ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY

FACULTY OF BUSSINES AND ECONOMICS

DEPARTMENT OF ECONOMICS

The Nexus between Working Population and Economic Growth in Ethiopia (1981-2013)

BY

GETACHEW SHIFERAW EMRIE

AUGUST, 2015

ADAMA, ETHIOPIA

THE NEXUS BETWEEN WORKING POPULATION AND ECONOMIC GROWTH IN ETHIOPIA (1981-2013)

Thesis Submitted in Partial Fulfillment of the Requirement for the Degree of Masters of Science in Development Economics.

By: Getachew Shiferaw Emrie

Advisor: Solomon Alemu (PhD)

AUGUST, 2015

ADAMA, ETHIOPIA

DEDICATION

I dedicate this thesis to my beloved wife, daughters and son **Kelemework Girmay, Nardos Getachew, Miliete Getachew,Tsigereda Getachew and Henok Getachew** respectively, my brother **Tsegay Shiferaw** , his wife **Tirhas Zenebe** , my friends **Asmamaw Mulusew, Gashaw Tsegaye, Gebretenae Zegeya and Ambachew Tsegaw** for nursing me with affections and love and their dedicated partnership in the success of my life.

Declared by:

Name: Getachew Shiferaw Emrie

Signature: _____

Date: _____

Place: Adama, Ethiopia

As thesis advisor, I hereby certify that I have read and evaluated this research work contribution, under my guidance, by **Getachew Shiferaw Emrie** entitled **"THE NEXUS between WORKING POPULATION AND ECONOMIC GROWTH IN ETHIOPIA (1981-2013)". X** I recommend that it be submitted as fulfilling the thesis requirement.

Solomon Alemu (PhD)_____ _____

Major Advisor **Signature**

SCHOOL OF GRADUATE STUDIES
ADAMA SCINCE AND TECHNOLOGY UNIVERSITY
ADVISSOR'S THESIS SUBMISSION APPROVAL SHEET

As member of board of Examiners of the M.Sc. Thesis Open Defense Examination, we certify that we have read and evaluated the thesis prepared by **Getachew Shiferaw Emrie** and examined the candidate. We recommended that it be accepted as fulfilling the thesis requirements for the degree of masters of Science in Economics major with **Development Economics.**

Chairperson	**Signature**	**Date**
Internal Examiner	**Signature**	**Date**
External Examiner	**Signature**	**Date**

ACKNOWLEDGMENT

I would like to express my depth of appreciation to my honorable adviser Dr. Solomon Alemu; he is the seed bed and garden maker of my academic success, which helped me in completing this study. Successful and timely accomplishment of the study would have been very difficult without his charitable time devotion from the beginning to the end of the thesis and thus I am very much thankful to his enthusiasm and diligent efforts that enabled me to finalize the study.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

ADF	Augmented Dickey Fuller
AGOA	Growth Opportunity Act
COLI	Cost of Living indices
CPI	Consumer price Index
DAG	Development Assistance Group
DF	Dickey Fuller
EDP	Ethiopian Democratic party
EFY	Ethiopian Fiscal Year
GCF	Gross Capital Formation
GGX	Government Total Expenditure
GDP	Gross Domestic Product
GTP	Growth and Transformation Plan
IMF	International Monetary Fund
LISA	List index Summary Analysis
MOFED	Ministry of finance and Economic Development
NBE	National bank of Ethiopia
OLS	Ordinary Least Square
PASDEP	Program for Accelerated & Sustainable Development
PRSP	Poverty Reduction Strategy Paper
SDPRP	Sustainable Development Poverty Reduction Paper
VECM	Vector Error Correction Model
WEO	World Economic Outlook

ABSTRUCT

The Nexus between Population and Real GDP growths is an age old question that remains controversial in the literature. The controversy is on, if population complements or retards economic growth momentums. One spectrum of such a debate is, if the composition of population (as opposed to dynamics in total population) has indeed a varying effect on Real GDP. In lee of this, the paper intends to investigate whether growth in working age population (age 15-64) affects the long and short run trends of GDP growth in Ethiopia. The Johansson Approach of Co-integration is followed, in a Vector Error Correction Framework. Besides, Granger causality test has been conducted to get a sense of causality among variables. Time series data (1981-2013) was obtained from the World Bank's World Development Indicators Database for Real Gross Domestic Product (proxy for economic growth); Working Age Population as share of total population (WAPOPL); Financial Deepening (M2 as percent of GDP), and Openness (total trade share of GDP). Stationary test using Augmented Dicky Fuller test revealed that all variables are non-stationary at their level but all of them become stationary at first difference. Hence variables are integrated of order one I (1) indicating the possibility of long run relationship among them, which was verified by both Trace statistic and Maximum Eigen value of the Johansson Co-integration testing approach. Both trace statistics and maximum Eigen value test reveals that, there is co-integration among the independent (predictable) variables and the dependent variable at 5% level of significance, suggesting that there is co-integrating or (or long run) relationship among them. VECM is found appropriate model to see the short run dynamics. The results revealed existence of both long and short run relationships between composition of WAPOPL and Real GDP growth. Working age population, Money supply, and openness all are found to have a positive and significant effect on the economic growth in the long-run. However, in the short-run the effect of money supply is not statistically significant indicating the fact that the economic effect of money supply on the real GDP is the long run one. The coefficient of error correction term (EC) is -0.667which is highly significant at 1% significance level. This clearly shows that, the speed of adjustment is quit fast with approximately 66.7 percent of its previous period's disequilibrium in the real GDP will be corrected in the next year.

***Key words**: population growth, Economic growth, money supply, openness, Co-integration, Granger Causality, vector error correction model, Stationary, Ethiopia, .*

CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

A high population growth is a growing concern throughout the world and it is a monster that threatens all economies because of its undesirable effect. It remains very important whether there is any causal link between population growth and economic growth, not only for demographers and economists but also for policy makers. However, this relationship has long been contentious. The world's population was about a billion in 1800 and rose to 2.5 billion in 1950 (Martin 2009). In the year 2013 the world's population was 7 billion and is projected to rise to 9.2 billion by 2050 with almost all population growth projected to occur in what are now considered less developed regions. Between 1950 and 2000, when the world's population increased from 2.5 billion to 6.1 billion, the major shifts in population weights by continent were the result of changes in fertility and mortality rather than large-scale migration (Martin, 2009).

According to Population 'revisionist' economists, population growth acts as an indispensable constituent for stimulating economic development because a sizeable population provides the required consumer demand to generate favorable economies of scale in production, lower production costs, and provide a sufficient and low-cost labor supply to achieve higher output levels (Todaro 1995, p. 303). Johnson (1999) pointed out that a high rate of economic growth is associated with high population growth and low economic growth is associated with low population growth.

Between1950- 2001, Pakistan's population increased 430 percent. Multivariate analyses of 1981 to 2005 data from the Pakistan *Economic Survey* and from the International Financial Statistics yearbooks found significant and negative relationship between population growth and measures of economic advancement. These results demonstrate that rapid population growth is a real problem in Pakistan because it contributes to lower investment growth and diminishes the savings rate.

The popular view in the 1960s and 1970sthat fertility decline would slow population growth in developing countries and thus reduce poverty came in for a great deal of criticism in the 1980s, and by the 1990s, it was no longer in vogue. Africa's population is rising rapidly and will most

likely double its population by 2050. This makes it the fastest growing continent and Africa's rapid growth will also shift the global population balance.

By 2050, Africa will be home to more than 20% of the world's population. When some of us were born in 1970, there were two Europeans for every African; by the time we may retire in 2030, there will be two Africans for every European. In recent years an increasing number of African people are being added every year. This was not always the case these population increases are unprecedented in history. But the problem of population is not simply a problem of numbers. It is a problem of human welfare and of development. Rapid population growth can have serious consequences for the well-being of humanity worldwide (OAU & ECA,2005). Many populations in sub-Saharan Africa have grown at rates exceeding 3 percent, with associated doubling times of less than 25 years. According to the UN, for example, Uganda's population in 1950 was about 5 million; in 2005 it is about 29 million; and the medium projection for the year 2050 is about 127 million. The rate of population growth in sub-Saharan Africa rose from 2.8 per cent per annum in 1965-80 to 3% in 1980-93. The latter rate is only marginally higher, by 3.4 per cent, than the rate for North Africa and the Middle East. It is, however, markedly higher by 36.4, 76.5, 42.9 and 500 per cent than the rates for South Asia, East Asia and the Pacific, Latin America and the Caribbean, and the industrialized countries respectively.

Generally, there is no consensus whether population growth is beneficial or detrimental to economic growth in developing economies. Moreover, empirical evidence on the matter for developing economies is relatively limited.

Population problem lies at the heart of Ethiopia's social, economic and political problems. Ethiopia's population is highly diverse. Most of its people speak a Semitic or Cushitic language. The Oromo, Amhara, and Tigreans make up more than three-quarters of the population, but there are more than 77 different ethnic groups with their own distinct languages within Ethiopia. Some of these have as few as 10,000 members. With a total population of 82.8 million in mid-2009*(CSA,2010)*, Ethiopia is the fourteenth most populous country in the world and the second most populous country in Africa, following Nigeria, which has a population of 152.6 million. Ethiopia's population has grown rapidly in recent years and, at an annual growth rate of 2.7%,

the population is expected to reach 113 million by 2025 and 149.5 million by 2050*(UN,2009.)*. Nearly half of the population (49.7%) is female.

Measuring efficiency of population on economic growth of the country has been an interesting query for the researchers, academicians, investors, entrepreneurs, government agencies and dignitaries. Thus, the government of Ethiopia has developed a wide range of policies and programs with the aim of rapid transformation of economic structure on a global scale in the recent past. The Ethiopian economy is crippled by the catastrophic consequence of rising population. This study will reveal an important initiative to determine the significance of the relation between population and economic growth by creating a linkage among them. Having stated the theoretical and empirical studies, the purpose of this paper will be to empirically examine and analyze over time, the relationship between population and economic growth.

1.2. Statement of the Problem

Recent research by economists called Allen Kelley (1988) and Robert Schmidt indicates that during the 1980s population growth, on average, acted as a brake on economic growth as measured by the growth rate of per capita gross domestic product, or GDP (This is a standard measure of a nation's total output of goods and services by residents and domestic business, excluding net income from foreign assets and that paid to foreign creditors.

Results of this extensive analysis suggest that the relationship between population growth and depressed economic performance is strongest among the poorest nations of the developing world, and that the effect on this group extends back through the 1960s and 1970s. The growth of gross domestic product can be constrained by high dependency ratios, which result when rapid population growth produces large proportions of children and youth relative to the labor force. Because governments and families spend far more on children than the children can quickly repay in economic production, especially as modern schooling and health care replaces child labor, economists expect consumption related to children to retard household savings, increase government expenditure and ultimately cut into the growth of GDP.

In many countries experiencing rapidly growing population, and thus growing dependency ratios, the influx of young people into the job market exceeded the jobs created during the 1980s. According to the World Bank Report (2000/01), "in many cases [in the developing world] lots of employment were being created, but not fast enough to match the rapid growth in the labor force.

Despite the logic of this relationship, signs of adverse effects on GDP from population growth did not emerge in multi-country comparisons of population and economic growth during the 1960s or 1970s, except in the poorest of the developing countries. The GDP downturns noted during the 1980s could have been amplified by global debt burden and recession. Or it could represent, at least in part, a delayed effect of the high fertility of these earlier decades. In fact, economists are unsure if the relationship between population and GDP growth that existed in the 1980s is continuing into the 1990s or will continue into the 21st century.

Despite lack of clear evidence for this relationship in previous decades, new data make clear that during the 1980s, on average, population growth dampened the growth of per capita gross domestic product, the primary measuring unit of economic growth. The negative effects of rapid population growth appear to have weighed most heavily on the poorest group of countries in the developing world during the 1980s and also throughout the two previous decades. Empirical evidence divides the negative consequences of population growth into several categories.

Firstly, rapid population growth lowers per capita income growth in most LDCs (Kelley (1988). The poor bears the brunt of the negative effects of population growth. They become landless, face loss in jobs, and the government reduction of expenditure on education and health. It is generally agreed that large family size and low incomes limit the opportunities of parents to educate all their children. High fertility harms the health of mothers and children. Rapid population growth generates food security problem and contributes to environmental degradation in the form of deforestation, soil erosion, unsafe water, air pollution and urban congestion. It is also the major factor causing increasing international migration both legal and illegal. The costs of rapid population growth are cumulative: more births today make the task of slowing population growth later difficult, as today's children become tomorrow's parents. In general, food supplies and agricultural production must be greatly increased to meet the needs of a rapidly growing population; this limits the allocation of resources to other economic and social sectors.

Secondly, the rapid increase in population means that there will be an increase in the dependency ratio (ibid). This implies that the country concerned will have to allocate increasing resources to feed, clothe, house and educate the useful component of the population which consumes but does not produce goods and services

Thirdly, a rapidly growing population has serious implications for the provision of productive employment. Since the rapid population growth is normally accompanied by a proportionate increase in the supply of the labor force, it means that the rate of job creation should match the rate of supply of the labor force. In Africa the rate of labor force supply has outstripped that of job creation, implying that the rates of unemployment have been increasing rapidly. In other words, the number of people seeking employment increases more rapidly than the number of available jobs. This kind of situation poses a menacing problem for society .When an ever-growing number of workers cannot be absorbed in the modern economic sectors of the African countries the workers are forced either into unproductive service occupations or back into the traditional section with its low productivity and low subsistence wage levels. This large supply for cheap labor tends to hold back technological change, and industrialization is slowed by mass poverty. This in turn reduces the demand for manufactured goods. The end results are low saving rates and low labor skills, both of which inhibit the full development and utilization of natural resources in some African countries. In other countries, the growing population would outrun the levels at which renewable resources could be sustained, and the resource bases would deteriorate. Thus, widespread poverty, low labor productivity, the growing demand for food and slow industrialization distort and degrade the international trade.

The socio-economic consequences of demographic evolution and vice-versa are extremely difficult to measure with accuracy. However, some studies have attempted to show the, relationship between population growth and socio-economic development. The correlation matrix of population and socio-economic development for 50 African countries during the last three decades has proved that population and development are inseparable and their relationship is reciprocal.

From these all it seems that, there is almost a universal consensus that economic stability, specifically defined as moderate population level, is positively related to economic growth. And yet there are also studies in Africa that found a strong and direct relationship between population growth. Gideon , Gachanja and Obere (2013) concluded that the Kenya population growth and economic growths are both positively correlated and that an increase in population will impact positively to the economic growth in the country.

This shows the fact that there is no consensus on the impact of population growth on the economic growth of the country and hence there is a need to further investigate the role of population growth to economic growth specifically the effect of working age population on the country's economic growth.

For the last six years, contemporary Ethiopia has gathered momentum by recording a steady state economic growth. Ethiopia has enjoyed improvements in its macroeconomic performance in the past decade. In spite of being the second most populous country in sub-Saharan Africa, gross national income per capita has been steadily increasing in recent years. According to 2008 World Bank estimates, GNI per capita has increased from $490 USD in 2003 to $870 USD. GDP growth rates reflect this improvement, with average rates consistently exceeding 10 percent from 2004 to 2008.Along with this growth; however, the country has seen an accelerated, population increase.

Keeping an eye on population is most important. There are several reasons why we should worry about the spike in the population growth rate in Ethiopia. Population is a tax on the poor and long-term lenders and the economy in general. The question of the existence and nature of the link between population and growth has been the subject of considerable interest and debate. Although the debate about the precise relationship between these two variables is still open; the continuing research on this issue has uncovered some important results. Population pressure in Ethiopia seems to be on the verge of distorting the allocation of resources and is likely to be a deterrent to undertaking productive investments instead of stimulating economic growth.

However, little work by the governmental policy makers and researchers has been done to mitigate the impact of population sustainably on economic growth. The empirical test of the long run relation between population and economic growth which is the subject matter of this study shall provide precise answer to the relation of the population growth paradox and how the problem could be tackled.

Knowing the impact of population growth on economic growth of the country has been an interesting query for the researchers, academicians, investors, entrepreneurs, government agencies and dignitaries. We all know that population growth is a very crucial element that affects the overall performance of the economy. Population growth is also supported by different

economic theory**.** Many empirical evidences through different developed as well as in emerging economies show that population growth is significantly have both macro and micro economic impacts in any economy.

This study reveals an important initiative to determine the significance of the long run relationship between population growth and economic growth by creating a linkage among them. This paper also examines whether there exist any Long run linkage between population growth and economic growth of the country.

