.023752
S.E. of regression	0.022780	Akaike info criterion		-4.641794
Sum squared resid	0.016086	Schwarz criterion		-4.507116
Log likelihood	81.91050	F-statistic		2.438446
Durbin-Watson stat	0.760350	Prob(F-statistic)		0.103867
ADF Test Statistic	0.262710	1% Critical Value*		-4.2505
		5% Critical Value		-3.5468
		10% Critical Value		-3.2056

*MacKinnon critical values for rejection of hypothesis of a unit root

(iii)Augmented Dickey Fuller Test Equation
Dependent Variable: D(LNCUTFE)
Method: Least Squares
Date: 12/29/05 Time: 13:45
Sample(adjusted) 1971 2004
Included observations: 34 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCUTFE(-1)	-0.165596	0.104761	-1.580696	0.1241
C	3.427570	2.142537	1.599771	0.1198
@TREND(1970)	0.015080	0.008210	1.836906	0.0758
R-squared	0.185182	Mean dependent var		0.079649
Adjusted R-squared	0.132613	S.D. dependent var		0.063572
S.E. of regression	0.059207	Akaike info criterion		-2.731449
Sum squared resid	0.108670	Schwarz criterion		-2.596770
Log likelihood	49.43463	F-statistic		3.522646
Durbin-Watson stat	0.843290	Prob(F-statistic)		0.041826

ADF Test Statistic	-1.580696	1% Critical Value*	-4.2505
		5% Critical Value	-3.5468
		10% Critical Value	-3.2056

*MacKinnon critical values for rejection of hypothesis of a unit root.

(iv)Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNFRTE)
Method: Least Squares
Date: 12/30/05 Time: 09:47
Sample(adjusted): 1971 2004
Included observations: 34 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNFRTE(-1)	-0.051230	0.064984	-0.788344	0.4365
C	1.005935	1.170308	0.859547	0.3966
@TREND(1970)	0.004828	0.006488	0.744073	0.4624
R-squared	0.020984	Mean dependent var		0.079649
Adjusted R-squared	-0.042178	S.D. dependent var		0.059195
S.E. of regression	0.060430	Akaike info criterion		-2.690560
Sum squared resid	0.113206	Schwarz criterion		-2.555881
Log likelihood	48.73952	F-statistic		0.332230
Durbin-Watson stat	0.546608	Prob(F-statistic)		0.719845
ADF Test Statistic	-0.788344	1% Critical Value*		-4.2505
		5% Critical Value		-3.5468
		10% Critical Value		-3.2056

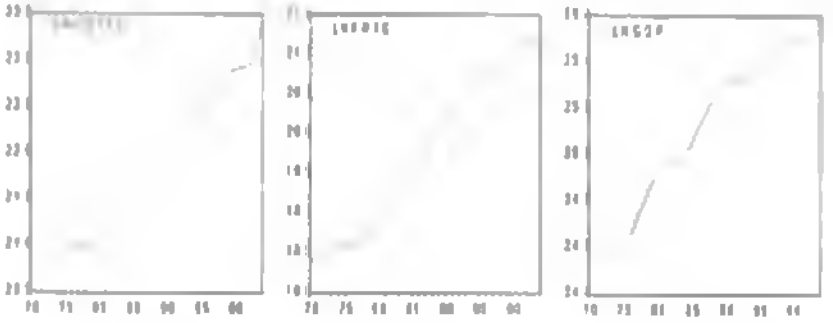
*MacKinnon critical values for rejection of hypothesis of a unit root