1.4. Research Questions

This research work shall be guided by the following questions:

- Is there a long run relationship between population growth and economic growth?
- What is the speed of adjustment or the error correction parameter of the variables under study?
- What is the direction of causality?

1.3. Objective of the Study

In light of the problems stated above the study have the following general and specific objectives.

General Objective

The general objective of the study is to empirically test and show the long run relationship between population growth and economic growth of Ethiopia.

Specific Objectives;

- To examine the long run relationship between population growth and economic growth.
- To determine the response of the economic growth due to shocks in population growth.
- To explore the speed of adjustment or error correction parameter.

1.4. Significance of the Study

A vital component of any move towards macroeconomic stability and economic growth is an integral effort; because it gives everyone some good feeling. Population growth is a key factor

to the growth and development of any country. And with continued divergence of opinions regarding the consequences of population growth on economic development, this study will thus serve as a necessary contribution to knowledge offering information regarding the same in Ethiopia. The study will also serve first, as a resource material to policy makers and scholars by providing the relevant information regarding the issue. Secondly, it provides information on the impact of population growth and how these growths influence the economic development.

The results of this study will be helpful to the policy makers by giving them useful information on various explanatory variables that may be targeted in the evaluation of policy changes and the provisions of new policies in order to enhance the desired level of economic growth. The study may help to provide useful information to the private and the public agencies in designing projects and programs that can assist in bringing a balance between growth in population and growth in economic growth. In general, this study will be significant in the following ways;

The study will have a direct effect on the efficiency of and effectiveness of the use of policy instruments in the stabilization of macroeconomic variables to stimulate production, investment and minimizing uncertainty and by creating a linkage among them.

This study will reveal an important initiative for students, policy makers and central bankers that want to know more about the long run relation between population and economic growth of Ethiopia.

The study will also reveal the remote and immediate causes and costs of population in Ethiopia with due consideration to theoretical foundation .Moreover, the analysis that will be carried out in this study is expected to contribute towards better eco-efficiency measurements.

1.5. Scope and Limitation of the Study

This study is limited to the period between 1981-2013 which covered thirty three years .The choice of the period of reference is significant because population constituted a matter of serious policy considerations .The period encompasses the major landmarks in our national economy. Since the mid-1970s the Ethiopian economy has undergone two major shifts in policies. The

first, Derg replaced mainly liberal policies of imperial era with a centralized regime that discourage a market economy and private property till 1991. The period was the era of political instability that affects every sector of the economy. Second, since 1992 the EPRDF government has focused on reorienting the economy through market reforms ,including a structural adjustment program by preparing a full poverty reduction strategy paper (full PRSP) ,Among other issues ,the process is expected to reducing debt through the Growth opportunity Act (AGOA).And, recently by Growth and Transformation Plan (GTP) initiatives.

The study mainly assesses the long run relationship between population and economic growth (real GDP) in Ethiopia by ignoring the psychological, political and social costs of population at both macro and micro level.

1.6. Organization of the Thesis

This research work commenced by providing a background of the subject matter justifying the need for the study as contained in chapter one. Chapter two presented related literatures concerning economic growth, its causes and affects both theoretically and empirically. The third and fourth chapters came up with the methodology of the study and discussion and estimation results respectively. Finally concluding comments in chapter five reflected on the conclusion and policy implications of the findings.

CHAPTER TWO: LITERATURE REVIEW

There have been extensive theoretical and empirical literature examine the relation between population growth and economic growth both in the context of developing and developed countries. This section will present a brief review.

2.1 Introduction

The relationship between population growth and economic development has been debated as long as the study of economics has existed. Although there is a widespread awareness of the high population growth rate, there is not always agreement or consensus about its implications of population growth. Thus, although the population is beyond dispute, its meanings and interpretations have been topics of lively controversy (Hussein, 2000:338; 1977:).

One school of thought sees the world population growth as a crisis for mankind, for human subsistence, and for living space. According to this view high population growth is likely to increase pressure upon food, space, and other resources, and also upon the social and community relationships with regard to the distribution of income. The result of scarcities in resources is likely to leak to an increase in economic hardship, malnutrition, and perhaps the death rate (Hussein, 2000:339). It is also widely believed that the resources drain, resulting from rapid population growth, frustrates efforts of the developing countries to accelerate economic and social development. Moreover, it hampers closing the gap between rich and poor countries (Matras, 1977).

A second school of thought views the current population growth as presenting an unprecedented opportunity for economic and social development, innovation, and human progress in most areas of the world. According to this school of thought, population growth enhances the prospects for economic development. Two basic reasons are cited in this regard. Firstly, economies of scale of a greater output per unit of input are made possible by larger markets and by a larger and more specialized labor force. Secondly, the pressures of increased family size or community size cause people to work harder and it also motivates both individuals an organizations to develop or adopt innovations or improved methods and processes of production (Matras,1977).

Recently, an additional argument for population growth has emerged. This school of thought links population growth with innovation, social and economic changes and with the research for

the discovery and exploitation of new resources, opportunities, and social forms. Population growth is thus viewed as a key to many of the recent historical patterns, such as industrialization, urbanization, and technological and social innovation. It also sees the current population growth in developing countries of the world as both a challenge and an opportunity for these countries to extend and exploit their resources. It also leads to the social and technological innovation that can catapult these countries into the modern economy of mass production (Matras,1977:2).

2.2 Theories of Population Growth

There are many theories of population growth. Two broad theories are the micro-analytical theory and macro-analytical theory. The micro-analytical theory stresses the role of individuals, while the macro-analytical theory stresses the role of social evaluation and decision making about marriage, family formation and the number of births (Matrad, 1977:209). Micro-analytical theories of population growth are concerned with two major aspects of fertility: Firstly, individual survival or life span variations in individual survival or life span causes an correlates, and secondly, the fertility of individuals or couples, variations in the number and spacing of births and causes and correlations of such variations (Matras,1977:209).

In contrast, the macro-analytical theories of population growth consist of societal patterns of fertility and mortality, and the structural and institutional features of societies, which bear upon survival, mortality and fertility (Matras, 1977:198), Macro-analytical theories, seek to account for societal variations in growth patterns, in terms on structural attributes of entire societies *Darrat* and *Al-Yousif* (1999).

2.2.1Micro-analytical Theory of Population Growth

The micro-analytical theory of population growth is divided into four sub-theories, which are the declining mortality theory, the social status theory, and the utility-cost theory (Cited by *Darrat* and *Yousif* (1999) in Matras (1977:198)

The Declining Mortality Theory of Population Growth

The explanation of the decline in mortality has two key arguments. The firs argument holds that declining mortality implies a need for fewer children to be born, in order to assure a desired

family size. It also implies that children will survive to look after their elderly parent, or that, a given number of children will survive to continue the family line. This means that parents no longer have to raise large families. The second argument is that declining mortality actually imposes objective hardships on families having to support and educate an ever-larger number of surviving offspring . there are simply more children surviving than used to be the case, and this means that today's families, with the same number of children as earlier families, end up with more children to feed. Therefore, those people who are alert enough to recognize the implications of declining mortality, and those who have access to knowledge, means and social support of controlling fertility, have taken steps to control their fertility *Darrat* and *Yousif* (1999).

The Social Status Theory of Population Growth

The social status theory of fertility states that the ambition to rise to higher social positions is widespread, but larger families inhibit social status mobility. Accordingly, people who seek to enhance their status tend to control fertility and family size. Variations of this analysis are sometimes formulated as an explanation of fertility differentials between, for example, urban and rural populations, foreign-born and first-generation natives. Lower urban compared to rural fertility, and lower population growth for first generation natives compared foreigners are explained in terms of the respective former categories to improve and assure socio-economic status *Darrat* and *Yousif* (1999).

The Utility-Cost Theory of Population Growth

The utility -cost explanation of fertility assumes that couples behave rationally with respect to their own fertility. That is, couples behave as if they were applying rough calculations to the problem of determining the desirable number of births (Hussen, 2000:406). The second assumption of the utility-cost theory is that these calculations are directed towards balancing the satisfaction or utility-cost or utility to be derived from an additional child against the cost. Both monetary and psychological benefits and costs of having that child are calculated.

This theory distinguishes between three types of utility to be derived from an additional child. The first is the child's utility as durable consumption goods, that is, a child is wanted for her or himself rather than for services or income she or he may provide. Children are classified as consumption good because they provide direct utilities to their parents, and durable, sine the

costs and benefits of having children extend over a relatively long period (Hussen, 2000:406). The second is a child's utility as a productive agent, as a person who may be expected eventually to work and to contribute to the family's old age. The costs of having an additional child are both direct and indirect. Direct costs are the usual expenses of maintaining the child until he is self-supporting. The indirect costs are those incurred when opportunities are lost, for example, the wife's employment is foregone because of the child's existence (Hussen, 2000:406; Matras, 1977:201).

The utility-cost explanation of class differentials in fertility holds, firstly because income varies over the different socio-economic groups, different groups can afford more or fewer children. Secondly, the pattern of utilities and cost varies among the different socio-economic groups. For example, the utility of an additional child is more for the farmer than for the clerk, just as the direct cost is different for the professor than for the college-educated career woman and the housewife (Matras, 1977:202).

The utility-cost analysis also offers an explanation of changes in fertility over time. Economic development is sometimes a reason for altering the pattern of utility and cost. For example, both the direct and the indirect costs of an additional child rise as income increases. Moreover, the utility of the additional child as a source of security and as a contributor to family income diminishes. Families with higher income typically spend more on their children for clothing, education and medical services. At the same time, the more highly educated mothers in such families forego relatively greater income opportunities, and so they incur higher indirect costs. On the other hand, high-income parents are less likely to need support from their children in their old age. Finally, the utility of an additional child as a consumption item is fixed in both high and low-income families (Matrasm 1977:202). The net effect of all the assets an debits in the utility-cost analysis is that the direct and indirect costs of raising children are higher in the more modernized societies where high proportions of the population an women in particular are educated. Thus, a decline in fertility is experienced in the modern developed countries *Darrat* and *Yousif* (1999).

The Theory of Changing Family Structure

This theory states that urbanization is associated with the subversion and breakdown of the extended family system. In extended families, the childbearing couple is not generally the

decision-making unit. Arrangements and decisions regarding matchmaking, marriage, residence, work and economic relations are not made by the couples themselves, but by the most senior members of the extended family. These members of the extended family also take care of the young. Similarly, there are typically limited discussions or decisions about childbearing on the part of the couple. Children are conceived, born and accepted as part of an inevitable life process rather than by decision Matras, (1977:208).

In the relatively independent nuclear family, couples make their own decisions before and after marriage. Each partner may decide to marry or not, each may choose his or her own spouse, and jointly the couple may make residential, occupation, and childbearing decisions (Matras, 1977:208). Such decisions may be determined entirely by tradition, they may be entirely rational or they may comprise some combination of these properties. According to Hussen (2000:405) this depends on couple's socio-economic factors, for example, women's level of education, level of income and participation of women in traditionally male-dominated sector.

According to Matras (1977:2004) industrialization causes and sustains institutionalization of the conjugal and relatively small family. Industrialization undermines the traditional family system by creating a class-differentiated mobility within kin groups and by organizing extra kinship institutions for meeting the needs and problems previously handled by kinship institutions *Darrat* and *Yousif* (1999).

2.2.2 Macro-analytical Theories of Population Growth

The macro-analytical theories of fertility are discussed here. The first is the Malthusian classical analysis of the relationship between food production, per capita income, and preventive checks on population growth. Secondly, the Neo-Malthusian theory which differs from the original Malthusian perspective, is discussed. It differs in that it openly advocates the use of all the forms of preventative checks to escape the Malthusian dilemma (Taylor, 1988:14). These preventative checks include birth control. In spite of this deviation from the path of the founder, the Neo-Malthusian theory uses the rest of his principles of population as justification for family planning programs (Yaukey, 1990:56). The third is the macro-analytical analysis of changing the family structure as expressed in the emergence of the conjugal family. The theory is based on the establishment of the nuclear family couple as a decision-making unit and is based on the

establishment of the nuclear family couple as a decision-making unit and the rationalizations of family formation. The forth is the theory of population balance, which explains changes in population size, distribution and other characteristics in terms of the availability of environmental resources, technological development and social organization (Avip, 1994:55).

Malthusian Theory of Population Growth

According to the Malthusian theory a large population might only be a reflection of earlier prosperity and a warming of imminent danger of falling living standards. Malthus took his stand on three propositions. Firstly, the population cannot increase without the means of subsistence, secondly, that population invariably increases when the means of subsistence are available, and thirdly, that6 the superior power of themselves population cannot be checked without producing misery or vice (Winch, 1987:19).

Malthus's principle suggests that population tends to grow more rapidly than the subsistence do. That is, unless checked in some way, population tends to grow in a geometric progression: 1, 2, 4, 8, 16 and it is likely to double every 25 years. On the other hand, there is no such tendency for the means for subsistence to expand by geometric progression. Subsistence rather expands by an arithmetic progression: 1, 2, 3, 4, 5, Moreover, where the means for subsistence are finite and limited, such as arable land in an already populated country, then the principle of diminishing returns will apply (Hornby & Jones, 1993; Nafziger, 1997:56).

Population is kept within the limits of the means of subsistence mainly by positive checks, which operate through the death rate. When the means for subsistence are inadequate to take care of population growth, the death rate goes up until the population has reached a supportable level. By the same token, whenever there is a surplus in the means of subsistence, this tends to lower to death rate and increases the rate of natural growth until the population has grown to the limits of the new means of subsistence. This is called the Malthus dilemma. Hypothetically, the way out of the dilemma is through the application of preventative checks on population's growth (Yaukey, 1990:56).

According to Winch (1987:19) there are two kinds of checks, the positive and the preventative. The positive checks reveal themselves in higher mortality rates and lower life expectancy. Malthus therefore sees them as any cause that contributes to shorten the natural duration of

human life. For example, poorliving conditions that might give rise to lower resistance to diseases. Factors such as disease, war and famine are also included (Hornby & Jones, 1993:66). The preventative checks operate by means of voluntary restraints on birth rates (Taylor, 1988:14). For example, moral restraint is seen as a deliberate decision by men to marry later in life than usual. They only marry at a stage when fully capable of supporting a family. It is anticipated that this would give rise to smaller families and probably to fewer families, but Malthus did not suggest that parents should try to restrict the number of children born to them after their marriage (Hornby & Jones, 1993:66).

Both preventive and positive checks entail misery and vice. This is a category designed to hold the casualties in the eternal struggle between good and evil being a probable result. War, pestilence, and famine were the main positive checks. Abortion, infanticide, prostitution, and other unnatural attempts to accommodate the constant passion between the sexes, while avoiding the consequences, accounted as preventative checks. According to this Malthusian theory no society's present or future living conditions could guarantee all its member to live in ease, happiness and comparative leisure, while feeling no anxiety about providing the means of subsistence for themselves and their families (Winch, 1987:21). In the world of plant and animals, overcrowding and failure of the excess to survive are counterbalanced by unrestricted increase.

The Capacity for reasoning and foresight acts as a preventative check for humans. Thus, in the present state of society, prudence takes account of such matters as the effect of marriage and reproduction on future independence and rank, the possible need to work harder, and the life-prospects of any offspring. In some respects, therefore, there is progress and improvement on the earlier savage state, where the positive checks operated with full force. However, despite such prudential considerations, population increase placed the lower class of every society under constant pressure of want. The same lower class society is also as a result of food scarcity, falling wage and increasing toil (Winch, 1987:21).

What Malthus had in mind was a form of cycle arising from delayed responses. According to him periods of good times are associated with high wages leading to early marriage and population increase. These periods are followed by bad times in which distress brings

population increase the halt (Womch. 1987:21). At the bottom of the cycle the cheapness of labor would act as an encouragement to food production, thereby restoring the balance between population and resources to themselves original position (Winch, 1987:21). According to Malthus there is a definite ceiling to food production from any given area. Thus, it can be argued that beyond a certain stage continued population growth results in less food being available per person until ultimately some people have insufficient to eat. They will then die, either directly from starvation or from diseases resulting from a lack of resistance brought about by malnutrition. This has happened on a dramatic scale in Ethiopia and Bangladesh recently (Winch, 1987:21).

If the decrease in population growth rate gives rise to a decline in total population, to a level where food supplies is again adequate, checks on growth would cease to operate and population would again increase *Darrat* and *Yousif* (1999).