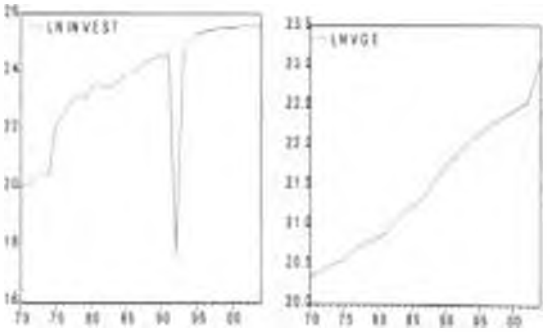
(v) Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNVGE)
Method: Least Squares
Date: 12/30/05 Time: 09:54
Sample(adjusted): 1971 2004
Included observations: 34 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNVGE(-1)	-0.054123	0.103979	-0.520515	0.6064
C	1.127305	2.091391	0.539022	0.5937
@TREND(1970)	0.006415	0.007877	0.814358	0.4217
R-squared	0.208563	Mean dependent var		0.079649
Adjusted R-squared	0.157502	S.D. dependent var		0.051839
S.E. of regression	0.047582	Akaike info criterion		-3.168639
Sum squared resid	0.070185	Schwarz criterion		-3.033960
Log likelihood	56.86686	F-statistic		4.084621
Durbin-Watson stat	0.824963	Prob(F-statistic)		0.026635
ADF Test Statistic	-0.520515	1% Critical Value*		-4.2505
		5% Critical Value		-3.5468
		10% Critical Value		-3.2056

*MacKinnon critical values for rejection of hypothesis of a unit root

APPENDIX 3(B): NON STATIONARITY-GRAPHICAL METHODS





APPENDIX 4(A) STATIONARITY-UNIT ROOT RESULTS

(i) Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DLNCUTFE,2)
Method: Least Squares
Date: 12/30/05 Time: 10:12
Sample(adjusted): 1973 2004
Included observations: 32 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DLNCUTFE(-1))	-0.691095	0.220382	-3.135902	0.0038
C	0.007980	0.009588	0.832322	0.4118
R-squared	0.246872	Mean dependent var		0.005965
Adjusted R-squared	0.221768	S.D. dependent var		0.061345
S.E. of regression	0.054117	Akaike info criterion		-2.934879
Sum squared resid	0.087859	Schwarz criterion		-2.843271
Log likelihood	48.95807	F-statistic		9.833882
Durbin-Watson stat	1.762026	Prob(F-statistic)		0.003818
ADF Test Statistic	-3.135902	1% Critical Value*		-3.6496
		5% Critical Value		-2.9558
		10% Critical Value		-2.6164

*MacKinnon critical values for rejection of hypothesis of a unit root

(ii) Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DLNGDP,2)
Method: Least Squares
Date: 12/30/05 Time: 10:14
Sample(adjusted): 1973 2004
Included observations: 32 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DLNGDP(-1))	-0.945583	0.182174	-5.190554	0.0000
C	-0.000585	0.003532	-0.165572	0.8696
R-squared	0.473147	Mean dependent var		-8.89E-05
Adjusted R-squared	0.455585	S.D. dependent var		0.027068
S.E. of regression	0.019972	Akaike info criterion		-4.928494
Sum squared resid	0.011967	Schwarz criterion		-4.836886
Log likelihood	80.85591	F-statistic		26.94185
Durbin-Watson stat	1.958860	Prob(F-statistic)		0.000014
ADF Test Statistic	-12.02327	1% Critical Value*		-3.6496
		5% Critical Value		-2.9558
		10% Critical Value		-2.6164

*MacKinnon critical values for rejection of hypothesis of a unit root

(iii)Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DLNINVEST,2)
Method: Least Squares
Date: 12/30/05 Time: 10:15
Sample(adjusted): 1973 2004
Included observations: 32 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DLNINVEST(-1))	-1.656101	0.137741	-12.02327	0.0000
C	-0.010370	0.423095	-0.024510	0.9806
R-squared	0.828138	Mean dependent var		-0.010015
Adjusted R-squared	0.822410	S.D. dependent var		5.679411
S.E. of regression	2.393388	Akaike info criterion		4.643758
Sum squared resid	171.8491	Schwarz criterion		4.735367
Log likelihood	-72.30013	F-statistic		144.5590
Durbin-Watson stat	2.630302	Prob(F-statistic)		0.000000
ADF Test Statistic	-6.075660	1% Critical Value*		-3.6496
		5% Critical Value		-2.9558
		10% Critical Value		-2.6164