The Modern Neo-Malthusian Theory of Population Growth

Part of the modern Neo-Malthusian theory is that food production all over the world is increasingly coming up against various major contains. The two most important constraints relate to land and water. The total amount of cropland is not changing very much, and therefore, the quantity per person is decreasing due to populations' growth. The demands that are made on the cultivated land lead to widespread land degradation (Aviv, 1994:56). This land degradation includes soil erosion, compact ton and desertification. It is claimed that throughout most of the developing world increasing population pressures are directly threatening the inherent productivity of the soil (Dyson, 1996:13). Fast growing cities are diminishing prime agricultural land, and the smaller supplies of new land, which might be brought in to cultivation, are generally of much poorer quality (Dyson, 1996:13).

Modern Neo-Malthusian writers do not deny that long-term improvements in per capita food production have taken place. However, they argue that during the 1980'sand 1990's the world has at least reached a critical turning point. They maintain that in certain crucial respects the situation which humanity now faces is different from what it confronted in the past. In particular, the Neo-Malthusian case highlights the extraordinary scale of contemporary world population and its relations with increasingly serious environmental problems to which this growth contributes *Darrat* and *Yousif* (1999).

Anti-Malthusian Theory of Population Growth

Instead of seeing a large and growing population as a problem for systems and food production, the opposing perspective sees these characteristics as both a sign and cause of prosperity. According to the modern American economist, Julian Simon, the ultimate resource for economic growth is people who are skilled and spirited. People who will exert their will and imaginations for their own benefit, and inevitably, for the benefit of everybody are especially needed (Dyson, 1996:6).

Simon and some economists are optimistic about technological changes. They not only believe that output will continue to grow more rapidly than population, but also that population growth stimulates the growth of per capita output. According to Nafziger (1997:197) Simon argues that population enhances the level of technology. More people increase the stock of knowledge through additional learning. They also gain through the combined effect of the quickening effect of greater competition and total demand. Division of labor and economies of scale in production increases as markets expand. In short, as population size increases productivity and economic growth, because population growth spurs economic growth. Simon's model requires no government interference and is consistent with a laissez-fair population policy. According to Simon the level of technology, which is combined with labor and capital in the production function, is directly or indirectly influenced by population growth *Darrat* and *Yousif* (1999).

Theory of Population Balance

This theory explains changes in population size, distribution and other characteristics in terns of the availability of environmental resources, technological development and social organization (Nafziger, 1977:197). According to Hussen (2000:408) the demand for children can be reduced through variety of economic policies at a macro-economic level. These policies have the effect of raising the income or standard living of the average family. The key policy target is to raise the income distribution profile is highly uneven; a policy of income redistribution could by itself be used as a way of reducing fertility. This happens because changes to a more even income distribution usually have the effect of raising the average family income. According to Hussen (2000:408) the above discussion suggests that a country can use economic incentives to control the rate of its population growth in a variety of ways. The discussion of population control through economic incentives is based on the general premise that human fertility decisions are

made primarily on a purely rational basis. Furthermore, the underlying motive of the individual family is to promote its self-interest, that is, to maximize the net benefits from having children *Darrat* and *Yousif* (1999).

Demographic Transition Theory

Most research on fertility and population growth has been carried out in the framework of demographic transition theory. This theory refers to changes in the population growth, which a country undergoes in its transition from a developing to a developed country (Nafziger, 1997:187) the theory was developed based on the demographic history of Western Europe as it experienced the industrial revolution. According to Okpala (1990:65) the theory is also based on the premise that there is a general pattern of transition from a state of high birth and death rates to a state of low birth and death rates.

When the theory was first developed, it was assumed that during the initial stage of demographic transition, high birth and death rates resulted in low rates of population growth. As industrialization and urbanization occurred, their mortality rates decreased rapidly owing to improved public health methods, availability of modern medicine, better diets and other positive effects. However, a decline in the mortality rate is not immediately accompanied by a decline in the birth rate. It therefore results in a sharp increase on population growth. When these counties became more industrialized and urbanized. The birth rate began to decline and eventual converged with mortality rate. This leads to stable and slow population growth rate (Jphrmfptm.1996:284; IL; 1991:53).

Although there is little agreement among demographers as to the reasons for demographic transition, the theory accepts that modernization is one of the important factors that have a bearing on the process. A particular level of modernization is found in all countries where demographic transition is taking place (Science Committee of the President's Council, 1990:66).

The demographic transition is divided roughly into three stages. In stage 1 there is a high economic growth potential, because both birth and death rates are high due to external checks such as war, famine and diseases. Stage 2 begins when modernization, associated with improved public health methods leads to a marked reduction in mortality that gradually raises life expectancy from under 40 over 60 years (Todaro, 2000:222). However, the decline in death rates

is not immediately accompanied by a decline in fertility. As a result, the growing divergence between high birth rates and falling death rates leads to a sharp increase in population growth compared to the past. Stage 3 occurs when the forces and influences of modernization and development cause fertility to decline so that falling birth rates converge with lower death rates, leaving little or no population growth. Many European countries appear to have passed through all three stages of population change *Darrat* and *Yousif* (1999).

2.3. Summary of Theoretical Review

Population growth plays a conflicting role in the economic development process. One school of thought sees the world population growth as a crisis for mankind, for human subsistence and for living space. According to this view, high population growth increases the pressure on food, space and other resources. This in turn increases economic hardship, malnutrition, poverty and the death rate. On the other hand population growth is viewed as an unprecedented opportunity for economic and social development, innovation and human progress. According to this view high population growth enhances the prospect for economic growth through economies of scale.

There are two broad theories of population growth, namely, theories that are optimistic about natural population growth and that who are pessimistic about population growth. The theories are further divided into macro-analytical and micro- analytical theories. The micro-analytical theory stresses the role of the individual, while the macro-analytic theory stresses the role of social conditions. The micro- analytical theory is concerned with the individual life span fertility of an individuals or couples. The macro-analytical theory is concerned with the social pattern of fertility and mortality and the structural and institutional features of societies.

Micro-analytical theory is further divided into four sub-theories, which are the declining mortality theory, social status theory, utility-cost theory and the theory of changing family structure. The declining mortality they holds that as the mortality rate decreases people need fewer children to assure a desired family size. Due to lower mortality rates these children survive to look after their elderly parents. The social status theory states that people who have the ambition to rise to higher social position limit their family's size, as large families inhibit social status mobility. The utility-cost theory holds that people try to balance the utility to be derived from additional children against the cost of having children. According to this theory

there are three types of utility to be derived from an additional child. Firstly, the child's utility as consumption good, that is, as a source of personal pleasure to the parents. Secondly, a child's utility as a production agent, that is, as a person who works and contributes to the family income. Thirdly, the child's utility as a potential source of security in the parent's old age. The theory of changing family structure states that urbanization leads to breakdown of the extended family system. The couples are therefore able to make their own decisions and choices on the number of children the y would like to have.

The macro-analytical theory is divided into the following sub-theories, namely the Malthusian theory, modern Noe-Malthusian theory and anti-Malthusian theory. According to the Malthusian theory, population tens to growth more rapidly than do the resources. The population is therefore kept within the limits of the means of subsistence mainly by positive checks. These positive checks are operating through the death rates. According to this theory there is a definite ceiling to food production for any given society. Thus, beyond that ceiling continued population growth results in people having insufficient food to eat. This in turn leads to starvation and death.

The Noe-Malthusian theory differs from the original Malthusian perspective in so far as that it openly advocates the use of all preventative checks to escape the Malthusian dilemma, including prominent birth control. The rest of the Noe-Malthusian population principle is based on family planning programs. The new Anti- Malthusian theory sees a larger and growing population as a sign and cause of prosperity. According to this theory, more people increase the stock of knowledge through competition among them. The division of labor and economies of scale take place if there is an increase in population growth. Thus, the population growth enhances economic growth and development. The alternative hypothesis of either push or pull effects of population growth are traced back to some theories which were formulated to describe and explain the effects of population n developing and developed countries. Empirical evidence shows that countries with a fundamentally sound population policy have low population growth rates and experiences high economic growth in general. Countries without a sound population policy have a high population growth rate and lower economic growth.

Demographic transition theory refers to changes in the population growth that a country undergoes in its transition from being a developing to a developed country. The thorny is based

on the premise that there is a general pattern of transition from a stat of high birth and death rates to a state of low birth and death rates. This theory explains why contemporary developed countries have more or less passed through the three stages of demographic transition. Be for their economic modernization, had stable or very low population growth rates for centuries, as a result of a combination of high birth rates and almost equally high death rates.

The demographic transition is roughly divided into three stages. Stag 1 takes place before the economic modernization. The county therefore had a slow population growth rate. Stag 2 was the beginning of Western Europe's demographic transition. It was initiated by a fall in death rates as a result of improving economic conditions, while the fertility rates remained stable. This growing divergence between high birth rates and falling death rates led to a sharp increase in population growth. In stag 3 the population growth is lower or does not grow at all, because fertility rates begin to decline. In this stage the falling birth rates converge with lower death rates *Darrat* and *Yousif* (1999).

2.4. Empirical Literature

Bloom and Freeman (1986) provided a comprehensive organizing framework for analyzing the impact of population growth on labor supply and employment. In particular, they identified two distinct mechanisms through which population growth affects labor supply and employment. One is the "accounting" aspect that refers to changes in the demographic structure and cohort size. The other is the "behavioral" aspect that refers to the decision to participate in the labor force, particularly for women. Fertility, mortality and migration will affect labor supply differently. Mortality and migration will have immediate effects while fertility will have delayed effects. They also pointed out that the structure of the labor market mediates the impact of population growth on employment. For instance, in a neoclassical labor market rapid population growth will instantaneously depress wages. In a dual labor market where one market (modern) is behaving like a new classical labor market and another (traditional) is characterized by surplus labor and low wage rates, rapid population growth will delay the tightening of and eventual dissolution of the low wage traditional labor market (or the elimination of the dualistic structure). In their review of labor

markets in developing countries covering the period 1960-80, they concluded that despite population increasing rapidly, developing countries managed, on the whole, to improve their economic positions significantly.

According to Kelley (1988) a lower the pace of population growth will help to enhance economic growth at a higher rate. The study elaborated that economic growth would be higher in the situation of slower population growth even though the impact of population growth in many countries was insignificant. Population and per capita income are closely associated to depict the picture of economic growth. Lower the population growth and higher the per capita income show that nation achieve their growth targets. Countries with population growth under 1 percent, their per capita income could increase at the rate of 2.5 percent annually. Countries with population growth more than 2 percent had a little increase in per capita income of less than 2 percent.

Mankiw et.al (1992) used a Cobb-Douglas economy-wide production function to investigate the impact of population growth on 'steady state' income per capita as well as on economic growth in the transition to the steady state. They revealed out that an increase in the population growth rate of 10% (e.g. 3% to 3.3%) would reduce per capita income in the steady state by 5%. If, however, one considered human capital to be an additional factor of production (which is eminently reasonable), then the negative impact of population growth is larger as population growth now forces economies to use their scarce savings to equip young people with physical and human capital. As a result, a 1% increase in population growth would decrease per capita income by 2%.

Bloom and Williamson (1997) also found that demographic factors are important determinants of economic growth. Their results show that it is not overall population growth rate that drives economic performance but age distribution. The age distribution effect operates through the difference in growth rates of the working-age and the dependent population. The study found that population dynamics explain as much as 1.4 to 1.9 percentage points of the GDP per capita growth in East Asia or as much as one third of the average East Asian miracle GDP per capita growth rate (1.9/6.1). In Southeast Asia, the estimated effect

ranges from 0.9 to 1.8 points of economic growth or about half (1.8/3.8) of the recorded growth in GDP per capita.

Bucci (2003) investigated whether there is a long-run relationship between population (size and growth) and per-capita income focusing on human and physical capital as reproducible inputs. The study found out that population growth exerts a negative effect on economic growth. However, when individuals choose endogenously how much to save, population growth can also have a neutral influence on economic growth. The study also extended its analysis to the case where physical and human capital can interact with each other in the production of new human capital. When the two types of capital are substitutes for each other in the education sector, the effect of population growth on per-capita income growth is always negative. Instead, if human and physical capital is complementary for each other, the impact of population change on real per -capita income growth becomes ambiguous.

The intuition is the following. For given per - capita physical capital stock, an increase of population causes the aggregate physical capital to rise. If physical and human capital are substitutes for each other (in the sense that the larger amount of physical capital now available in the economy deters the demand and, thus, the consequent supply of human capital), the increase of population size, together with the reduction of the aggregate human capital stock, determines an unambiguous decline of the per-capita level of skills and, via this channel, a lower per-capita income growth rate. On the other hand, if physical and human capital are complementary for each other (the increase in the supply of physical capital spurs the demand and, therefore, the consequent production of new human capital), the final effect on the per -capita level of skills and, hence, on per-capita income growth of an increase in population may be either positive, or negative, or else equal to zero.

Long-run per-capita income growth can be positive even without any population change; in equilibrium, both the growth rate and the level of per-capita income are independent of population size; the long-run level of per-capita income is proportional to per-capita human capital.

2.4.1. Macroeconomic Strategy to Achieve the Required Growth

The key elements of the medium term macroeconomic strategy are the continuation of the program by reorienting the budgetary resources towards poverty reducing sectors, laying the foundation for a strong revenue performance through the tax reform program, improving the monetary and financial sector reform, and capacity building and regulatory reforms to promote private sector development. Specific objectives in the medium term are to achieve an annual average real GDP growth of about 7 percent and maintain stable prices (i.e., an inflation rate in the single digits, preferably no more than 5 percent) as well as a foreign exchange reserve to cover 4-5 months of import of goods and non-factor services(NBE, 2011).

The fiscal policy in the medium term is aimed at reducing the deficit to a sustainable level while at the same time reorienting investment and current spending towards key sectors such as agriculture (food security), natural resource, education and health and road construction. On the revenue side, the Government is determined to lay the foundation for strong revenue performance during the program period. Tax revenue is forecast to increase from 14.3 percent of GDP in 2000/01 to 17.7 percent in 2004/05 (NBE, 2011).

Monetary policy will remain geared toward containing inflation and achieving the international reserve target. The net domestic assets of the central bank will remain the key aggregate in steering monetary policy. The central bank will continue to closely monitor developments in reserve money and broad money. Progress in fiscal consolidation, supported by substantial disbursements of foreign aid, is expected to facilitate a rebuilding of net international reserves, while leaving for adequate growth in domestic credit to the private sector.

In the case of the Financial Sector, the government is committed to the enhancement of efficiency and competition in the sector. To attain this objective, it will adopt by June 30,2002, a medium-term strategy covering the period 2002/03-2004/05. The strategy that is envisaged will proceed along three lines: first, creating a favorable external environment of banking; second, building the internal dynamics of banks; and third, fostering contestability of markets within the banking sector.

Overall Objectives of the Sustainable Development and Poverty Reduction Program

The overarching objective of the government's poverty reduction strategy is to reduce poverty through at the same time maintaining macroeconomic stability. According to HICE 1999/2000, poverty head count ratio is projected to decline by about 10 %(about 4 percentage points) by the end of the poverty reduction strategy program period (2004/05) from its 1999/00 level of 44 percent. Real GDP is targeted to grow by at least 7 percent on average during the program period. While recognizing the seriousness of the challenge, the Government is committed to and works towards meeting the Millennium Development Goals (MDGs) of 2015.

2.4.2. Ethiopia—Good Policies and Decent Outcomes

Ethiopia's recent economic performance has been quite encouraging. During 1992-2001 real GDP growth averaged 6% a year. Exports grew by about 5% a year, though there was considerable volatility across years. Annual inflation averaged about 4%. And by 2000/01 investment had risen to 16% of GDP. These outcomes are much better than those in 1975-91. And the positive trends are expected to continue, with GDP growth of 8.7% in 2000/01 and 7.0% in 2001/02 (MOFED, 2010). Still, poverty remains deep and severe, with nearly half of Ethiopian Living below poverty line.