*MacKinnon critical values for rejection of hypothesis of a unit root

(iv)Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DLNVGE,2)
Method: Least Squares
Date: 12/30/05 Time: 10:16
Sample(adjusted): 1973 2004
Included observations: 32 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DLNVGE(-1))	-1.103227	0.181581	-6.075660	0.0000
C	0.007292	0.007863	0.927395	0.3611
R-squared	0.551661	Mean dependent var		2.03E-05
Adjusted R-squared	0.536716	S.D. dependent var		0.064585
S.E. of regression	0.043960	Akaike info criterion		-3.350610
Sum squared resid	0.057975	Schwarz criterion		-3.259002
Log likelihood	55.60976	F-statistic		36.91365
Durbin-Watson stat	2.006147	Prob(F-statistic)		0.000001
ADF Test Statistic	-5.629972	1% Critical Value*		-3.6496
		5% Critical Value		-2.9558
		10% Critical Value		-2.6164

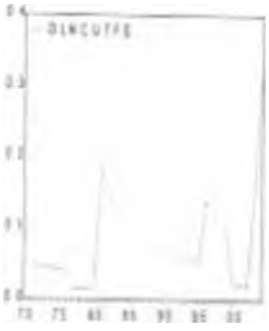
*MacKinnon critical values for rejection of hypothesis of a unit root.

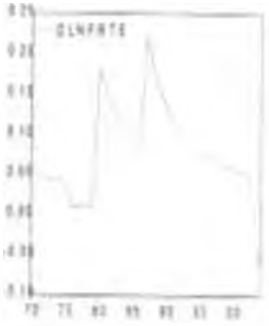
(v)Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DLNFRTE,2)
Method: Least Squares
Date: 12/30/05 Time: 10:30
Sample(adjusted): 1973 2004
Included observations: 32 after adjusting endpoints

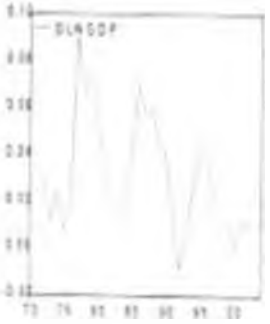
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DLNFRTE(-1))	-1.094601	0.194424	-5.629972	0.0000
C	-0.003553	0.008089	-0.439209	0.6637
R-squared	0.513749	Mean dependent var		-0.002775
Adjusted R-squared	0.497541	S.D. dependent var		0.064548
S.E. of regression	0.045754	Akaike info criterion		-3.270608
Sum squared resid	0.062803	Schwarz criterion		-3.178999
Log likelihood	54.32972	F-statistic		31.69659
Durbin-Watson stat	1.888570	Prob(F-statistic)		0.000004
ADF Test Statistic	-5.629972	1% Critical Value*		-3.6496
		5% Critical Value		-2.9558
		10% Critical Value		-2.6164

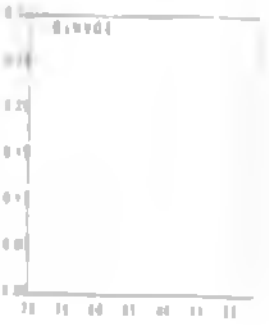
*MacKinnon critical values for rejection of hypothesis of a unit root

APPENDIX 4(B) STATIONARITY TEST -GRAPHICAL









APPENDIX 5: COINTEGRATION TEST USING ENGLE GRANGER

ADF Test Statistic	-5.335471	1% Critical Value*	-3.6496
		5% Critical Value	-2.9558
		10% Critical Value	-2.6164