Since the mid-1970s the Ethiopian economy has undergone two major shifts in policies. The first occurred in 1975, when the Imperial government was violently overthrown by a group of military officers known as the Derg. The Derg replaced mainly liberal policies of the Imperial era with a centralized regime that discouraged a market economy and private property. Land and medium-size and large enterprises were nationalized. Prohibitive tariffs, extensive quotas, and complicated licensing procedures restricted foreign trade. Manufactured goods were rationed. Small farmers were forced to join cooperatives and to deliver grain to a government marketing agency. These policies generated disastrous economic outcomes that, combined with brutal political repression, led to civil conflict. The conflict ended with the downfall of the Derg and the assumption of power by the Ethiopian People's Revolutionary Democratic Front (EPRDF) in 1991. Since 1992 the EPRDF government has focused on reorienting the economy through market reforms, including a structural adjustment program. As a result the state's direct role in economic activity has declined. Tariffs have been cut, quota constraints relaxed, licensing

procedures simplified, foreign exchange controls eased, compulsory cooperative membership and grain delivery discontinued, and privatization begun. The government has also adopted agriculture-led industrialization as a central plank of its development program, with a focus on productivity growth on small farms and labor-intensive industrialization. Increased agricultural productivity will be achieved primarily through an extensive extension program. These reforms, combined with peace and favorable weather conditions for most of the past decade, produced the good economic outcomes noted above. Still, Ethiopia remains one of the world's poorest countries, with a per capita income of just $110 in 2001.

The Ministry of Finance and Economic Development (MoFED) has published online Ethiopia's five-year national Growth and Transformation Plan. Ethiopia started the Poverty Reduction Strategy Paper (PRSP) process in 2000, and by 2002 had issued the first three-year Sustainable Development Poverty Reduction Program (SDPRP), which covered 2002-2005.

Under the umbrella of the Development Assistance Group (DAG), in-country staff of bilateral and multilateral donor agencies undertook a review of the final Ethiopian SDPRP and the results of this work were presented a Joint Partner Review (JPR). The aim of this exercise was to develop a joint in-country perspective on the quality of the SDPRP that would help inform our overall response as development partners – both at the IMF/World Bank Board.

CHAPTER THREE: METHODOLOGY OF THE STUDY

Empirical methodology is applied to address the purpose of the paper described in this part of the study .Since VAR model includes all empirical tools used to get more precise results within the given data for research, VAR is considered. There are some prerequisites dealing with data before realizing VAR models that should be implemented. First, time series included in VAR have to be stationary. Therefore, the tests for the unit root and statiaonarity is applied to the data. The test is Augmented Dickey Fuller (ADF) which is described in the following subtitles. Secondly, the appropriate lag length is determined. VAR model description follows the procedure, after which some alternative tools presented to help for interpretation of empirical results. They consist of Co-integration test, VECM, Granger causality test, Variance Decompositions and finally stability test.

3.1. Data Source and Type

For the purpose of assessing the macroeconomic determinants of real gross domestic product in the Ethiopian economy, time series data have been collected from secondary sources. The data covers macroeconomic variables that include real gross domestic product (RGDP); working population (WAPOPL), money supply (M2); and openness (OPPENN). One dummy variable has been included to capture policy changes from 1993onwards. The data of the study covers the period from1981 to 2013(a total of 33 years) on the annually frequency based on Gregorian calendar and it was collected from World Bank Data Base Organization (WDI).

3.2. Methods of Data Analysis

The nature of the links between real gross domestic product and population is a question that is central to the study of economic development. On the top of this, simultaneity, and crude proxies are important practical problems. Such constraints make the empirical study on the correlation between economic growth and population variables are very challenging. The functional relation or expected signs of the coefficients for the estimable model is summarized in the following way; hence the proposed functional form is:

3.2.1. Model Specification

For multiple regression model with one dependent variable and **k**-explanatory variables Gujarati, (2004) formulates the following model

$$Y_t = \beta_1 + \beta_2 X_{2t} + \beta_3 X_{3t} + \dots + \beta_k X_{kt} + \mu_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where **Y=** dependent variable;

X= explanatory variables;

I=**i**th observation; in the case the data is time series,

the subscript **'t '**will denote **t**th observation;

« = error term. The shorthand form of OLS multiple regression models in equation (1) above According to Wooldridge (2005) and Green (2002) is

$$y_t = \alpha + x_t\beta + \epsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

where

β represents for $\beta_1 + \beta_2 X_{2t} + \beta_3 X_{3t} + \dots + \beta_k X_{kt}$ and

y_t is dependent variables to be explained in this case real domestic product,

α and **β** are parameters to be estimated,

x_t is defined as variables representing factors affecting the dependent variable in year **t**, and

ϵ_t is a random error term in year **t** holding OLS assumptions.

After reviewing relevant theoretical literature and empirical considerations, the following functional model for the study is specified for analysis based on models used by Ahmad and Qayyum (2009), Frimpong and Marbuah (2010), and Lesotho (2006).

RGDP= f (WAPOPL, M2, OPPENN, D)……………………………………………..… (3)

Where RGDP = Real Gross Domestic Product; WAPOPL = Working Age Population; M2= Broad Money Supply and OPPENN = Trade Openness. All variables of the study are annual time series data. These variables were chosen based on growth theories that are among the most important factors determining Real GDP. All variables are in natural logarithm except population because variable transformation to natural logarithm can reduce the problem of hetroscedasticity as it compresses the scale in which the variables are measured, thereby reducing a tenfold difference between two values to a twofold difference. In this case the transformed variables' coefficients represent constant elasticity. Therefore, the explicit estimable econometric model used in this paper was formulated as follows:

$$\mathbf{LnRGDP_t = \beta_0 + \beta_1 LnWAPOPL_t + \beta_2 LnM2_t + \beta_3 LnOPPENN_t + \beta_4 STBRK_t + \epsilon_t} \ldots\ldots \mathbf{(4)}$$

Where

Ln represents natural logarithm and all variables are as previously defined, and

$\beta_1, \beta_2, \ldots . \beta_4$ are coefficients of explanatory variables and

ϵ_t is error term at time **t** and it is assumed that it has zero mean i.e. $E(\epsilon_t) = 0$; constant variance i.e. $\mathbf{Var}(\epsilon_t) = \delta^2$ and it is normally distributed with zero mean and constant variance i.e. $\epsilon_t \sim N(0, \delta^2)$.

3.2.2. Description of Variables

This research uses four macroeconomic factors time series as sample data for testing. The macroeconomic factors are real GDP, working age population, money supply and trade openness. The data set covers from 1981 until 20103on annually basis. All macroeconomic variables employed in this paper have been used previously in many papers and below we present short theoretical intuition why we have chosen these factors.We have taken Real GDP (perfect proxy of economic growth) as dependent variables and working age population, money supply and trade openness as independent variables. Then each of the variables will be examined with respect to their descriptive statistics after then we transformed all the raw data into natural logarithms .Then all these variables are tested using **Eviews 6 software** VAR model, based on the following econometric methods;

Dependent Variable

Real Gross Domestic Product: Real GDP is the dependent variable of the model. It is GDP adjusted for changes in money-value or it is GDP measured at constant price. Real GDP tells us how much a country's has produced in a particular year. Its growth rate will tell us by how much the overall production has increased (or decreased, if the growth rate is negative) compared to the previous year. But, this variable has strong interdependence with inflation. Real GDP growth with low level of inflation is a good indicator for real economic growth of any country. Hence, the independent variables of the model are described as follows

Independent variables

Working Population (WAPOPL)1 : It comprised people who are economically active. That is people who supply labor for the production of goods and services during a specified period in case of Ethiopia between the ages of 15 to 64 . It includes both the employed and the nonemployee. The neoclassical economists believe that to raise the trend rate of growth a higher level of productivity of labor and capital are needed. This is because only a s sustained rise in capital stock increases the growth rate only temporarily. However, the marginal product of additional units of capital may decline and thus an economy moves back to a long-term growth path (Riley, 2012) . So a higher level of labor is needed to bring a large and sustained increase in economic growth. Hence, productive labor force is expected to have positive impact on economic growth.

Broad Money Supply (M2): Different measures of money supply. Not all of them are widely used and the exact classifications depend on the country. M2 includes M1 plus short-term time deposits in banks and 24-hour money market funds.

In economics, broad money is a measure of the money supply that includes more than just physical money such as currency and coins (also termed narrow money). It generally includes demand deposits at commercial banks, and any monies held in easily accessible accounts. Components of broad money are still very liquid, and non-cash components can usually be converted into cash very easily. However broad money can have different definitions depending on the situation of usage, usually it is constructed as required to be the most useful indicator in the situation.

More generally, broad money is just a term for the least liquid money definition being considered and less a fixed definition across all situations. As such broad money may have different

implications in the United States than it does in Ethiopia and even from academic paper to paper. The term broad money will usually be more exactly defined before a discussion, when it is not sufficient to assume a wider definition of money. The effect of money supply is not determined as it may either positively or negatively affect the economic growth depending on different conditions and time period.

Trade Openness (OPPENN): The most commonly used standard measure of liberalization in the new growth theory literature is the ratio of total trade export + import to GDP (Adsera & Boix, 2002) . It is suggested that the more open is an economy, the more it is likely for the economy to develop financially and hence adds more to economic growth. Besides creating conducive environment for financial sector, the financial openness promotes growth through increased international trade. Moreover, according to the current orthodox view, trade openness is essential for growth. The orthodox assumes that poor countries do not sufficiently participate in world trade. Countries that liberalize their imports and orientate production toward exports are ass med to ha e faster growth than those countries that do not and the faster the rate of opening, the greater the prospects for development Shafaeddin, 2006). It is expected to have opposite impact on economic growth since it reduces financial constraints in the domestic economy.

3.3. Unit Root Tests

The stationarity or otherwise of a series can strongly influence its behavior and properties. For example, if the series is not stationary, there will be persistence of shocks infinitely which makes the regression result spurious. Here a regression of one on the other could have a high $\boldsymbol{R^2}$ even if the two are totally unrelated. The usual "*t*-ratios" will not follow a *t* distribution, so one cannot validly undertake hypothesis tests about the regression. Therefore, it is important to make a stationary test for series before conducting regression. There are three models which have been frequently used to characterize non-stationarity:

Random walk without drift:

$$y_t = y_{t-1} + u_t \quad \text{.....(5)}$$

Random walk with drift:

$$y_t = \mu + y_{t-1} + u_t \quad \text{.....(6)}$$

Random walk with drift and trend:

$$y_t = \alpha + \beta_t + y_{t-1} + u_t \quad \text{.....(7)}$$

For a given interest of variable $\mathbf{Y_t}$,the DF Unit Root Test is based on the regression of,

$$\Delta Y_t = \alpha + \beta T + \delta Y_{t-1} + u_t \quad \text{.....(8)}$$

Depending on the nature of $\mathbf{Y_t}$,**α** and **β** are zero when it is without Constant and Trend, **β** is zero when it is with constant otherwise it is with Constant and Trend:

The hypothesis is **Ho: δ=0**(unit root) and **Hl: δ≠0.** The decision rule is that if the calculated **t***value is less than the DF critical value (in absolute term), we will not reject the null hypothesis, that is, unit root exists (**Yt** is not stationary); but if **t***calculated is greater than DF critical value, the null hypothesis is rejected and **Yt** is stationary.

The ADF test requires running a regression of the first difference of the series against the series lagged once, lagged first difference terms, and a constant with a time trend of the following form (Gujarati, 2003);

$$\Delta Yt = \alpha + \beta T + \delta Yt - 1 + \gamma i \sum \Delta Y_{t-i} + ut \quad \text{.....(9)}$$

Where $\mathbf{Y_t}$is the variable of interest is the trend and $u_t$is the error term. The estimation strategy consists of a ***t***-test for the OLS estimate of the coefficients, where the null hypothesis is that the series are **I(1)** and non-stationary. From the output of ADF test, if the estimated ADF statistic is larger (in absolute) than its critical value then the null hypothesis is rejected suggesting that the series are stationary (Gujarati, 2003). In this study ADF is selected. ADF is an extension of the Dickey–Fuller (DF) test called the Augmented Dickey-Fuller test (ADF), which removes all the structural effects (autocorrelation) in the time series and then tests using the same procedure. The Augmented Dickey–Fuller (ADF) statistic, used in the test, is a negative number. The more negative it is, the stronger the rejections of the hypothesis that there is a unit root at some level of confidence.

3.4. Co-integration Test

Most of the time most macroeconomic time series are non-stationary. A regression result based on these non-stationary data tends to produce spurious result. However; some linear combinations of the series may become stationary. In this case they are said to be co-integrated. That is, the series may wander around, but in the long run there are economic forces that tend to push them to equilibrium. Hence, co integrated series will not move far away from each other and are linked in the long-run and the regression result is not spurious (Gujarati, D. N. (2004). There are two commonly used tests for Co integration namely; these are Engle and Granger and Johansen co integration test. However, in this study the later test is preferred and is describe as follows.

Johansen`s Test

Johansen`s test for co integration is as follows: Given a p variable VAR model;

$$\boldsymbol{Yt = u + \sum_{i=1}^{k} \phi_i Y_{t-i} + \varepsilon t} \quad \textit{(10)}$$

,where u is the constant term, Y_t is $(P \times 1)$ vector of the variables under study, and the disturbance vector ε_t of dimension $(P \times 1)$ is distributed as an i.i.d. Gaussian process with zero mean and variance Ω. Assuming that series are cointegrated, the above equation may be re-parameterized to give the following ECM representation

$$\boldsymbol{\Delta Yt = u + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \Pi Yt - k + \varepsilon t} \quad \textit{(11)}$$

$$\Gamma j = -[I - \sum_{i=1}^{j} \phi_i]$$

$$\Pi = -[I - \sum_{i=1}^{k} \phi_i]$$

"I" represents the identity matrix. The long-run relationship between series is determined by the rank of $\prod$. If time series are non stationary and co-integrated, then $\prod$ is not full rank, that is $0 <$ rank $(\prod) = r < p$, where r is the number of co-integrating vectors. Johansen proposed two likelihood testing procedures in order to estimate the rank of $\prod$. The first tests the hypothesis that the number of co-integrating vector is at most equal to r (Trace test). The second tests the hypothesis that the number of co-integrating vectors is equal to r (Max Eigen value test). When the series are found to be co-integrated, Johansen further demonstrated that $\prod$ can be factored as:

$$\Pi = \alpha\beta' \quad \text{.....(12)}$$

; Where β is matrix of *r* co-integrating vectors and α is the matrix of weights (the adjustment parameter) attached to each co-integrating vectors in the second equation. Both α and β represents $P \times r$ matrices.

It can be shown that for a given *r*, the maximum likelihood estimator of **β** defines the combination of $\mathbf{y}_{t-1}$ that yields the *r* largest canonical correlations of $\Delta\mathbf{y}_t$ with $\mathbf{y}_{t-1}$ after correcting for lagged differences and deterministic variables when present. Johansen proposes two different likelihood ratio tests of the significance of these canonical correlations and thereby the reduced rank of the **Π** matrix: the trace test and maximum eigen value test, shown in the following equations respectively.

$$J_{trace} = -T\sum_{i=r+1}^{n} \ln(1 - \lambda_i) \quad \text{.....(13)}$$

$$J_{max} = -T \ln(1 - \lambda_{r+1}) \quad \text{.....(14)}$$

Here *T* is the sample size and λ_i is the i^{th} largest canonical correlation. The trace test tests the null hypothesis of *r* co integrating vectors against the alternative hypothesis of *n* co integrating vectors. The maximum eigen value test, on the other hand, tests the null hypothesis of *r* co-integrating vectors against the alternative hypothesis of *r* +1 co-integrating vectors(Eviews 6 user`s Guide). But in this study the both are test were used.

3.5. Choice of the lag length

Lag length selection is One of the most important steps after stationary test and before co integration test. Hence, we employed the information criteria methods like Akaike's (1974) information criterion (AIC), Schwarz's Bayesian (1978) information criterion, and Hannan-Quinn information criterion (HQIC) show the optima lag length where the information criterion is smallest. That how much lag length should be incorporated in the model? With the help of this procedure it is possible to examine the long run relationships between four variables.

If two or more series are individually integrated (in the time series sense) but some linear combination of them has a lower order of integration, then the series are said to be co integrated.

A common example is where the individual series are first-order integrated (**I(1)**) but some (co integrating) vector of coefficients exists to form a stationary linear combination of them. Before the 1980s many economists used linear regressions on non-stationary time series data, which Nobel laureate Clive Granger. And others showed to be a dangerous approach that could produce spurious correlation. His 1987 paper with Nobel laureate Robert Engle, formalized the co integrating vector approach, and coined the term.

The possible presence of co integration must be taken into account when choosing a technique to test hypotheses concerning the relationship between two variables having unit roots (i.e. integrated of at least order one).
The usual procedure for testing hypotheses concerning the relationship between non-stationary variables was to run ordinary least squares (OLS) regressions on data which had initially been differenced. Although this method is correct in large samples, co integration provides more powerful tools when the data sets are of limited length, as most economic time-series are.