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESDLNGDP,2)
Method: Least Squares
Date: 12/30/05 Time: 10:47
Sample(adjusted): 1973 2004
Included observations: 32 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RESDLNGDP(-1))	-0.990047	0.185559	-5.335471	0.0000
C	0.000686	0.003633	0.188886	0.8516
R-squared	0.486892	Mean dependent var		0.000525
Adjusted R-squared	0.469789	S.D. dependent var		0.028224
S.E. of regression	0.020552	Akaike info criterion		-4.871273
Sum squared resid	0.012671	Schwarz criterion		-4.779664
Log likelihood	79.94037	F-statistic		28.46725
Durbin-Watson stat	1.930103	Prob(F-statistic)		0.000009

ADF Test Statistic	-12.01108	1% Critical Value*	-3.6496
		5% Critical Value	-2.9558
		10% Critical Value	-2.6164

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESDLNINVEST,2)
Method: Least Squares
Date: 12/30/05 Time: 10:49
Sample(adjusted): 1973 2004
Included observations: 32 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RESDLNINVEST(-1))	-1.655545	0.137835	-12.01108	0.0000
C	0.011661	0.423640	0.027525	0.9782
R-squared	0.827849	Mean dependent var		-0.008628
Adjusted R-squared	0.822111	S.D. dependent var		5.681910
S.E. of regression	2.396453	Akaike info criterion		4.646318
Sum squared resid	172.2896	Schwarz criterion		4.737926
Log likelihood	-72.34108	F-statistic		144.2660
Durbin-Watson stat	2.630714	Prob(F-statistic)		0.000000

APPENDIX 6: WHITES HETEROSCEDATICITY TEST

(A) Resid. invest

White Heteroskedasticity Test:

F-statistic	0.622646	Probability	0.710539
Obs*R-squared	4.132622	Probability	0.658735

Test Equation
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/30/05 Time: 11:08
Sample: 1971 2004
Included observations: 34

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.837392	9.545828	-0.925786	0.3628
DLNCUTFE	-172.2038	139.7337	-1.232371	0.2284
DLNCUTFE^2	603.1983	533.8859	1.129826	0.2685
DLNFRTE	205.7403	172.9274	1.189750	0.2445
DLNFRTE^2	-929.3001	739.7858	-1.256175	0.2198
DLNVGE	220.6628	216.9578	1.017077	0.3181
DLNVGE^2	-617.1718	793.2991	-0.777981	0.4433

R-squared	0.121548	Mean dependent var	3.021050
Adjusted R-squared	0.073664	S.D. dependent var	11.88203
S.E. of regression	12.31190	Akaike info criterion	8.040250
Sum squared resid	4092.736	Schwarz criterion	8.354501
Log likelihood	-129.6843	F-statistic	0.622646
Durbin-Watson stat	1.362182	Prob(F-statistic)	0.710539

(B).Resid. Gdp (NI)

White Heteroskedasticity Test

F-statistic	1 500811	Probability	0.206933
Obs*R-squared	11 03105	Probability	0 199946

Test Equation
Dependent Variable RESID^2
Method Least Squares
Date 12/30/05 Time. 11 10
Sample 1971 2004
Included observations 34

Variable	Coefficient	Std Error	t-Statistic	Prob
C	0 001282	0 000542	2 327895	0 0283
DLNCUTFE	-0 001468	0 007995	-0 183663	0 8558
DLNCUTFE^2	-0 010948	0 030420	-0 359903	0.7219
DLNFRTE	-0.015507	0.009879	-1.569725	0 1291
DLNFRTE^2	0 059199	0 042384	1 396710	0 1748
DLNINVEST	-1 42E-05	6 78E-05	-0 209874	0 8355
DLNINVEST^2	1 71E-05	1 07E-05	1 604968	0.1211
DLNVGE	0 003535	0 012319	0 286934	0 7765
DLNVGE^2	-0.022018	0 044685	-0 492741	0 6265

R-squared	0.324443	Mean dependent var	0 000509
Adjusted R-squared	0 108264	S D dependent var	0 000726
S E of regression	0 000686	Akaike info criterion	-11 51088
Sum squared resid	1 17E-05	Schwarz criterion	-11.10684
Log likelihood	204 6849	F-statistic	1 500811
Durbin-Watson stat	2 260589	Prob(F-statistic)	0 206933