In practice, co-integration is often used for two I(1) series, but it is more generally applicable and can be used for variables integrated of higher order (to detect correlated accelerations or other second-difference effects). Multi co-integration extends the co integration technique beyond two variables, and occasionally to variables integrated at different orders.

However, these tests for co-integration assume that the co-integrating vector is constant during the period of study. In reality, it is possible that the long-run relationship between the underlying variables change (shifts in the co-integrating vector can occur). The reason for this might be technological progress, economic crises, changes in the people's preferences and behaviour accordingly, policy or regime alteration, and organizational or institutional developments. This is especially likely to be the case if the sample period is long.

3.6. Error Correction Model (ECM)

Co-integration among a set of variables implies that there exist fundamental economic forces, which make the variables move stochastically together over time (Urbain, 1992 cited in Niemi, 2003). These movements in variables are related in a predictable way to the discrepancy between observed and equilibrium states. The ECM then corrects for any disequilibrium between variables that are cointegrated, because the sequence of the discrepancy between observed and equilibrium states tends to decay to its mean, which is zero (Gujarati, 2004). An important theorem, known as the Granger representation theorem (1987) cited in Gujarati (2004), states that if two variables Y and X are cointegrated, then the relationship between the two can be expressed as ECM (Gujarati, 2004). Granger representation states that the short run dynamic model can be represented by the error correction mechanism on the assumption that the time series data are non-stationary at level and presence of cointegrating relationship between the variables.

In this paper short run ECM was employed using Autoregressive Distributive lag (ARDL) approach in which the first difference of both dependent and independent variables with respective lags are entered in the short run ECM including one period lag residuals saved from long run static level regression. An advantage of the ARDL approach is that it is possible that different variables can have different optimal numbers of lags in the ECM (Mosayeb, and Mohammad, 2009). In this process an approach called general to specific approach advocated by Hendry's (1986) were performed. The Hendry's approach to economic modeling starts with a model with several regressors and then whittles it down to model containing only the important variables. Terms with insignificant coefficients are progressively eliminated from the equation and variables of statistically significant at given level of significance are re estimated to arrive at parsimonious or preferred mode. In this way, the selected parsimonious or final model should satisfy the diagnostics test and the model must be purely random or the residuals should white noise.

Frimpong and Marbuah (2010), Acosta and Loza (2005), Rabbi (2011), used ARDL approach of error correction model. There for following them the following short run dynamic error correction model has been adopted in this paper.

$$\Delta LnRGDPt = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta LnPOPLt - 1 + \sum_{i=0}^{q} \alpha_{2i} \Delta LnRGDP_{t-i} + \sum_{i=0}^{r} \alpha_{3i} \Delta LnM2t - i + \sum_{i=0}^{s} \alpha_{4i} \Delta LnOPPENNt - i + \alpha_5 Dummy_t + \theta EC_{t-1} + \xi_t \quad \textit{(15)}$$

Where Δ denotes difference operator and α_0, α_1 ….., and α_5 are coefficients of selected time series variables and α_5 which is coefficient of Structural break (STBRK) representing policy change. θ is coefficient of EC_{t-1} which measures speed of adjustment towards equilibrium and it should be statistically significant to support the existence of co-integration. Whereas p, q, r, and s are the optimal number of lags included in the variables to avoid the problem of autocorrelation in residuals. To determine each variable's optimal lag number to be included, Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) were used in this paper. These optimal lag lengths determined by AIC and SBC were also the same with the lag length included in the first difference of variables up to which the variables are stationary in the ADF unit root test. EC_{t-1} is one lagged error correction term retrieved from long run co-integrating equation. ξ_t denotes white noise error term. The larger the coefficient of EC_{t-1}, the faster the speed of adjustment back to the long run equilibrium after a short run disturbance.

3.7. Granger Causality Test

Granger causality test implemented to identify how much the one factor significant in forecasting the other one Granger (1969). The results are not coefficients of the real dependence or indicators of the actual causality; rather it is just a sign of existing linear interdependency of one factor on another. The test for Granger causality works by first doing a regression of ΔY on lagged values of ΔY. (Here ΔY is the first difference of the variable Y — that is, Y minus its one-period-prior value. The regressions are performed in terms of ΔY rather than Y if Y is not stationary but ΔY is.) Once the set of significant lagged values for ΔY is found (via t-statistics or p-values), the regression is augmented with lagged levels of ΔX. Any particular lagged value of ΔX is retained in the regression if (1) it is significant according to a t-test and (2) it and the other lagged values of ΔX jointly add explanatory power to the model according to an F-test. Then the null hypothesis of no Granger causality is retained if and only if no lagged values of ΔX have been retained in the regression.

3.8. Diagnostic Tests

The model chosen for empirical analysis should be adequate in the sense that it does not violate one of more assumptions underlying the classical normal linear regression model. Therefore, the

validity of the estimated models is tested using the standard diagnostic tests. These are the Jarque-Bera test for normality, Breusch-Godfrey, Lagrangian multiplier (LM) test for serial correlation of higher orders, white heteroskedasticity to detect the presence of heteroskedasticity problems.

3.8.1. Jarque-Bera Normality Test

The classical normal linear regression assumes that each of the regression disturbances μ_t (error term) is distributed normally, i.e. they have zero expectations, are uncorrelated, and have a constant variance. This assumption may be stated as:

$$\epsilon_t \sim N(0,\delta^2). \quad \textit{(16)}$$

where N stands for normally and independently distributed. According to Eviews (1999) the Jarque-Bera (JB) test of normality is an asymptotic test based on OLS residuals and uses the following test statistic:

$$Jarque - Bera = \frac{N-k}{6}\left[S^2 + \frac{(K-3)^2}{4}\right] \quad \textit{(17)}$$

where S denotes the skewness which is a measure of asymmetry of the distribution of the series around its mean. K is the kurtosis which means a measure of peakedness or flatness of the distribution of the series, k represented the number of estimated coefficients used to create the series and N is number of observation in the sample.

Under the null hypothesis of a normal distribution, the JarqueBera statistics is distributed as χ^2(Chi-square) with 2 degrees of freedom (Eviews, 1999) & is reported as Obs*R-squared in Eviews program. Where Obs*R^2isto mean the number of observation times the goodness of fit (R^2)through this paper. The reported probability is the probability that a JarqueBera-statistic exceeds (in absolute value) the observed value under the null. A small probability value leads to the rejection of the null hypothesis of normal distribution. For 95% confidence level a probability value less than 0.05 falls under the rejection area of the null hypothesis of normally distributed. But if the *p* value of the computed chi-square statistic in an applications reasonably high, one does not reject the normality assumption Johnson (2000) and Eviews (1999). If the residuals are normally distributed, the histogram is bell shaped and the Jarque-Bera statistic

should not be significant. That means the probability value corresponding to Obs*R-squared should be greater than 0.05 for 95 percent confidence level.

3.8.2. Serial Correlation Lagrange multiplier (LM) test

Unlike the Durbin-Watson statistic for first order serial correlation, the LM test will be used to test for higher order serial correlation (Johnson, 2000). The null hypothesis of the Breusch-Godfrey LM test is that there is no serial correlation up to lag order p, where p is a pre specified integer (Eviews 1999). Here in this study, because of small sample size, lag order up two was used. The alternative hypothesis states that, the residuals are auto correlated. The software package used in this paper reports two test statistics (Eviews, 1999). The F-statistic is an omitted variable test for the joint significance of all lagged residuals. Because the omitted variables are residuals and it is not independent variables. The second test statistic reported by Eviews is Obs*R-squared. Obs*R-squared is a Breusch-Godfrey LM test statistic. The LM test statistic is asymptotically distributed as a χ^2 (p) where p is lag order included in the test. To determine whether the null hypothesis can be rejected up to specified degrees of freedom, it is compared with given critical values. If the reported Breusch-Godfrey LM test statistics exceeds the critical value one can reject the hypothesis of no serial correlation up to lag order specified with a given percent of confidence level (in most cases 95% confidence level). The probability printed to the right of Breusch-Godfrey test statistic (Obs*R-squared) represents the probability that one would be incorrect if one rejects the null hypothesis of no serial correlation up to lag order specified with a given confidence level (Eviews1999). Therefore, small probability value (<0.05 in this paper at 95% confidence level) is used as a decision to reject the null hypothesis of no serial correlation. But larger probability value here in this study greater than 0.05 is an evident of absence of serial correlation in the residuals (Seruvant and Tayaraman, 2001).

3.8.3. White Heteroskedasticity Test

White Heteroskedasticity test is a test for heteroskedasticity in the residuals from a least squares regression. Ordinary least squares estimates are consistent in the presence of heteroskedasticity, but the conventional computed standard errors are no longer efficient (Woorldge, 2005).

The White's test is a test of the null hypothesis of homoskedastic against heteroskedasticity in the alternative. White heteroskedasticity test is also a general test for model misspecification, since the null hypothesis underlying the test assumes that the errors are both homoskedastic and independent of the regressors and the linear specification of the model is correct (Johnson, 2000). The same principle is followed as Breusch-Godfrey LM test statistic to reject or fail to reject the null hypothesis. However, White's test statistic is asymptotically distributed as $\chi^2$with degrees of freedom equal to the number of slope coefficients excluding the constant in the test regression. That is the decision is based on the computed Obs*R-squared which follows χ^2 distribution with specified lag order and critical values of the chi-square (Eviews, 1999). If the computed Obs*R-squared is greater than critical values the null hypothesis of homoskedasticity is rejected. Or if the probability value reported corresponding to Obs*R-squared is less than 0.05 at 95% confidence level the null hypothesis of no heteroskedasticity i.e. homoskedasticity will be rejected otherwise the null hypothesis is not rejected and therefore the variances are equal or homoskedastic.

3.8.4. Autoregressive Conditional Heteroskedasticity (ARCH) Test

The autoregressive conditional heteroskedasticity (ARCH) test is based on the regression of squared residuals on lagged squared residuals (Gujarati, 2004). It is a LM test for autoregressive conditional heteroskedasticity (ARCH) in the residual. The key idea of ARCH is that the variance of regression disturbances of $\mu_t$at time (=δ^2) depend on the size of the squared error term at time (t-1), that is, on$(\mu_{t-1})^2$.More specifically, an ARCH process can be written as:

$$Var(\mu_t) = \delta^2 = \alpha_0 + \alpha_1 {\mu^2}_{t-1} + \alpha_2 {\mu^2}_{t-2} + \ldots + \alpha_p {\mu^2}_{t-p} \quad \textit{(18)}$$

If there is no autocorrelation in the error variance, we have H_0:$\alpha_0 = \alpha_1 = \ldots = \alpha_p = 0$ in which case var $(\mu_t) = \alpha_0$ and there is a case of homoskedastic error variance. As Engle (1982) cited in Neimi(2003) has shown, a test of the preceding null hypotheses can be made by running the following auxiliary regression:

$$\hat{\mu}^2_t = \hat{\alpha}_0 + \hat{\alpha}_1 \hat{\mu}^2_{t-1} + \hat{\alpha}_2 \hat{\mu}^2_{t-2} + \ldots + \hat{\alpha}_p \hat{\mu}^2_{t-p} \quad \textit{(19)}$$

Which can be expressed as?

$$\hat{\mu}^2{}_t = \beta_0 + \left(\sum_{i=1}^{p} \beta_i \hat{\mu}^2{}_{t-i}\right) + \nu_t \quad \text{.....(20)}$$

where $\hat{\mu}^2$ denote the OLS residuals estimated from the regression model. One can test the null hypotheses H_0 by the usual F test or, alternatively, by computing nR^2, where R^2 is the coefficient of determination from the auxiliary regression.

It can be shown that $nR^2 \sim \chi^2{}_p$ that is, nR^2 follows the chi-square distribution with degree of freedom equal to the number of autoregressive terms in the auxiliary regression.

The ARCH in itself does not invalidate standard least square inference. However, ignoring ARCH effects may result in loss of efficiency (Johnson, 2000). As the same way as serial correlation test, the software package used to perform the ARCH test reports two test statistics. The F-statistics is an omitted variable test for the joint significance of all lagged squared residuals. The Obs*R-squared statistic is Engle's LM test statistic, computed as the number of observations times the R^2 from the test regression. The probability value less than 0.05 at 95% confidence level is a valid conclusion to reject the null hypothesis of no ARCH effect against the alternative hypothesis of there exist ARCH effect. If the probability value is greater than 0.05 at 95 percent confidence level, the null hypothesis cannot be rejected and therefore, it means no ARCH effect in the model (Johnson, 2000; Eviews, 1999).

CHAPTER FOUR: RESULTS AND DISCSSION

4.1. Description of Trends of Ethiopian Economy

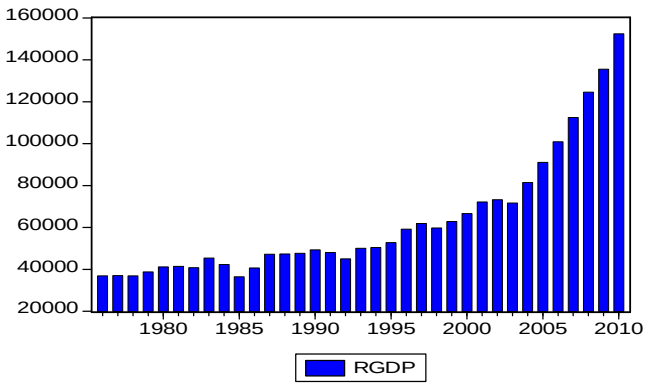
Over the last decade, the Government of Ethiopia (GOE) has been implementing a development program aimed at poverty reduction through rapid economic growth and macroeconomic stability. The country has recorded strong economic growth over the past six years mainly due to the government-led development policies emphasizing public investment, commercialization of agriculture and non-farm private sector development. After a significant draught-related contraction in EFY2003, growth rebounded Public Disclosure at an annual average of 11.2 percent for EFY2004-2009 which was significantly above average of 6.3 percent of Sub-Saharan Africa. The economic growth rate has also exceeded the minimum growth target of 7 percent established in the Program for Accelerated and Sustainable Development (PASDEP) for FY2006-2010.

Ethiopia has been implementing policies to reduce inflation and rebuild the external reserves affected by the commodity price surges in EFY2008. A policy package was adopted in late 2008 that included substantial fiscal and monetary adjustments, notably the elimination of fuel subsidies and measures to protect vulnerable groups. Following these reforms, inflation declined sharply to single digits by mid-2009. However, in the last few years, inflation has been again rising sharply and stood at nearly 40% at the end of September 2011, aided by significant increase in international food and fuel prices.

Ethiopia's new Growth and Transformation Plan (GTP) for EFY2011-2015 seeks to achieve macroeconomic stability and continued economic growth (at least 11 percent real growth rate) to enhance social development and reach the Millennium Development Goals. Although agriculture remains the engine of growth, industry is expected to play an increasing role in economic development. Large public investments in transportation and energy infrastructure are envisaged by the GTP.

4.1.1. Trend of Real GDP Growth

Ethiopia has experienced strong economic growth in recent years. With real GDP growth at or near double digit levels since 2003/04, the country has consistently outperformed. According to 2003 estimations, total GDP at current market Price was 54,585.9 million Birr, while in terms purchasing power parity it was $ 46.81 billion, with real growth rate of -3.8%. Although GDP per capita is roughly about $100, the GDP Per Capita, PPP is $ 700. Agriculture contributes 46% of GDP, while industry and service contribute 12.6% and 41.4% respectively. The country's development strategy has focused on agricultural development as the catalyst for economic growth. It has eliminated discriminatory tax, credit, and foreign trade treatment of the private sector and tried to simplify bureaucratic regulations and procedures. From 1998-2002, the country achieved an annual average economic growth rate of about 4.2% and annual inflation rate averaged – 0.4%. In EFY 2002/03, GDP fell by 3.8 percent and inflation rose by 15.1 percent, mainly due to decline in agricultural output by 12.2 percent caused by a severe drought. Agricultural output had recovered somewhat during the 2003/04-crop year due to more normal rains. The Government of Ethiopia and IMF estimated that the economy has registered a growth rate of 11.6% and the agricultural sector 18.9% in EFY 2003/04 (MOFED,2004).



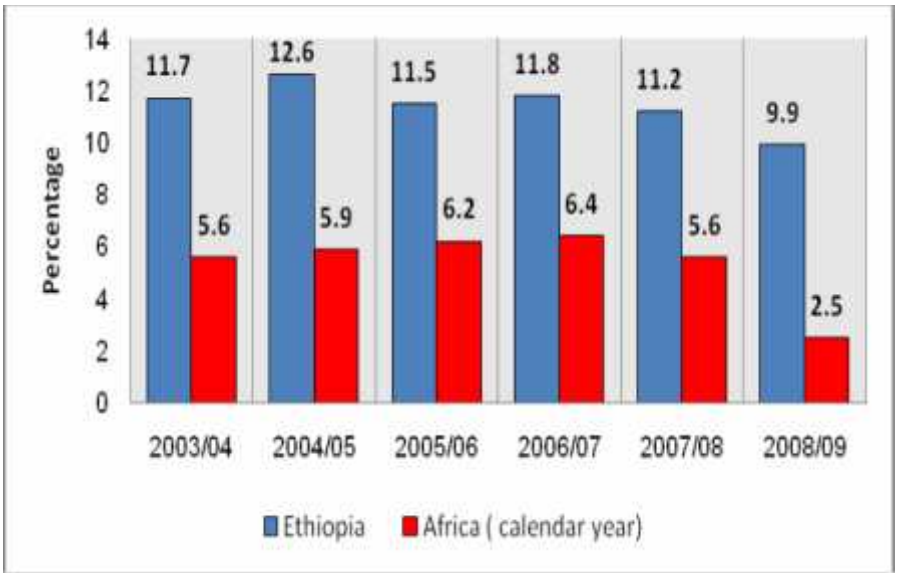
Source: Author's estimation based on secondary data

Figure 4.1: Trends in GDP

Ethiopia's economy is highly vulnerable to exogenous shocks by virtue of its dependence on primary commodities and rain fed agriculture.

Ethiopia has experienced major exogenous shocks during the past five to seven years. These are notably droughts and adverse terms of trade (e.g., prices of coffee and fuel). There is a strong correlation between weather conditions and Ethiopia's growth performance

Real GDP growth averaged 11.2% per annum during the 2003/04 and 2008/09 period, placing Ethiopia among the top performing economies in Sub-Sahara Africa. This growth performance is well in excess of the population growth rate and the 7 percent rate required for attaining the MDG goal of halving poverty by 2015. Yet, a number of issues warrant the attention of policy makers. (MOFED,2009).



Source: world economic outlook, IMF data file.

Figure 4. 2:GPD Growth rate of Ethiopia in comparison with Africa average

Ethiopia's recent growth has been accompanied by mounting macroeconomic pressures. The country has had to grapple with the twin macroeconomic challenges of high inflation and low international reserves. Pressures on prices and the balance of payment heightened from FY 2007/2008 as a result of the global food and economic crisis. The difficult macroeconomic situation Ethiopia faced during the period EFY 2007/08 to 2008/09 is also attributable to the structural weaknesses in the economy, including supply-side rigidities. The growing domestic

supply-demand gap, in the context of the surge in growth, contributed to a rise of inflation and the depletion of foreign exchange between 2007/08 and 2008/09(IMF, 2010).

4.1.2. Trends of Population Growth in Ethiopia

With one of the highest poverty levels in the world, Ethiopia is considered by many to be one of the most under-developed nations in the world. But within its African boundaries lies a nation filled with a rich culture and heritage. Bordered by Kenya, South Sudan, Sudan, Dijibouti, Eritrea, and Somalia, Ethiopia has an estimated 2015 population of 98.9 million, which ranks 13th in the world.

With a 2015 population of approximately 98.9 million, up from 2013's estimate of 95 million, Ethiopia is the most populous landlocked country in the continent of Africa and the second-most populous country of Africa after Nigeria. This estimate of how many people live in Ethiopia is based on the most recent United Nations projections, and makes Ethiopia the 13th most populous country. The most recent census in 2007 found an official population of 73.7 million. Ethiopia has a population density of 214 people per square mile (214/square mile), which ranks 123rd in the world.

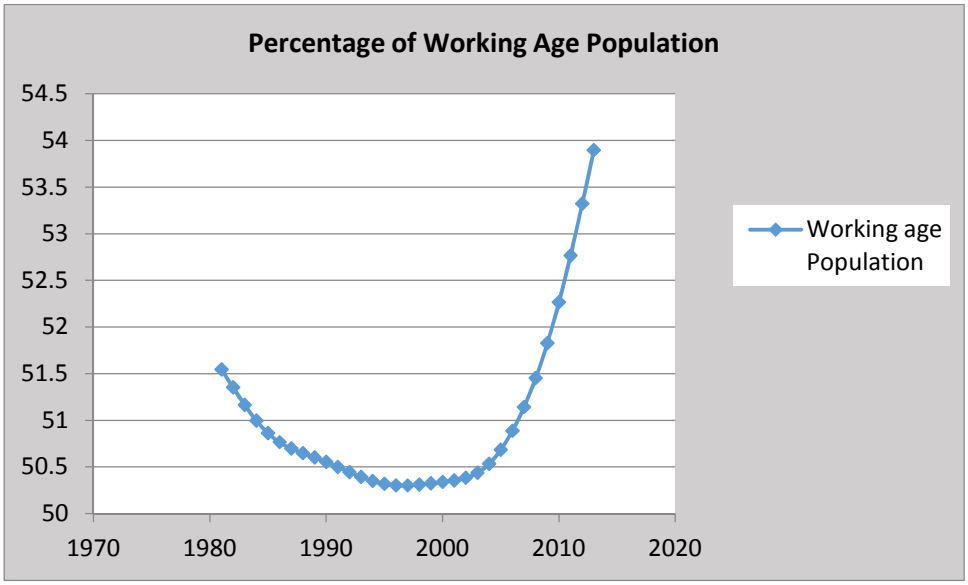
The largest city and capital of Ethiopia is Addis Ababa, or Addis Ababa, which has a population of 3.4 million in the city proper and a metro population of more than 4.6 million. Being as old as two millenniums, its cultures and traditions hold family as a significant part of Ethiopian life, sometimes even surpassing the significance their careers or businesses might have other major cities include Adama (324,000), Gondar (324,000), Mek'ele (324,000), and Hawassa (302,000).

Ethiopia Population Projections

Ethiopia is currently one of the fastest growing countries in the world, with a growth rate of 3.02% per year. If Ethiopia follows its current rate of growth, its population will double in the next 30 years, hitting 210 million by 2060. Most of the world's population growth in the next 40-50 years is expected to come from Africa, and Ethiopia will be a large part of the growth.

If Ethiopia follows its current rate of growth (3.02%), its population will double in the next 20 years and cross 300 million by 2050. Most of the world's population growth in the next 40-50 years is expected to come from Africa, and Ethiopia will be a large part of the growth.

According to the census of 1984, the population of Ethiopia was 42.2 million which was growing at 2.95 % per annum (CSA, 1985). By mid 1990, the population was estimated at 50.6 million of which about 89 % lived in rural areas (CSA, 1990). The population in 1994 was 53.5 million which grew to 61.7 million in 1999 of which 85% are rural and 15% are urban (CSA, 1999). Based on the projection made by Anders et, al. 2000, the population is expected to increase to 102 million by year 2020. The high population growth is driven by a high fertility rate of about 6 children per year. The trend of the working age population is presented in figure below.



Source: World Bank data based

Figure 4.3: Trends of Working age Population in percent

The same report indicated that there has been a change in the annual population growth rate from 2.18 % between 1955 and 1960 which increased to 2.43 % between 1975 and 1980. The growth rate then changed to 2.45 % between 1995 and 2000. It is expected to grow to 2.49 % between 2015 and 2020.

In addition, the current population density of 57 persons per square kilometer is expected to increase to 93 persons per square kilometer by the year 2020. The rural population alone is expected to reach over 84 million from the current 54 million. Similarly, the urban population is expected to increase to 34.4 million from the current population of 11.6 million. The structure reflects a high dependency ratio with about 45.4 percent of the total population under the age of 15 years and 3.2 % aged 65 and above (NMSA, 2000).

Ethiopia today has approximately 10.2 million households with about 5.2 persons per households. Urban households are smaller than rural households with a high dependency on agriculture. If all other factors remain unchanged, the remaining forest land is likely to be converted to agricultural land.

The increase in both human and livestock population has led to decreased holdings of arable land. Arable land per capita declined significantly. In 1994/95, about 61 % of farming households cultivated less than one hectare of land. Only 1 % of the farmers own holdings greater than 5 hectares and these are likely to be concentrated in the sparsely populated areas with low agricultural potential.

The increase both in the rural and urban population means that there will be more pressure both on forest and agricultural lands. This also means an increase in the demand for forest products.

Population growth (annual %) in Ethiopia

Population growth (annual %) in Ethiopia was last measured at 2.55 in 2013, according to the World Bank. Annual population growth rate for year t is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, which are generally considered part of the population of the country of origin.

According to the 2010 revision of the UN's World Population Prospects, the total population was 82,950,000 in 2010, compared to 18,434,000 in 1950. The proportion of children below the age of 15 in 2010 was 41.5%, 55.2% was between 15 and 65 years of age, while 3.3% was 65 years or older.

4.2. Unit Root Test

4.2.1. Augmented Dickey Fuller (ADF) Unit Root Tests

This involves testing for stationarity of the individual variables using the Augmented Dickey Fuller (ADF)test to find the existence of unit root in each of the time series. This test has been conducted with intercept only; and with trend and intercepts assuming the same null hypothesis of no unit root in the data series. The results of the ADF test is reported in Table 4.1 both at levels and first difference.

All the variables were not found stationary at their levels. This can be seen by comparing the observed values (in absolute terms of the ADF test statistics with the critical values (also in absolute terms) of the test statistics at the 1%, 5% and 10% level of significance. A result from Table 4.1 provides strong evidence of non stationarity. Therefore, the null hypothesis is accepted and it is sufficient to conclude that there is a presence of unit root in the variables at levels.

Table 4. 1 : Augmented Dicky Fuller Test (ADF) Results[1]

Variables	**At Level** (t-statistics)		**At First Difference** (t-statistics)	
	Intercept only	Intercept and Trend	Intercept only	Intercept and Trend
Ln(RGDP)	2.610396	-0.411647	-4.079297***	-3.719885***
Ln(WAPOPL)	-3.248344**	-0.598040	-1.386174*	-3.708808**
Ln(M2)	-2.243944	-1.171689	-5.411685***	-6.009299***
Ln(OPPENN)	-0.877583	-2.044951	-6.114485***	-6.001234***

Source: Researchers estimated based on secondary data

In the above result, all the variables were differenced once and the ADF tests were conducted on them as shown in Table 5.1. The coefficients compared with the critical values (1%, 5% &10% level of significance) reveals that all the variables were found stationary at first difference and on the basis of this,

[1]Note: Significant at 1% (***), Significant at 5% (**),and Significant at 10% (*).

the null hypothesis of non-stationarity is rejected and it is safe to conclude that the variable are stationary. This implies that the variables are integrated of order one, .i.e. (1).

The other test that should be known before co integration test is the residual stationarity test. If the model residual is found stationary at level, it also means that variables in the model are co-integrated or they have long run relationship or equilibrium relationship between them. In other words, the model is a long run model. Since the residual test of ADF reveals, at level residual was found stationary or I (0) at 1% level of significance, this confirms the model is a long run model.

4.3. Optimum Lag Selection

Selection of VAR order in the VAR regression must be known before co integration test is conducted. Information criteria method is the optimal way to identify the proper lag length for VAR model. There are few ways; one of the ways is to choose the lowest Akike Information Criteria (AIC) value. The lower the AIC value, better the model. The lag length is also, indispensable to determine the rank of cointegration. Lag orders 1 to 4 were supported by information criteria but consumed more degree of freedom. By using AIC as provided by the Table 4.2. appropriate lag length was selected by applying a simple VAR model.

Table 4. 2:VAR Lag Order Selection

Criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	137.9168	NA	2.08e-09	-8.639795	-8.454765	-8.579480
1	326.0173	315.5234	3.17e-14	-19.74305	-18.81790	-19.44148
2	363.9249	53.80429*	8.16e-15*	-21.15645*	-19.49117*	-20.61361*

Source: Author's Estimation using Eviews 6.0

* indicates lag order selected by the criterion

Where LR: sequential modified LR test statistic (each test at 5% level) , FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

Here, the appropriate lag length is two. Since, all information criteria supported lag length two and lowest AIC value was found here. Therefore, we continue to test for co-integration by applying the Johnson trace and Maximum- Eigen value co-integration tests.

4.4. Co-integration Test

Once we know VAR lag order, we can apply the Johnson_Juselious maximum likelihood method of co integration to obtain the number of co-integrating vectors. Johnson-Juselious approach is preferred over Engel-granger method due to some statistical reasons. Since all the independent and dependent variables are integrated of order one, we can apply Johnson_Juselious maximum likelihood method to obtain the number of co-integrating Vectors.

The result of the co-integration condition (that is the existence of a long term linear relation) is presented in Table 4.3. Trace Statistics and Maximum Eigen value using methodology proposed by Johnsen and Juselius (1990) shows the rank of co-integration among the variables.

Table 4.3: Johansen Co-integration Test Result (Trace & Maximum Eigen Value)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.926562	107.1033	47.85613	0.0000
At most 1	0.477449	28.76408	29.79707	0.0654
At most 2	0.264003	9.293078	15.49471	0.3390
At most 3	0.003235	0.097215	3.841466	0.7552

Trace test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.926562	78.33927	27.58434	0.0000
At most 1	0.477449	19.47100	21.13162	0.0840
At most 2	0.264003	9.195863	14.26460	0.2702
At most 3	0.003235	0.097215	3.841466	0.7552

Source: Author's Estimation based on secondary data
Max-eigenvalue test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

In the Johansson co-integration table 4.3 , both trace statistics and maximum Eigen value statistic indicated, there is co-integration among the independent(predictable) variables and the dependent variable at 5% level of significance, suggesting that there is co-integrating or (or long run) relationship among them. The null hypothesis of no co integration equation is rejected by both tests. The rank of Co-integration is found to be unity, implying the presence of only one co-integrating equation in the system.

In a nut shell, the result shows the null for no co-integration is rejected at 5% level of significance by both the maximal and the trace statistics. Here, it can be concluded that there is a long-run relationship among the variables which is explained by a linear combinations of I (1). From a statistical point of view, co-integration of two economic variables implies that they move together over time so that deviations from their long-term trend will be adjusted over time [Engle and Granger, 1987].

The other important test that must be done is, the presence of residual Heteroskedasticity which was tested by white Heteroskedasticity with no cross terms. The result revealed that there is no sufficient information to reject the null hypothesis. In addition to this, stability test was conducted and found to impose two unit roots indicating that the VECM is stable and there is only one potentially co-integrating equation in the system.

Similarly, the serial correlation test for residuals (see annex) was performed and the test result highlighted that residuals are not serially correlated at 5% critical.

4.5. Long run Model Estimation

Variables are tested for their significance to determine the long run relation with economic growth measured by real GDP. The result of the test along with their respective level of significance of is reported in table 4.4.

Table 4.4: Estimated Long run Model

Dependent Variable: LNRGDP
Included observations: 33

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNWAPOPL	0.5545410***	4.522239	12.26253	0.0000
LNM2	0.595171***	0.122854	4.844548	0.0000
LNOPPENN	0.258920**	0.100657	2.572298	0.0157
Policy Regime	0.106912	0.091431	1.169323	0.2521
C	-2.822915	1.925117	-1.466361	0.1537

R-squared	0.948816	Mean dependent var	22.96462
Adjusted Rsquared	0.941504	S.D. dependent var	0.480533
S.E. of regression	0.116221	Akaike info criterion	-1.327913
Sum squared resid	0.378207	Schwarz criterion	-1.101170
Log likelihood	26.91057	Hannan-Quinn criter.	-1.251621
F-statistic	129.7616	Durbin-Watson stat	0.640555
Prob(F-statistic)	0.000000		

Source: Own estimation Eviews 6.0;***, and ** shows significance of 1%, and 5% level of significance respectively.

Table 4.4 presents long run regression coefficients of the regressors with their t- stat and probability values respectively. The model has a high R-squared and very close to 1, implying the sample regression line fits the data very well. 94 percent of the variation in the real GDP can be explained by the independent variables included in the model. The F statistic also is highly significant and displays that all the coefficients jointly are different from zero; implying that the explanatory values jointly have impact on the regressand.

As it can be seen from the table 4.4 the long run model results depicts that all explanatory variables except policy change (Policy Regime) are statistically significant in affecting real GDP in the long at less than 5% significant level. Moreover, the variables are consistent with the theory and the researcher's expectation. Hence, the long run growth equation with the corresponding signs and T-statistics is presented as follows:

RGDP=-2.82+0.555**WAPOPL** +0.595**M2** +0.259**OPPENN** + 0.107**POLREG**

(12.26253) *** (4.444548) *** (2.572298) ** (1.169323)

The growth model which is specified in a log- linear form and the coefficients of the independent variables can be interpreted as elasticity with respect to real GDP.

Working Age Population: The long run model shows that real GDP is positively and significantly affected by working age population in the long run. The coefficient of working age population 0.55 suggests that, a one percent increase in the working population will increase the real GDP by 0.55%.

Money Supply (M2): The long-run impact of broad money supply on economic growth is found to be positive and statistically significant at 1% level of significant, which means that other things remain constant a one percent increase in broad money supply raise real GDP by 0.59 percent in the long run. This finding states that appropriate monetary policy supported with sound fiscal policy can positively contribute to the growth of the level of output.

Trade Openness (OPPENN): The long run impact of trade openness on economic growth is found to be positive and statistically significant, which means that a one percent increase in trade openness raises economic growth measured by real GDP nearly by 0.26 percent in the long run. This finding indicates that international integration is a beneficial strategy for growth in the long term, which is in line with what is predicted by Orthodox trade growth theory. According to the current Orthodox view, the positive contribution of trade openness to growth stemmed from the notion that liberalization increases specialization and the division of labor, thus improving productivity and export capability, as well as economic performance. The finding is consistent with Akano(2000).

4.6. Estimation of the Short run Dynamic Model (Error Correction Model)

After determining the long run model and its coefficients, the next step is the determination of short run dynamics. The coefficients of difference of the variables represent the coefficients of short run dynamics whereas the coefficient of lagged error correction term ECM - captures the speed of adjustment towards the long run

equilibrium relationship. The short -run model is obtained via the general to specific model selection method where insignificant coefficients and significant coefficients with unexpected sign are eliminated from the short run model until parsimonious model is obtained. However, in the study almost all variables become statistically significant (except money supply and variables in their second lag) affecting economic growth in the short run. Hence, no need to move from general to specific model.

The ECM integrates the short run dynamics with the long run equilibrium without losing long run information which is contained in the error correction term. However, there may be disequilibrium in the short run. The error term from the long run regression can be used to tie the long run and short run behavior of the model through the mechanism of error correction mechanism (ECM) that measures the speed of adjustment to equilibrium after a shock in the short run. The error correcting term is expected to have negative sign and to be significant.

Table 4. 5: The Short run Dynamic Model

Variable	Coefficient	Standard Error	T-stat.	P-value
EC-1	-0.6672***	(0.2071)	[-3.22056]	0.0019
D(LNRGDP(-1))	0.2576*	(0.1531)	[1.68249]	0.0966
D(LNRGDP(-2))	-0.2995**	(0.1473)	[-2.03263]	0.0456
D(LNWAPOPL(-1))	0.3574***	(0.6857)	[5.21306]	0.0000
D(LNWAPOPL(-2))	-2.0567**	(0.7925)	[-2.59542]	0.113
D(LNM2(-1))	-0.1012	(0.0834)	[-1.21328]	0.2288
D(LNM2(-2))	-0.0429	(0.0867)	[-0.49480]	0.6222
D(LNOPPENN(-1))	-0.2236***	(0.0601)	[-3.71806]	0.0004
D(LNOPPENN(-2))	-0.0279	(0.0607)	[-0.45939]	0.6473
POLICYREGIME	0.0923***	(0.0210)	[4.38916]	0.0000
C	-0.1023***	(0.0333)	[-3.06615]	0.0030
R-squared	0.858574	S.E. of regression	0.032265	
Adjusted R-squared	0.784139	Durbin-Watson stat	1.99834	

Source: Author's Estimation using Eviews 6.0.

Table 4.5 indicated that only money supply at its first difference is statistically insignificant in determining the real GDP in the short run indicating that the effect of the money supply measured by M2 on economic growth seems a long-run phenomenon and hence its impact in short run is minimal. But both working age population (WAPOPL) and real GDP (RGDP) have positive and statistically significant impact on economic growth in their first lag. However, the

effect of trade openness (OPPENN) on economic growth happen to be negative at its first lag and this negative effect is statistically significant at 1% level significance. Hence it can be concluded that there is both long-run and short run relation between working age population and economic growth measured by real GDP.

The R-squared, which measures the goodness of fit of the equation, is satisfactory at 85.8% percent, indicating that about 86% percent of the variations in economic growth (RGDP) in Ethiopia can be explained by independent variables in the short run.

The speed of adjustment coefficient is statistically significant with correct and negative theoretical sign. It will tell us how it will rightly act to correct any deviation from the long-run equilibrium. The coefficient of error correction term (EC-`1) is -0.667 which is highly significant at 1% significance level. This clearly shows that, the speed of adjustment is quit fast with approximately 66.7 percent of its previous period's disequilibrium in the real GDP will be corrected in the next year.

The result indicated that working age population is one of the most important determining factor of economic growth in both long and shut run period.

4.7. Granger Causality Test Analysis

Causality does not necessarily suggest endogeneity in the sense that the result gotten may not show whether the relationship is positive or negative. However, determination of the direction of causality among the variables has crucial role for further analysis of the relationship of the variables. The following result shown in the tables 4.6 below reveals the direction of causality among predictable variables and dependent variable.

Table 4.6 : Pairwise Granger Causality Tests

Pair wise Granger Causality Tests

Lag: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LNWAPOPL does not Granger Cause LNRGDP	30	5.17423	0.0070
LNRGDP does not Granger Cause LNWAPOPL		6.37804	0.10026
LNM2 does not Granger Cause LNRGDP	30	2.26622	0.1077
LNRGDP does not Granger Cause LNM2		0.45113	0.7189
LNOPPENN does not Granger Cause LNRGDP	30	2.57735	0.0784
LNRGDP does not Granger Cause LNOPPENN		0.75657	0.5299

Source: Author's Estimation using Eviews 6.0.

Engel and Granger illustrate that if co-integration exists between two variables in the long run, then, there must be either unidirectional or bi-directional Granger causality between these variables. In all first lag the test failed to reject the hypothesis that RGDP does not granger cause Working Age Population (WAPOP). However, the hypothesis that Working Age Population (WAPOP) does not granger cause economic growth (RGDP) was rejected at 1% significant level. Thus, the result shows unidirectional causality.

CHAPTER FIVE: CONCLUTION AND POLICY IMPLICATION

5.1. Summary

The study is based on a time series data covering a time period of 1981 to 2013 and analyzed the causal relationship between population and economic growth (Real GDP is used as a proxy). Both descriptive and econometric methods of analysis were employed. The descriptive analysis shows existence of high population growth in Ethiopia

To get a robust econometric analysis, the study employed different tests such as unit root, co-integration, and Granger causality tests. The unit root test indicates that the variables considered are stationary at first difference. The co-integration test using Johansen test (trace and maximum eign value tests) revealed that population and real GDP drifts together in the long run. Based on this, a VECM with an optimal lag length of two were estimated considering real GDP and working age population as dependent variables. The model used is valid in terms of the normality, hetrosekedasticity, and no serial correlation of the residual term.

According to the estimation result, population Granger causes real GDP in the long run, there is no Granger causality from real GDP to working age population.

The short run result is also consistent with the long run result in the sense that jointly coefficients of lagged population (as indicated by Wald test) cause real GDP, where the reverse scenario is not valid. On the other hand, the short run speed of adjustment is quit fast with 66.7 percent to restore to the long run equilibrium level in response to the disequilibrium caused by short run shocks of previous period. Which means that approximately 66.7 percent of its previous period's disequilibrium in the real GDP is corrected in the next year.

5.2. Conclusion

The study showed that the population growth in Ethiopia is one of the highest in the world. In fact its higher than the Sub Sahara African countries. This is evidenced by persistent and large gap between birth rate and death rate where the birth rate is on average was greater by around 27 per 1,000 Population. In addition, the doubling time of the population is declining. Based on the trend of population and economic growth while there exist a persistence increment in population size and real GDP, there is slight fluctuation in the real GDP overtime. When we look at the

working age population in Ethiopia, it contribute above 50% of the total population of the country. As predicted it has both long run and short run relation with economic growth. In fact the economic growth is positively associated with the growth of the working age population as the working age population is the major sources of labor force. On the basis of empirical evidence obtained through the analysis of historical data it can finally be concluded that that working age population is one of the most important determining factor of economic growth of Ethiopia in both long and shut run period.

5.3. Policy implication

Empirical findings obtained in the long-run model showed that there is no doubt that working age population coupled with trade openness and appropriate monetary could be the engine of real GDP growth.

With respect to the study the relationship between working age population and economic growth the country exhibits a long-run relationship and it has positive effect on economic growth. Currently the population policy advocates lower fertility rate but it does not consider the working age population. Based on the study the working age population contributes positively to real GDP. Therefore, increase in working age population has positive rather than negative consequences. So the government to sustain economic growth should able to revise the current population policy of the country.

The export ratio also has a positive impact on real GDP and the higher the variety of the export basket, the higher the impact of the trade ratio. It is interesting to note that the effect of the trade ratio and trade in variety clearly relates to changes at the intensive and extensive margin of trade. Hence, further investigations are required to clarify the role of trade dependency and trade in variety as regards the relationship between trade openness and economic growth.

Therefore, considering the significant and positive impact of working age population and trade openness on economic growth, the concerned body has to device sound population policy and foreign trade policy that enhances economic growth so as to reap the fruit of blossom economy.

REFERENCES

A.F. Darrat and *Y.K. Al-Yousif* (1999),*Eastern Economic Journal*, vol. 25, issue 3, pages 301-313

Ajayi, A. and Kovole, J. (1998), "Kenya's Population Policy: From Apathy to Effectiveness," of Population Policies Matter? New York: Population Council, .pp 13-25.

Anker, R. Knowles, C. J. (1983) Population growth employment and economic interactions in Kenya. Gower publishing company Hampshire England.

Bloom, D. E., and Freeman, R. (1986) "The Effects of Rapid Population Growth on Labor Supply and Employment in Developing Countries," Population and Development Review, pp. 381–414.

Bloom, D. E. and Williamson, G. (1997). "Demographic Transitions and Economic Miracles in Emerging Asia," World Bank Economic Review 12 (3): 419-55.

Bloom, D., E., and Freeman R., E. (1998) 'Economic Development and the Timing and Components of Population Growth.' Journal of Policy Modeling 10(1), 57–81

Bloom, D., E. Canning, D. (2003) "Contraception and the Celtic Tiger The Economic and Social Review, Vol. 34, No. 3, Winter, 2003, pp. 229–247.

Bloom, D., D. Canning, and B. Graham. (2003). "Longevity and life-cycle savings," National Bureau of Economic Research Scandinavian Journal of Economics 105: 319–338.

Boserup, E. (1965), The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure. London.

Bucci, A. (2003) "Population Growth in a Model of Economic Growth with Human Capital Accumulation and Horizontal R&D" University of Milan: Milan,

Coale, A. J., and Hoover E., M. (1958) Population Growth and Economic Development in Low- Income Countries .Princeton: Princeton University Press.

Esther Muia, Patrick Ndavi, Joyce Olenja, Paul Kizito, Sian Curtis, and Ani Hyslop" (2003) Factors that Contribute to the Utilization of Quality Reproductive Health Care: Findings from Further Analysis of the Kenya Service Provision Assessment of 1999". .National Council for Population and Development. Nairobi, Kenya.

Eviews 5 User`s Guide, 2004, Quantitative Micro Software LLC.

Friedberg, R.and J. Hunt (1995). "The Impact of Immigrants on Host Country Wages, Employment and Growth (in Symposia: Immigration)." The Journal of Economic Perspectives (2): 23 -44.

Gerald, M. and Meier, M., G. (1995), "Leading Issues in Economic Development" New York: Oxford University Press, 1995), p.276.

Gachanja and Obere (2013). The Impact of Population Change on Economic Growth in Kenya. International Journal of Economics and Management SciencesVol. 2, No. 6, 2013, pp. 43-60

Gujarati, D. N. (2004). *Basic econometrics*, (4th ed.). New York: The McGraw-Hill Companies

Johansen, S., and Juselius, K. (1990). Maximum likelihood estimation and inference on co integration with applications to the demand for money. *Oxford Bulletin of Economics and statistics*, *52*(2), 169-210.

Johns, C. (1998).*Introduction to economic growth* (2nd ed). New York: N. Norton & Co.

Kenya National Bureau of Statistics (2007), Kenya integrated household budget survey

(KIHBS) 2005/06. Nairobi: KNBS

Kenya National Bureau of Statistics, (2008), Well-Being in Kenya, a socio-economic profile.Nairobi: KNBS

Kenya National Bureau of Statistics, (2009). Demographic and Health survey 2009, Government Printer, Nairobi: KNBS

International Journal of Economics and Management Sciences Vol. 2, No. 06, 2013, pp. 43-60.

Kelley, A. C. (1988). Population matters - demographic change, economic growth, and poverty In the developing world. New York: Oxford University Press.

Kelley, A. C. & R. M. Schmidt. (1995), "Aggregate Population and Economic Growth Correlations: The role of the components of demographic change," Demography, 32(4): 543-555

Kirori, G.N. and Ali, J. (1998) "Macroeconomic Implications of Demographic Changes in Kenya" Africa Economic Research Consortium .Research Paper eighty-three.

Macharia, K, (1997). "Social and Political Dynamics of the Informal Economy in African Cities" Harare and Nairobi. Lanham, University press of America.

Malthus, T.R. (1798), An Essay on the Principles of Population, (Cambridge: Cambridge University Press.

Matras, K, (1977). "Social and Political Dynamics of the Informal Economy in African Cities" Harare and Nairobi. Lanham, University press of America.

Mukras, M. S.(1993) Elementary Econometrics: Theory, Application and Policy. Nairobi: East African Educational Publishers Ltd.

National Council for Population and Development (NCPD) [Kenya], Central Bureau of Statistics (CBS), and

Macro International Inc. (MI). 1999. Kenya demographic and health survey 1998. Calverton, Maryland: NCPD, CBS, and MI.

Oduor, J. (2008) Impacts of Real Exchange Rate Misalignment on Trade Creation and Diversion within

Regional Trading Blocks: The case of Comesa. Shaker: Verlag, Germany.

Republic of Kenya (2006) Demographic and Health Survey Government Printer, Nairobi:

Republic of Kenya (2010) 2009 Kenya Population and Housing Census. Government Printer, Nairobi:

Ralph Thomlinson (1965), Population Dynamics Causes and Consequences of World Demographic Change California state college random house. New York

Simon, J. L. (1977), The Economics of Population Growth. Princeton University Press: Princeton New Jersey,

Simon, J. L. (1992) Population and Developing Countries, Princeton University Press: Princeton, New. Jersey

Srinivasan, T. N., (1988) "Population Growth and Economic Development," Journal of Policy Modeling, Vol. 10, No. 1, spring. pp. 7–28.

Stock, J.H., and Watson, M.W.(2001) Vector Auto Regressions journal of economic pespectives15, 101-115

Tournemaine, Frederic, (2007) "Can population promote income per-capita growth? A balanced Perspective." Economics Bulletin, Vol. 15, No. 8 pp. 1-7

Thirlwal, A. P. (1993) "Growth and Development with Special Reference to Developing Economies", University of Kent at Canterbury, 5Th Edition. Pp. 143-155.

World Bank, World Development Report 2000/2001, Washington, DC: World Bank; and ford University Press, 2000, Table 1.1, p. 23.

Malthus TR, *An Essay on the Principle of Population,* New York: W. W. Norton, 1976, p. 132.

Kelley AC, The population debate in historical perspective: revisionism revised, in:

Birdsall N, Kelley AC and Sinding SW, eds., *Population Matters: Demographic Change, Economic Growth, and Poverty in the Developing World*, New York: Oxford University Press, 2001

Simon JL, *Population: The Ultimate Resource,* Princeton, NJ, USA: Princeton University Press, 1981.

Todaro, M.P and S. C. Smith, (2005), Economic Development, Addison Wesley ninth edition

National Research Council, *Population Growth and Economic Development: Policy Questions,* Washington, DC: National Academy Press, 1986.

Johnson DG and Lee RD, *Population Growth and Economic Development: Issues and Evidence,* Madison, WI, USA: University of Wisconsin Press, 1987

APPENDEX

Annex 1. Unit Root Test Using Augmented Dickey Fuller (ADF) Testing.

Stationarity Test of Log(RGDP) Using ADF Test

At Level and Intercept Ln (RGDP)

Null Hypothesis: LNRGDP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.610396	1.0000
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

At Level, Trend and Intercept Ln(RGDP)

Null Hypothesis: LNRGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.411647	0.9827
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

At First Difference and Intercept Ln (RGDP)

Null Hypothesis: D(LNRGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.079297	0.0035
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

At First Deference, Trend and Intercept Log (RGDP)

Null Hypothesis: D(LNRGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.719885	0.0375
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996) one-sided p-values.

Stationarity Test of Ln(WAPOPL) Using ADF Test

At Level and Intercept Ln (WAPOPL)

Null Hypothesis: LNWAPOPL has a unit root
Exogenous: Constant
Lag Length: 6 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.248344	0.0284
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

At Level, Trend and Intercept Ln (WAPOPL)

Null Hypothesis: LNWAPOPL has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 6 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.598040	0.9705
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNWAPOPL)
Method: Least Squares
Date: 08/10/15 Time: 05:14
Sample (adjusted): 1988 2013
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNWAPOPL(-1)	-0.006292	0.010520	-0.598040	0.5577
D(LNWAPOPL(-1))	3.238834	0.251478	12.87919	0.0000
D(LNWAPOPL(-2))	-4.448101	0.790966	-5.623630	0.0000
D(LNWAPOPL(-3))	3.818323	1.214200	3.144723	0.0059
D(LNWAPOPL(-4))	-2.640869	1.247362	-2.117163	0.0493
D(LNWAPOPL(-5))	1.535905	0.841434	1.825343	0.0856
D(LNWAPOPL(-6))	-0.548160	0.290983	-1.883823	0.0768
C	0.002472	0.004416	0.559673	0.5830
@TREND(1981)	4.89E-06	7.00E-06	0.698661	0.4942

R-squared	0.999710	Mean dependent var	0.000808
Adjusted R-squared	0.999574	S.D. dependent var	0.001367
S.E. of regression	2.82E-05	Akaike info criterion	-17.84632
Sum squared resid	1.35E-08	Schwarz criterion	-17.41083
Log likelihood	241.0022	Hannan-Quinn criter.	-17.72091
F-statistic	7331.478	Durbin-Watson stat	2.262656
Prob(F-statistic)	0.000000		

At First Difference and Intercept Ln (WAPOPL)

Null Hypothesis: D(LNWAPOPL) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.386174	0.5745
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

At first Deference, Trend and Intercept Ln (WAPOPL)

Null Hypothesis: D(LNWAPOPL) has a unit root

Exogenous: Constant, Linear Trend
Lag Length: 5 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.708808	0.0397
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Stationarity Test of LnM2) Using ADF Test

At Level and Intercept Ln (M2)

Null Hypothesis: LNM2 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.243944	0.1956
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

At Level, Trend and Intercept Ln (M2)

Null Hypothesis: LNM2 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.171689	0.8995
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

At First Difference and Intercept Ln (M2)

Null Hypothesis: D(LNM2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.411685	0.0001
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

At first Deference, Trend and Intercept Ln (M2)

Null Hypothesis: D(LNM2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.009299	0.0001
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Stationarity Test of Ln(OPPENN) Using ADF Test

At Level and Intercept Ln (OPPENN)

Null Hypothesis: LNOPPENN has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.877583	0.7823
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

At Level, Trend and Intercept Ln (OPPENN)

Null Hypothesis: LNOPPENN has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.044951	0.5554
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

At First Difference and Intercept Ln (OPPENN)

Null Hypothesis: D(LNOPPENN) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.114485	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

1.4.3 At First Deference, Trend and Intercept Log (OPPENN)

Null Hypothesis: D(LNOPPENN) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.001234	0.0001
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

1. Johansson Test of Cointegration

Date: 08/09/15 Time: 20:29

Sample (adjusted): 1984 2013
Included observations: 30 after adjustments
Trend assumption: Linear deterministic trend
Series: LNRGDP LNWAPOPL LNM2 LNOPPENN
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.926562	107.1033	47.85613	0.0000
At most 1	0.477449	28.76408	29.79707	0.0654
At most 2	0.264003	9.293078	15.49471	0.3390
At most 3	0.003235	0.097215	3.841466	0.7552

Trace test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.926562	78.33927	27.58434	0.0000
At most 1	0.477449	19.47100	21.13162	0.0840
At most 2	0.264003	9.195863	14.26460	0.2702
At most 3	0.003235	0.097215	3.841466	0.7552

Max-eigenvalue test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LNRGDP	LNWAPOPL	LNM2	LNOPPENN
-34.00138	229.0014	0.904209	8.197280
-13.11144	293.8993	6.290682	4.421986
5.697433	55.59611	5.794635	-6.771702
17.30677	-1129.486	-11.12540	-4.170047

Unrestricted Adjustment Coefficients (alpha):

D(LNRGDP)	0.013066	0.021641	-0.001048	0.001059
D(LNWAPOPL)	-5.25E-05	1.75E-05	1.23E-06	-3.10E-07
D(LNM2)	-0.003948	-0.037088	-0.028714	0.001493
D(LNOPPENN)	-0.037324	0.013590	0.030002	0.006077

1 Cointegrating Equation(s): Log likelihood 401.9405

Normalized cointegrating coefficients (standard error in parentheses)

LNRGDP	LNWAPOPL	LNM2	LNOPPENN
1.000000	-6.735063	-0.026593	-0.241087

	(1.70046)	(0.02290)	(0.01004)

Adjustment coefficients (standard error in parentheses)

D(LNRGDP)	-0.444256		
	(0.27886)		
D(LNWAPOPL)	0.001785		
	(0.00023)		
D(LNM2)	0.134236		
	(0.62207)		
D(LNOPPENN)	1.269071		
	(0.94114)		

2 Cointegrating Equation(s): Log likelihood 411.6760

Normalized cointegrating coefficients (standard error in parentheses)

LNRGDP	LNWAPOPL	LNM2	LNOPPENN
1.000000	0.000000	0.168062	-0.199778
		(0.04958)	(0.04336)
0.000000	1.000000	0.028902	0.006133
		(0.00700)	(0.00612)

Adjustment coefficients (standard error in parentheses)

D(LNRGDP)	-0.727995	9.352255	
	(0.24130)	(2.46711)	
D(LNWAPOPL)	0.001556	-0.006880	
	(0.00020)	(0.00202)	
D(LNM2)	0.620514	-11.80424	
	(0.59429)	(6.07610)	
D(LNOPPENN)	1.090890	-4.553258	
	(1.00260)	(10.2506)	

3 Cointegrating Equation(s): Log likelihood 416.2740

Normalized cointegrating coefficients (standard error in parentheses)

LNRGDP	LNWAPOPL	LNM2	LNOPPENN
1.000000	0.000000	0.000000	0.111057
			(0.09543)
0.000000	1.000000	0.000000	0.059588
			(0.01586)
0.000000	0.000000	1.000000	-1.849520
			(0.48279)

Adjustment coefficients (standard error in parentheses)

D(LNRGDP)	-0.733966	9.293993	0.141876
	(0.24408)	(2.49287)	(0.05691)
D(LNWAPOPL)	0.001563	-0.006812	6.97E-05
	(0.00020)	(0.00204)	(4.7E-05)
D(LNM2)	0.456920	-13.40061	-0.403264
	(0.55293)	(5.64721)	(0.12893)
D(LNOPPENN)	1.261825	-2.885252	0.225592
	(0.98414)	(10.0513)	(0.22948)

2. VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: LNRGDP LNWAPOPL LNM2 LNOPPENN
Exogenous variables: C
Date: 08/10/15 Time: 06:38
Sample: 1981 2013
Included observations: 31

Lag	LogL	LR	FPE	AIC	SC	HQ
0	137.9168	NA	2.08e-09	-8.639795	-8.454765	-8.579480
1	326.0173	315.5234	3.17e-14	-19.74305	-18.81790	-19.44148
2	363.9249	53.80429*	8.16e-15*	-21.15645*	-19.49117*	-20.61361*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Vector Error Correction Test

Vector Aoutoregression Estimation

Vector Autoregression Estimates
Date: 08/10/15 Time: 06:37
Sample (adjusted): 1982 2013
Included observations: 32 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LNRGDP	LNWAPOPL	LNM2	LNOPPENN
LNRGDP(-1)	0.944282	0.003468	0.137968	0.054719
	(0.10596)	(0.00038)	(0.14575)	(0.25788)
	[8.91157]	[9.18079]	[0.94660]	[0.21219]
LNWAPOPL(-1)	6.184342	1.013656	-14.10070	-2.046605
	(7.18513)	(0.02561)	(9.88326)	(17.4865)
	[0.86071]	[39.5742]	[-1.42673]	[-0.11704]
LNM2(-1)	0.088944	0.000341	0.707329	0.200399
	(0.10103)	(0.00036)	(0.13896)	(0.24587)
	[0.88041]	[0.94706]	[5.09009]	[0.81507]
LNOPPENN(-1)	0.053451	-0.000668	0.009535	0.826598
	(0.05351)	(0.00019)	(0.07361)	(0.13023)
	[0.99887]	[-3.50255]	[0.12954]	[6.34718]
C	-1.694461	-0.083604	3.615871	-0.492686
	(1.46977)	(0.00524)	(2.02168)	(3.57698)
	[-1.15288]	[-15.9565]	[1.78854]	[-0.13774]

R-squared	0.984797	0.998768	0.909372	0.901559
Adj. R-squared	0.982545	0.998586	0.895945	0.886975
Sum sq. resids	0.108439	1.38E-06	0.205171	0.642279
S.E. equation	0.063374	0.000226	0.087172	0.154234
F-statistic	437.2397	5474.350	67.73003	61.81879
Log likelihood	45.59081	225.9629	35.38831	17.12945
Akaike AIC	-2.536926	-13.81018	-1.899269	-0.758091
Schwarz SC	-2.307904	-13.58116	-1.670248	-0.529070
Mean dependent	22.98020	0.411928	3.398015	3.327927
S.D. dependent	0.479674	0.006008	0.270237	0.458767

Error Correction:	D(LNRGDP)	D(LNWAPOPL)	D(LNM2)	D(LNOPPENN)
CointEq1	-0.667154	0.001657	0.492792	0.727198
	(0.20715)	(0.00021)	(0.56532)	(0.81851)
	[-3.22056]	[7.91633]	[0.87170]	[0.88844]
D(LNRGDP(-1))	0.257631	-0.000716	0.006015	-0.813021
	(0.15312)	(0.00015)	(0.41788)	(0.60503)
	[1.68249]	[-4.63015]	[0.01439]	[-1.34377]
D(LNRGDP(-2))	-0.299454	-0.000669	-0.065554	-1.098117
	(0.14732)	(0.00015)	(0.40205)	(0.58211)
	[-2.03263]	[-4.49201]	[-0.16305]	[-1.88644]
D(LNWAPOPL(-1))	357.4937	1.970767	-496.9502	-12.24774
	(68.5765)	(0.06929)	(187.145)	(270.961)
	[5.21306]	[28.4438]	[-2.65543]	[-0.04520]
D(LNWAPOPL(-2))	-205.6725	-1.417724	419.1840	-233.8200
	(79.2446)	(0.08006)	(216.258)	(313.113)
	[-2.59542]	[-17.7072]	[1.93835]	[-0.74676]
D(LNM2(-1))	-0.101265	-3.62E-05	-0.278627	-0.126415
	(0.08346)	(8.4E-05)	(0.22777)	(0.32978)
	[-1.21328]	[-0.42961]	[-1.22327]	[-0.38332]
D(LNM2(-2))	-0.042929	9.18E-05	0.090813	-0.576700
	(0.08676)	(8.8E-05)	(0.23677)	(0.34282)
	[-0.49480]	[1.04749]	[0.38354]	[-1.68224]
D(LNOPPENN(-1))	-0.223657	0.000222	0.257251	-0.257089
	(0.06015)	(6.1E-05)	(0.16416)	(0.23768)
	[-3.71806]	[3.65272]	[1.56708]	[-1.08165]
D(LNOPPENN(-2))	-0.027907	0.000185	0.183957	0.132013
	(0.06075)	(6.1E-05)	(0.16578)	(0.24003)
	[-0.45939]	[3.01346]	[1.10962]	[0.54998]
C	-0.102333	0.000140	0.220430	0.026442
	(0.03338)	(3.4E-05)	(0.09108)	(0.13187)
	[-3.06615]	[4.14052]	[2.42018]	[0.20051]

STBRK	0.092372	5.97E-05	-0.150496	0.254166
	(0.02105)	(2.1E-05)	(0.05743)	(0.08316)
	[4.38916]	[2.80836]	[-2.62036]	[3.05650]
R-squared	0.858574	0.999637	0.438041	0.574640
Adj. R-squared	0.784139	0.999446	0.142272	0.350766
Sum sq. resids	0.019780	2.02E-08	0.147307	0.308805
S.E. equation	0.032265	3.26E-05	0.088051	0.127487
F-statistic	11.53459	5230.511	1.481027	2.566801
Log likelihood	67.29629	274.2201	37.17834	26.07550
Akaike AIC	-3.753086	-17.54800	-1.745222	-1.005034
Schwarz SC	-3.239313	-17.03423	-1.231450	-0.491261
Mean dependent	0.049730	0.000597	0.019928	0.028511
S.D. dependent	0.069446	0.001385	0.095074	0.158221

Probability Value (P-Value)

System: UNTITLED
Estimation Method: Least Squares
Date: 08/23/15 Time: 21:42
Sample: 1984 2013
Included observations: 30
Total system (balanced) observations 120

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.667154	0.207155	-3.220560	0.0019
C(2)	0.257631	0.153124	1.682493	0.0966
C(3)	-0.299454	0.147324	-2.032628	0.0456
C(4)	357.4937	68.57654	5.213061	0.0000
C(5)	-205.6725	79.24455	-2.595415	0.0113
C(6)	-0.101265	0.083464	-1.213277	0.2288
C(7)	-0.042929	0.086762	-0.494796	0.6222
C(8)	-0.223657	0.060154	-3.718063	0.0004
C(9)	-0.027907	0.060749	-0.459387	0.6473
C(10)	-0.102333	0.033375	-3.066152	0.0030
C(11)	0.092372	0.021046	4.389163	0.0000
C(12)	0.001657	0.000209	7.916334	0.0000
C(13)	-0.000716	0.000155	-4.630152	0.0000
C(14)	-0.000669	0.000149	-4.492006	0.0000
C(15)	1.970767	0.069286	28.44383	0.0000
C(16)	-1.417724	0.080065	-17.70723	0.0000
C(17)	-3.62E-05	8.43E-05	-0.429609	0.6687
C(18)	9.18E-05	8.77E-05	1.047487	0.2982
C(19)	0.000222	6.08E-05	3.652716	0.0005
C(20)	0.000185	6.14E-05	3.013464	0.0035
C(21)	0.000140	3.37E-05	4.140524	0.0001
C(22)	5.97E-05	2.13E-05	2.808361	0.0063
C(23)	0.492792	0.565323	0.871701	0.3861
C(24)	0.006015	0.417875	0.014394	0.9886
C(25)	-0.065554	0.402045	-0.163051	0.8709
C(26)	-496.9502	187.1447	-2.655432	0.0096
C(27)	419.1840	216.2576	1.938355	0.0563
C(28)	-0.278627	0.227772	-1.223273	0.2250

C(29)	0.090813	0.236772	0.383544	0.7024
C(30)	0.257251	0.164160	1.567076	0.1213
C(31)	0.183957	0.165784	1.109620	0.2707
C(32)	0.220430	0.091080	2.420175	0.0179
C(33)	-0.150496	0.057433	-2.620364	0.0106
C(34)	0.727198	0.818515	0.888436	0.3771
C(35)	-0.813021	0.605029	-1.343770	0.1830
C(36)	-1.098117	0.582110	-1.886443	0.0631
C(37)	-12.24774	270.9615	-0.045201	0.9641
C(38)	-233.8200	313.1132	-0.746759	0.4575
C(39)	-0.126415	0.329784	-0.383325	0.7025
C(40)	-0.576700	0.342816	-1.682244	0.0966
C(41)	-0.257089	0.237682	-1.081649	0.2828
C(42)	0.132013	0.240033	0.549980	0.5839
C(43)	0.026442	0.131872	0.200512	0.8416
C(44)	0.254166	0.083156	3.056499	0.0031
Determinant residual covariance		9.59E-18		